SAIC 89/1033

NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

HOPE CREEK

50-354

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CAUTION

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

NOTICE

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

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

HOPE CREEK
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	10/89	Original report

HOPE CREEK SYSTEM SOURCEBOOK

This sourcebook contains summary information on the Hope Creek 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 Hope Creek nuclear plant is listed below:

- Docket number	50-354
- Operator	Public Service Electric and Gas Company
- Location	Salem County in New Jersey
- Commercial operation date	6/86
- Reactor type	BWR/4
- NSSS vendor	General Electric
- Power (MWt/MWe)	3293/1118
- Architect-engineer	Bechtel Power Corporation
- Containment type	Steel drywell and wetwell (Mark I)

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The Hope Creek nuclear plant has a 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
- Fitzpatrick
- Duane Arnold
- Peach Bottom 2 and 3
- Fermi Unit 2
- Brunswick Unit 1 and 2
- Limerick Units 1 and 2 (Mark II Containment)
- Shoreham (Mark II Containment)
- Susquehanna Units 1 and 2 (Mark II Containment)

3. SYSTEM INFORMATION

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Heat Removal Systems			
- Reactor Coolant System (RCS)	Same	3.1	5
- Reactor Core Isolation Cooling (RCIC) Systems	Same	3.2	5.4.6
- Emergency Core Cooling Systems (ECCS)	Same	-	6.3
- High-Pressure Injection & Recirculation	High-Pressure Coolant Injection (HPCS) System	3.3	6.3.1.2.1, 6.3.2.2.1
- Low-Pressure Injection & Recirculation	Core Spray (CS) System,	3.3	6.3.1.2.3, 6.3.2.2.3
	Low-Pressure Coolant Injection (LPCI) System (an operating mode of the RHR system)	3.3	5.4.7, 6.3.1.2.4, 6.3.2.2.4
- Automatic Depressurization System (ADS)	Same	3.3	5.2.2, 6.3.1.2.2 6.3.2.2.2,
- Decay Heat Removal (DHR) System (Residual Heat Removal (RHR) System)	Residual Heat Removal (RHR) System (a multi-mode system)	3.3	5.4.7
- Main Steam and Power Conversion Systems	Main Steam Supply System,	X	6.7, 10.3
	Condensate and Feedwater Systems,	X	10.4.7
	Circulating Water System	X	10.4.5
- Other Heat Removal Systems	Steam-condensing RHR/RCIC operation	3.2	5.4.6, 5.4.7

Table 3-1. Summary of Hope Creek 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	5.4.8
- ECCS	See ECCS above	-	-
- Control Rod Drive Hydraulic System (CRDHS)	Control Rod Drive (CRD) System	3.6	4.6
Containment Systems			
- Primary Containment	Containment	X	6.2.1
- Secondary Containment			
- Standby Gas Treatment System (SGTS)	Filtration, Recirculation, and Ventilation System (FRVS)	X	6.8
- Containment Heat Removal Systems			
- Suppression Pool Cooling System	Same (an operating mode of the RHR system)	3.3	5.4.7, 6.2.2
- Containment Spray System	Same (an operating mode of the RHR system)	3.3	5.4.7, 6.2.2, 6.5.2
- Containment Fan Cooler System	Primary Containment Ventilation System	X	9.4.5
- Containment Normal Ventilation Systems	Primary Containment Ventilation System	X	9.4.5
- Combustible Gas Control Systems	Containment Hydrogen Recombiner System,	X	6.2.5.2.4
	Hydrogen/Oxygen Analyzer System,	X	6.2.5.2.5
	Vacuum Relief Valve System,	X	6.2.5.2.3
	Containment Inerting and Purging System	X	6.2.5.2.3

Table 3-1. Summary of Hope Creek 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	4.1.2.1
- Control Rod System	Control Rod Drive (CRD) System	X	4.6
- Chemical Poison System	Standby Liquid Control System (SLCS)	X	9.3.5
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Same	3.4	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safety Feature Systems	3.4	7.3
- Remote Shutdown System	Same	3.4	7.4.1.4
- Other I&C Systems	Various I&C Systems, Process and Post-Accident Sampling Systems	X X	7.4 to 7.7 9.3.2
Support Systems			
- Class 1E Electric Power System	Same	3.5	8.3
- Non-Class 1E Electric Power System	Same	X	8
- Diesel Generator Auxiliary Systems	Same	3.5	8.3.1.1.3 9.5.4, 9.5.5
- Component Cooling Water (CCW) System	Safety and Turbine Auxiliaries Cooling System (SACS & TACS)	3.7	9.2.2

Table 3-1. Summary of Hope Creek 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)	Station Service Water System	3.8	9.2.1
- Residual Heat Removal Service Water (RHRSW) System	Safety Auxiliaries Cooling System (SACS)	3.7	9.2.2
- Other Cooling Water Systems	Reactor Auxiliaries Cooling System (RACS)	X	9.2.8
	Plant Chilled Water System	X	9.2.7
- Fire Protection Systems	Same	X	9.5.1
- Other Water Systems	Makeup Demineralizer System,	X	9.2.3
	Potable and Sanitary Water System,	X	9.2.4
	Condensate and Refueling Water Storage and Transfer System,	X	9.2.6
	Equipment and Floor Drainage Systems	X	9.3.3
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Habitability Systems,	X	6.4, 6.5.1.1
	Air Conditioning, Heating, Cooling, and Ventilation Systems	X	9.4
- Instrument and Service Air Systems	Compressed Air Systems,	X	9.3.1
	Primary Containment Instrument Gas System	X	9.3.6
- Refueling and Fuel Storage Systems	Fuel Storage and Handling	X	9.1
- Radioactive Waste Systems	Radioactive Waste Management Systems	X	11
- Radiation Protection Systems	Same	X	12

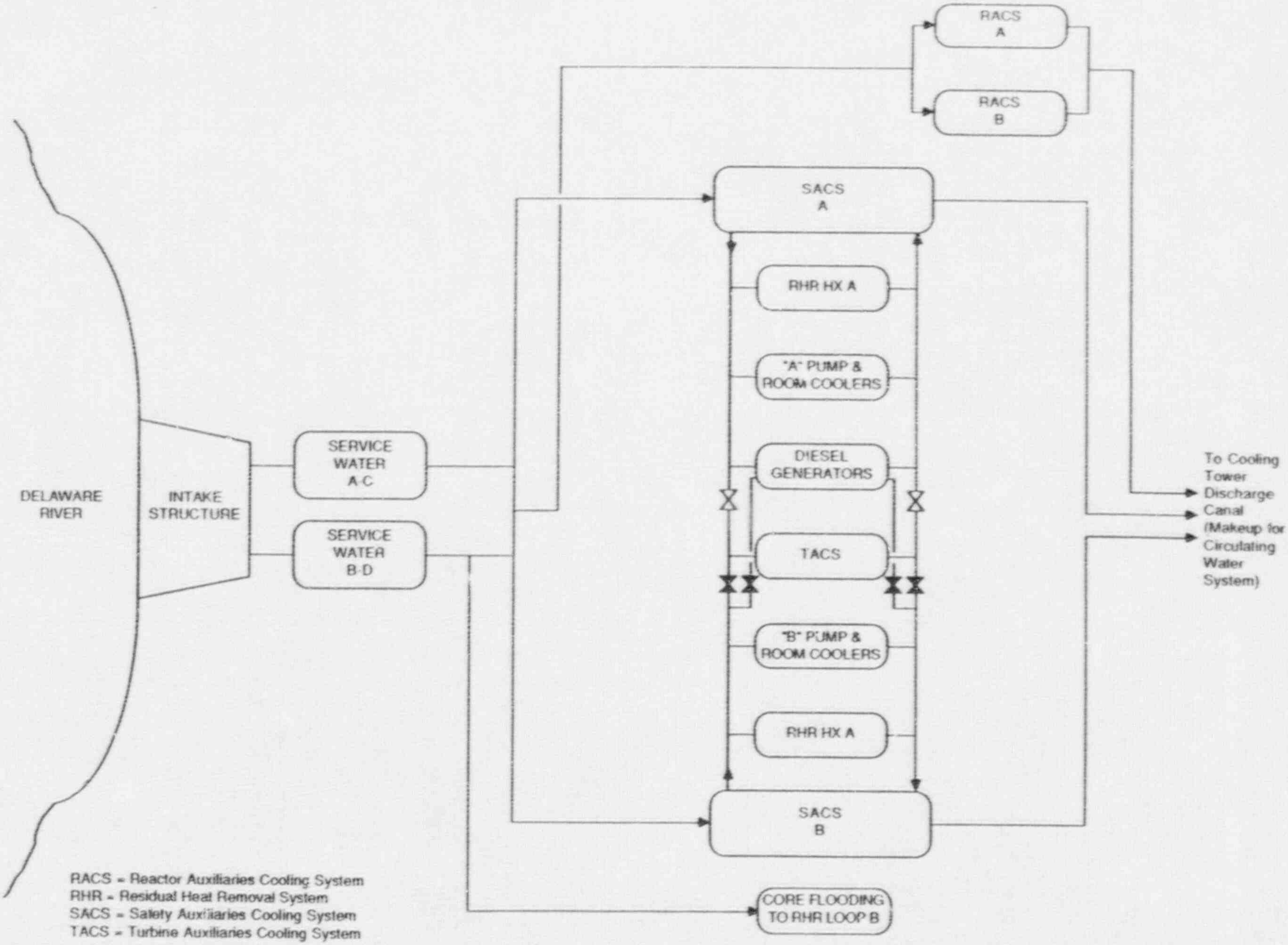


Figure C-1. Cooling Water Systems Functional Diagram for Hope Creek

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) 14 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. Note that individual valves have more than one identification number in the original Hope Creek source drawings. Secondary valve identification numbers are indicated in parentheses 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.

A portion 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) and one main steam stop valve (MSSV) 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 Safety Auxiliaries Cooling System and Service Water System complete the heat transfer path from the containment to the ultimate heat sink (see Sections 3.7 and 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 fourteen 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. Steam flow: 10.16×10^6 lbm/hr
2. Normal operating pressure: 1005 psig

B. Safety/relief Valves (14)
1. Set pressure: 4 @ 1108 psig, 884,000 lbm/hr (each)
   5 @ 1120 psig, 893,000 lbm/hr (each)
   5 @ 1130 psig, 901,000 lbm/hr (each)

C. Recirculation Pumps (2)
1. Rated flow: 45,200 gpm @ unknown head
2. Type: Single stage vertical centrifugal, variable speed

D. Jet Pumps (20)

3.1.6 Support Systems and Interfaces

A. Motive Power
1. The recirculation pumps are supplied by non-Class 1E power through variable frequency AC motor generator sets.

B. MSIV Operating Power

The compressed air system supports normal operation of the outboard MSIV. The Primary Containment Instrument Gas System supports normal operation of the inboard MSIV. Valve operation is controlled by two AC solenoid valves, one energized by AC train A and one by AC train B. A third solenoid valve exercises the valve at low speed. 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 independent valve closing springs.

C. Recirculation Pump Cooling

The Reactor Auxiliary Cooling System provides cooling water to the recirculation pump coolers.

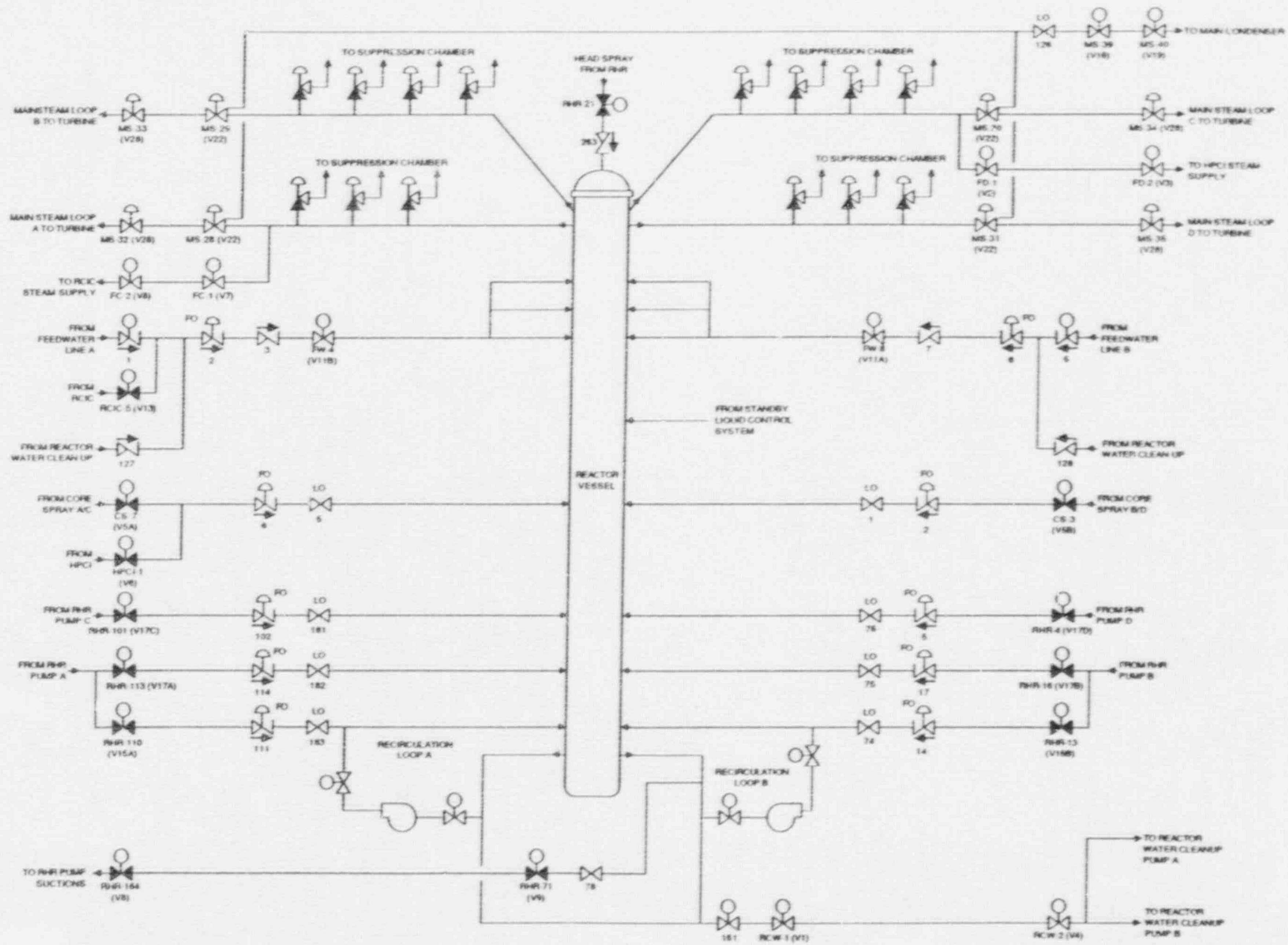


Figure 3.1-1. Hope Creek Reactor Coolant System

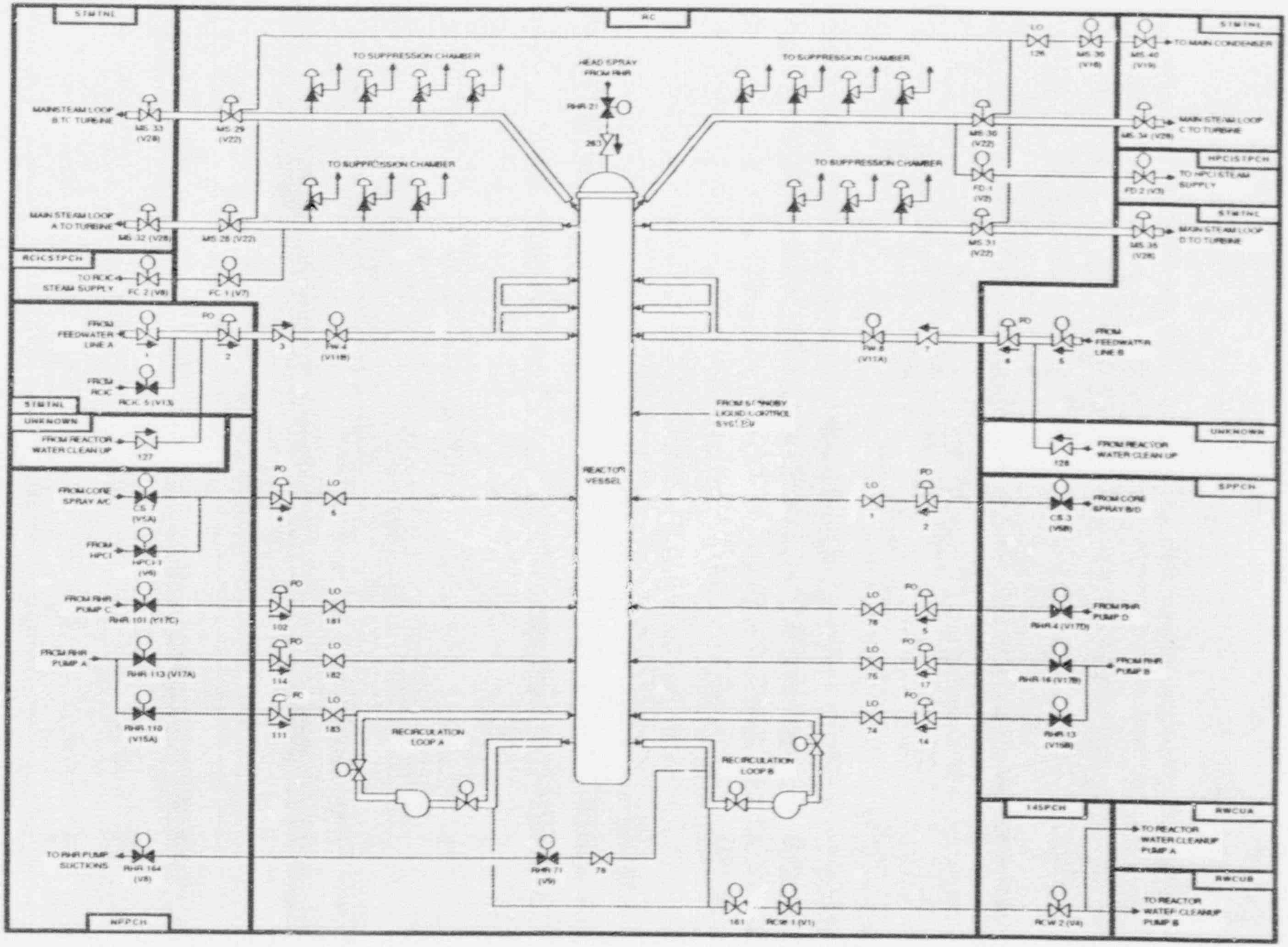


Figure 3.1-2. Hope Creek Reactor Coolant System Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
FC-1	MOV	RC	MCC-B242	480	E77HALL	AC/D
FC-2	MOV	RCICSTPCH	MCC-B222	480	RB102	AC/B
FD-1	MOV	RC	MCC-B232	480	RB102NE	AC/C
FD-2	MOV	HPCISTPCH	MCC-B212	480	SACSA	AC/A
MS-28,29,30, 31	MSIV	RC				
MS-32,33,34,35	MSIV	STMTNL				
MS-39	MOV	RC	MCC-B212	480	SACSA	AC/A
MS-40	MOV	STMTNL	MCC-B242	480	E77HALL	AC/D
RCUW-1	MOV	RC	MCC-B212	480	SACSA	AC/A
RCUW-2	MOV	SPPCH	MCC-B242	480	E77HALL	AC/D
RHR-164	MOV	NPPCH	MCC-B242	480	E77HALL	AC/D
RHR-71	MOV	RC	MCC-B451	480	SGRMA	AC/A
RPV	RPV	RC				

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.

3.2.2 System Definition

The reactor core isolati cooling system consists of a steam turbine-driven 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 used to be able to operate in conjunction with the RHR system in the steam condensing mode, however, the valves in the interconnecting piping have been permanently removed from service. The RCIC turbine is driven by steam from main steam line A. The turbine exhausts to the suppression pool.

Simplified drawings of the reactor core isolation cooling system are shown in Figures 3.2-1 and 3.2-2. Note that individual valves have more than one identification number in the original Hope Creek source drawings. Secondary valve identification numbers are indicated in parentheses 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 isolation valves to the RCIC turbine driven pump open, the turbine supply valve (RCIC-21) shut and the pump suction aligned to the condensate storage tank.

Upon receipt of an reactor pressure vessel (RPV) low water level signal, the turbine-pump steam supply valves are opened and makeup water is supplied to the RPV via feedwater line A. The primary water supply for the RCIC is the condensate storage tank (CST). At the rated RCIC pump flow rate the CST will be exhausted in less than four hours. By controlling the RCIC flow rate, the CST water volume can be managed and should be adequate for dissipating the integrated decay heat over more than an eight hour period. The suppression pool is used as a backup water supply for the RCIC system. The system automatically switches the pump suction from the CST to the suppression pool upon a low level signa' in the CST. 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 point at which suppression pool cooling becomes necessary for maintaining operation of the RCIC system is not known. Suppression pool cooling is provided by the RHR system.

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
   4. Design Temperature: 140°F

B. Condensate Storage Tank
   1. Capacity: 135,000 gallons reserved for use by both HPCI and RCIC.

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. The system automatically shuts down when the reactor vessel water level reaches a specified level, and automatically restarts if the level returns to the low level trip point.
      b. The RCIC pump suction is automatically switched to the suppression pool upon low condensate storage tank level.
      c. The RCIC pump is automatically shutdown upon receipt of any of the following signals:
         - Reactor vessel high water level
         - Turbine over-speed
         - Pump low suction pressure
         - Turbine high exhaust pressure
         - Isolation signal

   2. Remote Manual
      The RCIC pump can be actuated by remote manual means from the control room or the remote shutdown panel.

B. Motive Power
   1. The RCIC turbine driven pump is supplied with steam from main steam line A, upstream of the main steam isolation valves.
   2. The RCIC motor-operated valves are either Class 1E AC or Class 1E DC loads that can be supplied from the standby diesel generators or the station batteries, respectively, as described in Section 3.5.

C. Other
   Lubrication for the turbine-driven pump is assumed to be supplied locally. Lube oil cooling water is supplied from the discharge of the RCIC pump. The RCIC Vacuum Tank Condensate Pump returns the cooling water to the RCIC pump suction via the vacuum tank.

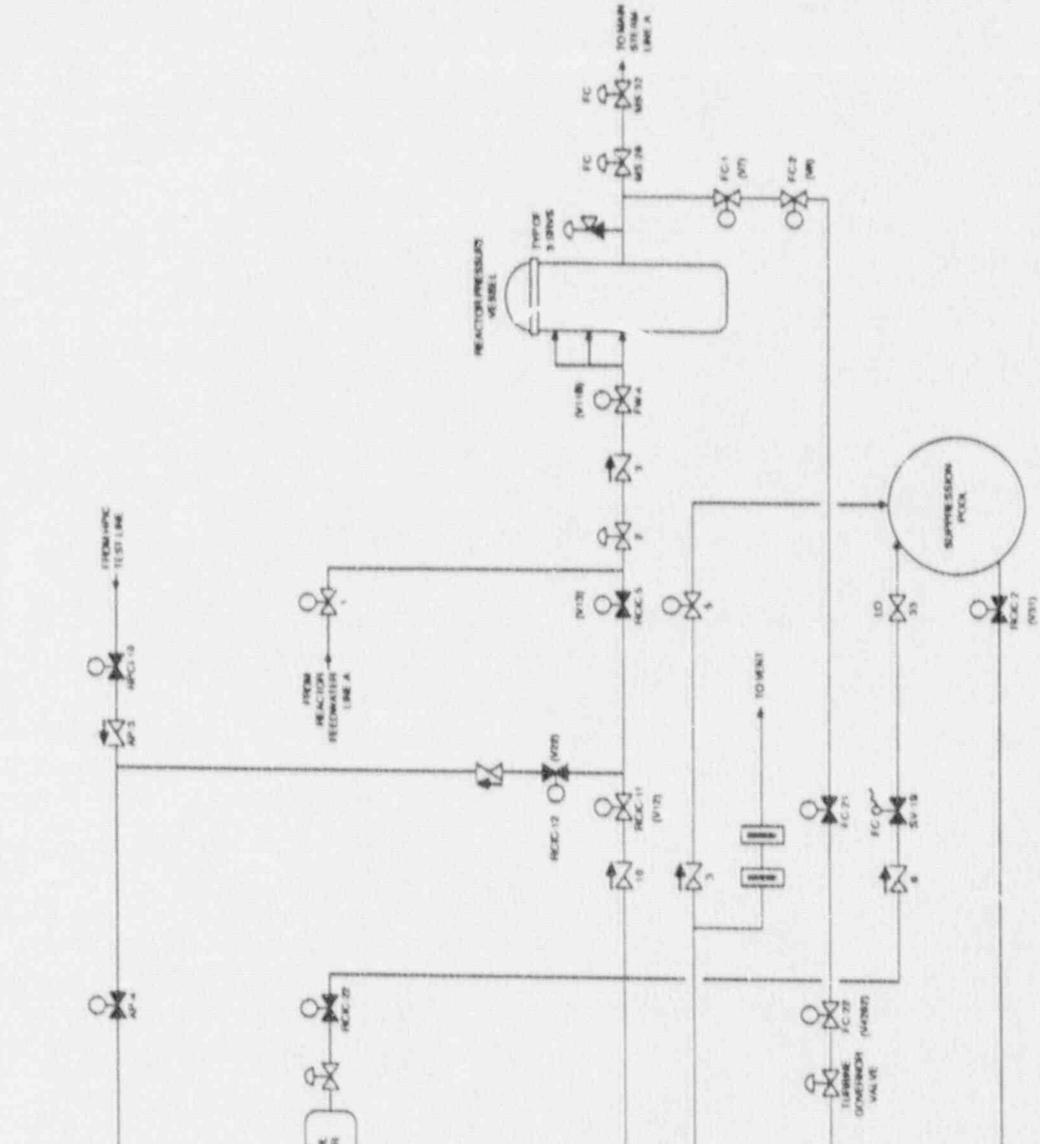


Figure 3.2-1. Hope Creek Reactor Core Isolation Cooling System

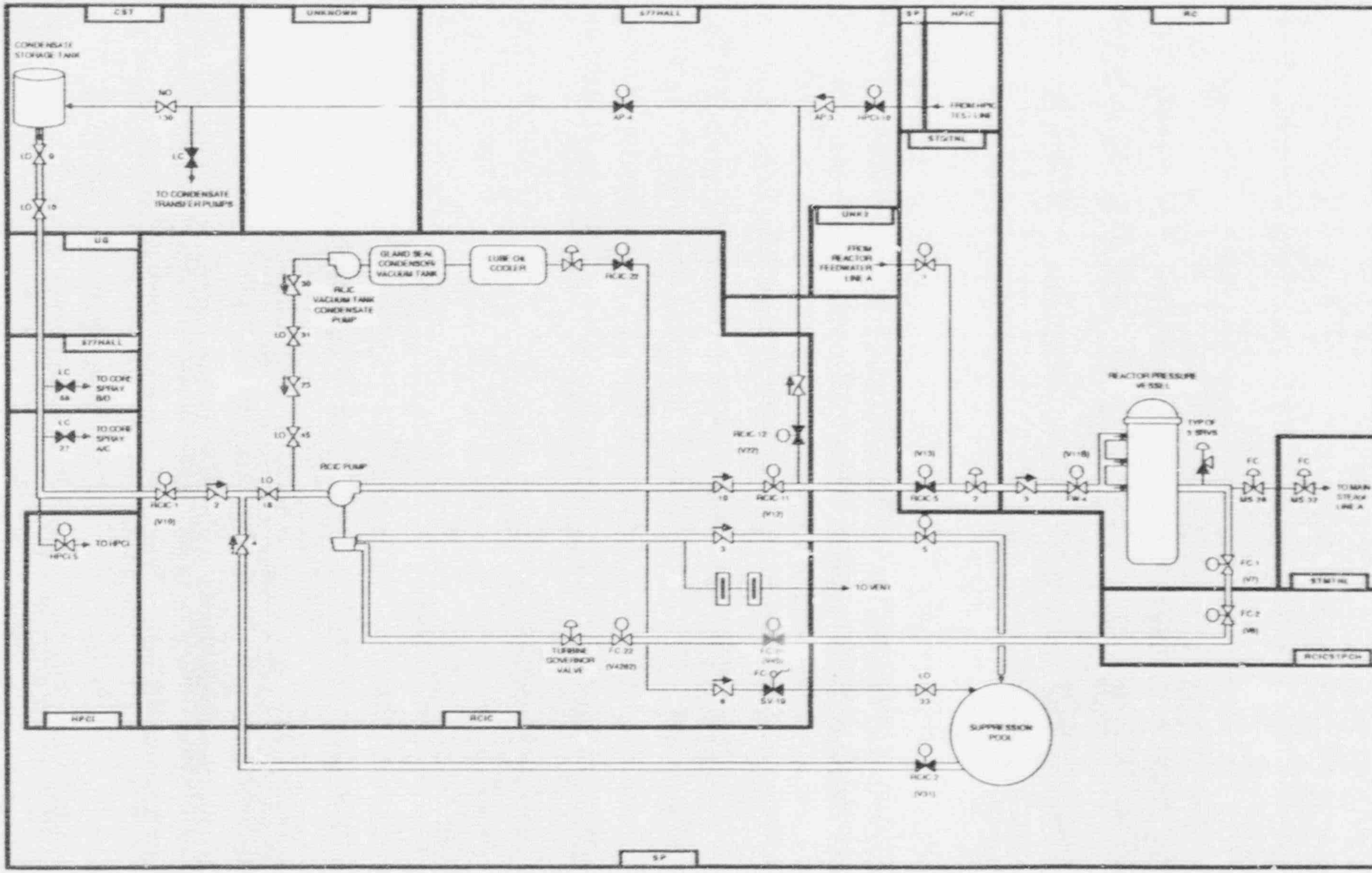


Figure 3.2-2. Hope Creek Reactor Core Isolation Cooling System Showing Component Locations

Table 3.2-1. Hope Creek 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	TANK	CST				
FC-1	MOV	RC	MCC-B242	480	E77HALL	AC/D
FC-2	MOV	RCICSTPCH	MCC-B222	480	RB102	AC/B
FC-21	MOV	RCIC	MCC-D261	250	RCICMCC	250B
FC-22	MOV	RCIC	MCC-D261	250	RCICMCC	250B
FW-4	MOV	RC	UNKNOWN	480	RB145	NONE
PNL BD417	DIST. PNL	SGRMB	BUS D420	125	SGRMB	125B
RCIC TDP	TDP	RCIC				
RCIC-1	MOV	RCIC	MCC-D261	250	RCICMMC	250B
RCIC-11	MOV	RCIC	MCC-D261	250	RCICMCC	250B
RCIC-12	MOV	RCIC	MCC-D261	250	RCICMCC	250B
RCIC-2	MOV	SP	MCC-D261	250	RCICMCC	250B
RCIC-22	MOV	RCIC	MCC-D261	250	RCICMCC	250B
RCIC-5	MOV	STMTNL	MCC-D261	250	RCICMCC	250B
SV-19	SOV	RCIC	PNL BD417	125	SGRMB	250B
AP-4	MOV	S77HALL				

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

- High Pressure Coolant Injection (HPCI) System
- Automatic Depressurization System (ADS)
- Core Spray (CS) System
- Low Pressure Coolant Injection (LPCI) System

The HPCI system is provided to supply 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 turbine-driven pump and booster pump, system piping, valves and controls. The HPCI pump can draw suction from either the CST or the suppression pool. Water is injected into the reactor via feedwater line A and core spray line A. The HPCI turbine is driven by steam from main steam line C. The turbine exhausts to the suppression pool.

The automatic depressurization system (ADS) provides automatic RPV depressurization for small breaks and transients so that the low pressure systems (LPCI and CS) can provide makeup to the RCS. The ADS utilizes 5 of the 14 safety/relief valves that discharge the high pressure steam to the suppression pool.

The CS system supplies make-up water to the reactor vessel at low pressure. The system consists of two discharge headers with two pumps per header which supply two spray spargers in the reactor vessel above the core. Each CS pump takes a separate suction on the suppression pool.

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 four loops with one pump in each loop. The four pumps with their associated loops are designated LPCIA, LPCIB, LPCIC, and LPCID. Each loop consists of a motor driven pump which supplies water from the suppression pool into the reactor vessel. There are two heat exchangers in the system, one for pump A and one for pump B. The RHR system can be remotely realigned as needed to perform suppression pool cooling or containment spray as part of the basic emergency core cooling function. The RHR system can no longer be aligned for steam condensing operation since the valves in the interconnecting piping to the RCIC system are permanently taken out of service.

Simplified drawings of the HPCI system are shown in Figures 3.3-1 and 3.3-2. The CS system is shown in Figures 3.3-3 and 3.3-4. The LPCI system is shown in Figures 3.3-5 and 3.3-6 (loops A and C), and Figures 3.3-7 and 3.3-8 (loops B and D). Note that individual valves have more than one identification number in the original Hope Creek source drawings. Secondary valve numbers are indicated in parentheses in Figures 3.3-1 to 3.3-8. Interfaces between these systems and the RCS are shown in Section 3.1. A summary of selected data on 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 or high containment pressure, 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. Steam to drive the HPCI turbine is routed from main steam line C. If the break is of such a size that the coolant loss exceeds the HPCI system capacity, then the CS and LPCI systems can provide higher capacity makeup to the reactor vessel.

The Automatic Depressurization System will automatically reduce RCS pressure if a break has occurred and RPV water level is not maintained by the HPCI system. Rapid depressurization permits flow from the CS or LPCI systems to enter the vessel.

The CS system consists of two loops, each containing two 50% capacity pumps with separate suctions. Each loop provides makeup to the reactor vessel through separate spray spargers. The source of water is the suppression pool.

The LPCI system is an operating mode of the RHR system. In the LPCI mode the four pumps take suction on the suppression pool and inject back into the vessel through four separate reactor vessel nozzles and core shroud penetrations. Other operating modes of the RHR system include: (a) suppression pool cooling, in which water is recirculated from the suppression pool through RHR heat exchangers and back to the suppression pool; (b) containment spray, in which water is pumped to fog jet nozzles in the drywell and suppression pool; and (c) shutdown cooling.

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 Hope Creek FSAR but can be inferred from pump capacities that are defined 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 (Ref. 1):

- 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 (Ref. 1):

- 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. Note that there may be integrated success criteria involving combinations of core spray and LPCI pumps. 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 EC 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.

3.3.5 Component Information

A. Turbine-driven HPCI pump P204
   1. Rated flow: 5600 gpm @ unknown head
   2. Rated capacity: 100%
   3. Type: centrifugal

B. Motor-driven CS pumps A, B, C, D
   1. Rated flow: 6250 gpm @ 105 psid (vessel to drywell)
   2. Rated capacity: 50%
   3. Type: centrifugal

C. Motor-driven LPCI (RHR) pumps A, B, C, D
   1. Rated flow: 10,000 gpm @ 20 psid (vessel to drywell)
   2. Rated capacity: 100%
   3. Type: centrifugal

D. RHR Heat Exchangers A and B
   1. Heat transfer capability: 286.2×10^6 Btu/hr
   2. Rated capacity: 100%
   3. Type: shell and tube

E. Automatic-depressurization valves (5)
   1. Rated flow: 800,000 lbm/hr @ 1125 psid
   2. Rated capacity: 25%

F. Pressure Suppression Chamber
   1. Design temperature: 310°F
   2. Maximum operating temperature: 95°F
   3. Minimum water volume: 118,000 ft^3

G. Condensate Storage Tank
   1. Capacity: 135,000 gallons reserved for use by both HPCI and RCIC

3.3.6 Support Systems and Interfaces

A. Control signals

1. Automatic
   a. The HPCI pump, CS pumps, and the LPCI pumps, and all their associated valves function upon receipt of low water level in the reactor vessel or high pressure in the drywell. When the reactor vessel pressure is low enough, the CS and LPCI injection valves open.
   b. The HPCI pump is automatically tripped upon turbine overspeed, reactor vessel high water level, HPCI pump low suction pressure, or HPCI turbine exhaust high pressure. If an initiation signal is received after the turbine is shut down, the system restarts automatically, provided no shutdown signal exists. Containment isolation signals will isolate the HPCI turbine steam supply line.
   c. HPCI pump suction is automatically switched from the CST to the suppression pool upon low CST level or high suppression pool water level.
   d. The ADS system is actuated upon coincident signals of the reactor vessel low water level, high drywell pressure and at least one CS or LPCI pump running at discharge pressure, or upon coincident signals of low reactor water level, high drywell pressure bypass timer timed out (6 minutes), and one CS or LPCI pump running at discharge pressure. If all signals are present the ADS valves will open after the ADS two minute timer runs out. The time delay gives the HPCI system a chance to operate before blowdown occurs.
   e. LPCI initiation automatically causes all RHR components to perform their function under the LPCI mode.
   f. HPCI flow is held constant over all operating pressures using a flow controller which sends a signal to the turbine governor.
2. Remote manual
   ECCS pumps and valves and the ADS can be actuated by remote manual means from the main control room.

B. Motive Power

1. The CS and LPCI motor-driven pumps and motor-operated valves are Class 1E AC loads that can be supplied from the emergency diesel generators, as described in Section 3.5.
2. Most of the HPCI motor-operated valves are Class 1E DC loads. The HPCI pump is supplied with steam from main steam line C.

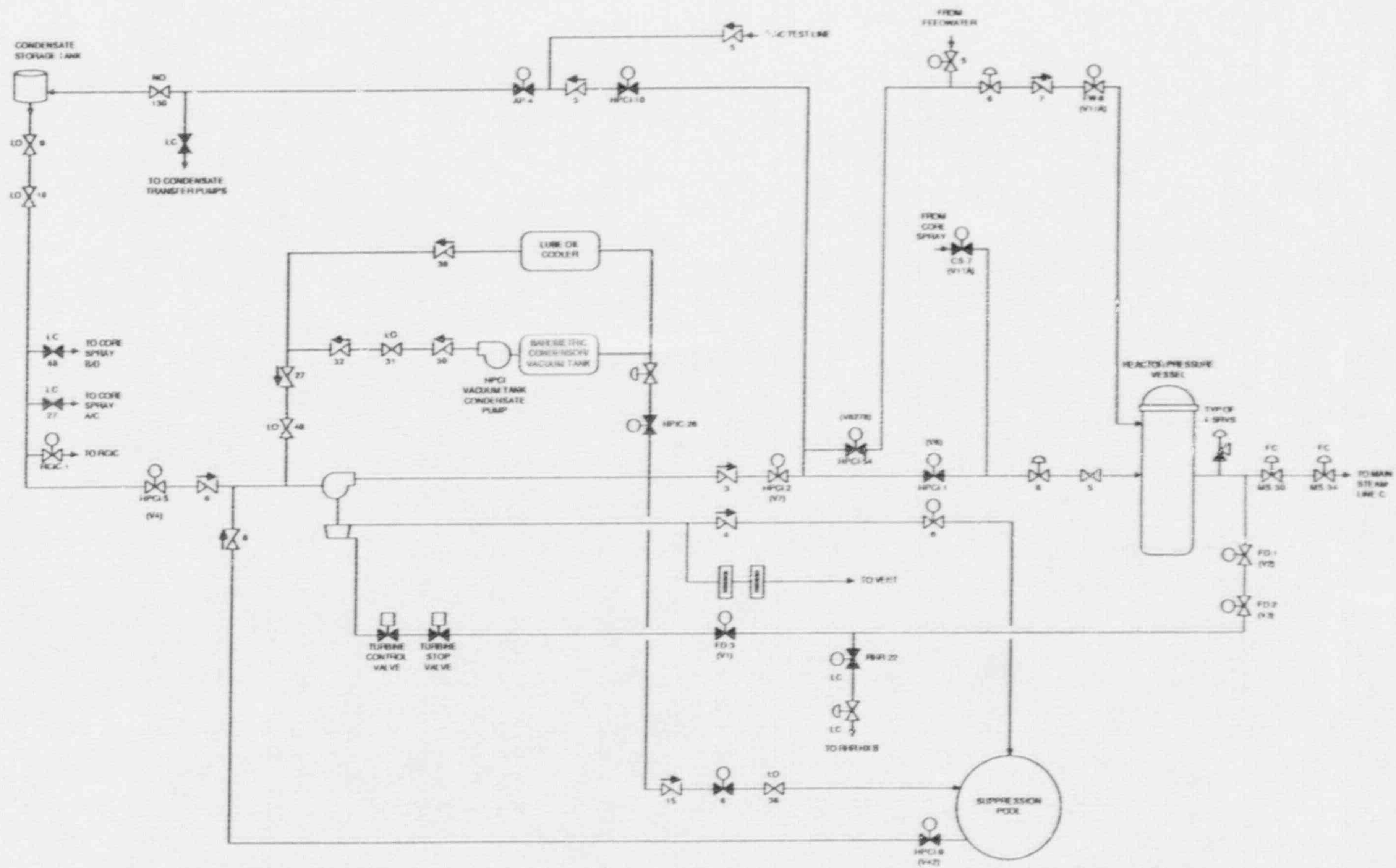
C. Other

1. The HPCI pump has a DC powered auxiliary lube oil pump that is required for pump startup (i.e. to pressurize the oil system for pump thrust bearing lubrication and for operation of the governor system and the hydraulic steam supply valves for the HPCI turbine). Power source for the HPCI DC lube oil pump is 250 VDC MCC D251 (the HPCI MCC). Once the HPCI pump is operating, a shaft-driven lube oil pump provides oil pressure, and the DC lube oil pump is stopped.
2. Lubrication and cooling for the CS pumps are assumed to be supplied locally.
3. LPCI (RHR) pump lubrication is assumed to be provided locally. RHR pump seals are cooled by the safety auxiliaries cooling system (see Secion 3.7).

4. ECCS pump room ventilation systems are cooled by the Safety Auxiliaries Cooling System (see Section 3.7).
5. The RHR heat exchangers are cooled by the Safety Auxiliaries Cooling System (see Section 3.7).

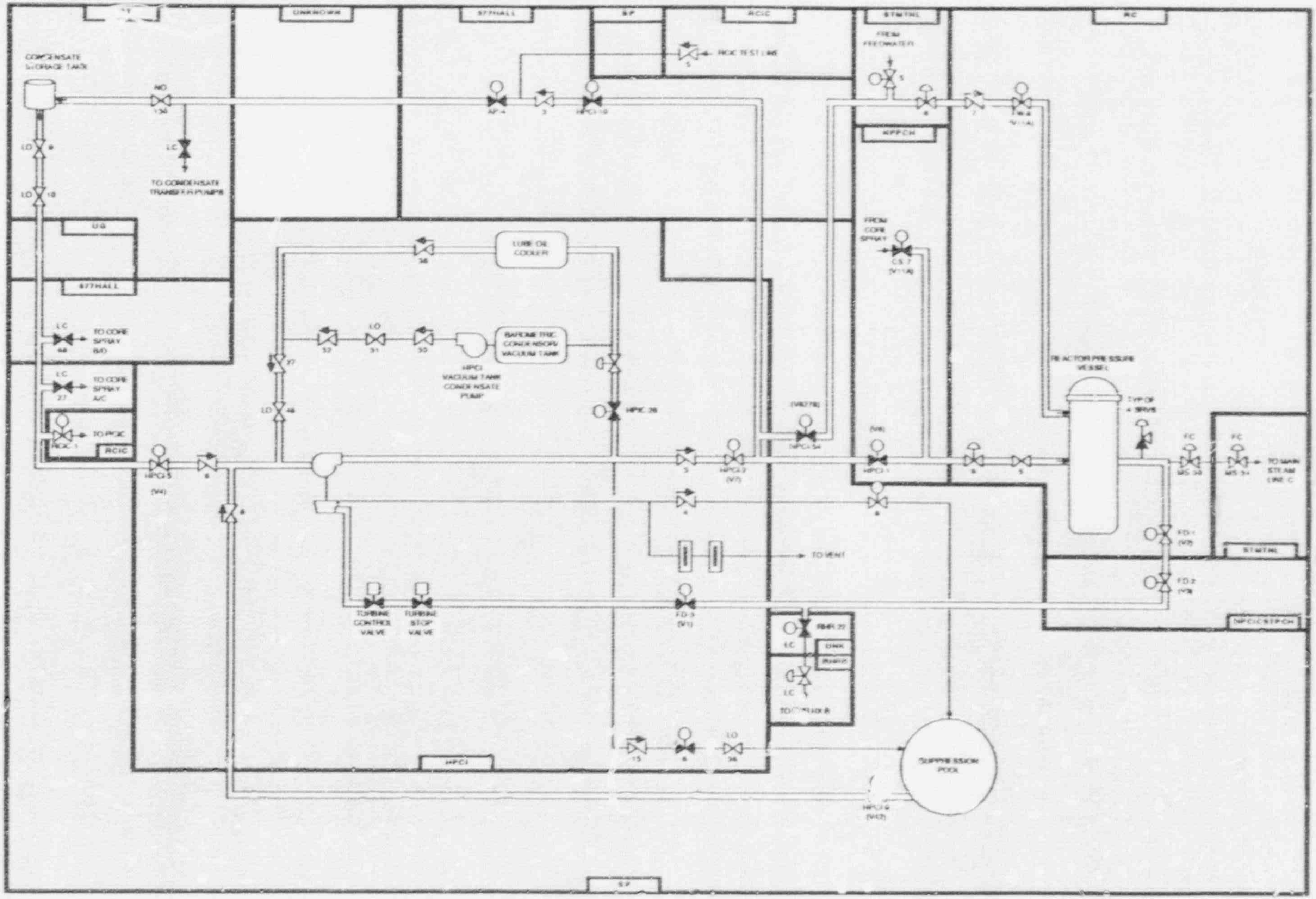
3.3.7 Section 3.3 References

1. Hope Creek Updated Final Safety Analysis Report, Section 6.3.



NOTE: THE HPCI BOOSTER PUMP AND THE HPCI PUMP ARE DRAWN AS A SINGLE UNIT.

Figure 3.3-1. Hope Creek High Pressure Coolant Injection System



NOTE: THE HPCI BOOSTER PUMP AND THE HPCI PUMP ARE DRAWN AS A SINGLE UNIT

Figure 3.3-2. Hope Creek High Pressure Coolant Injection System Showing Component Locations

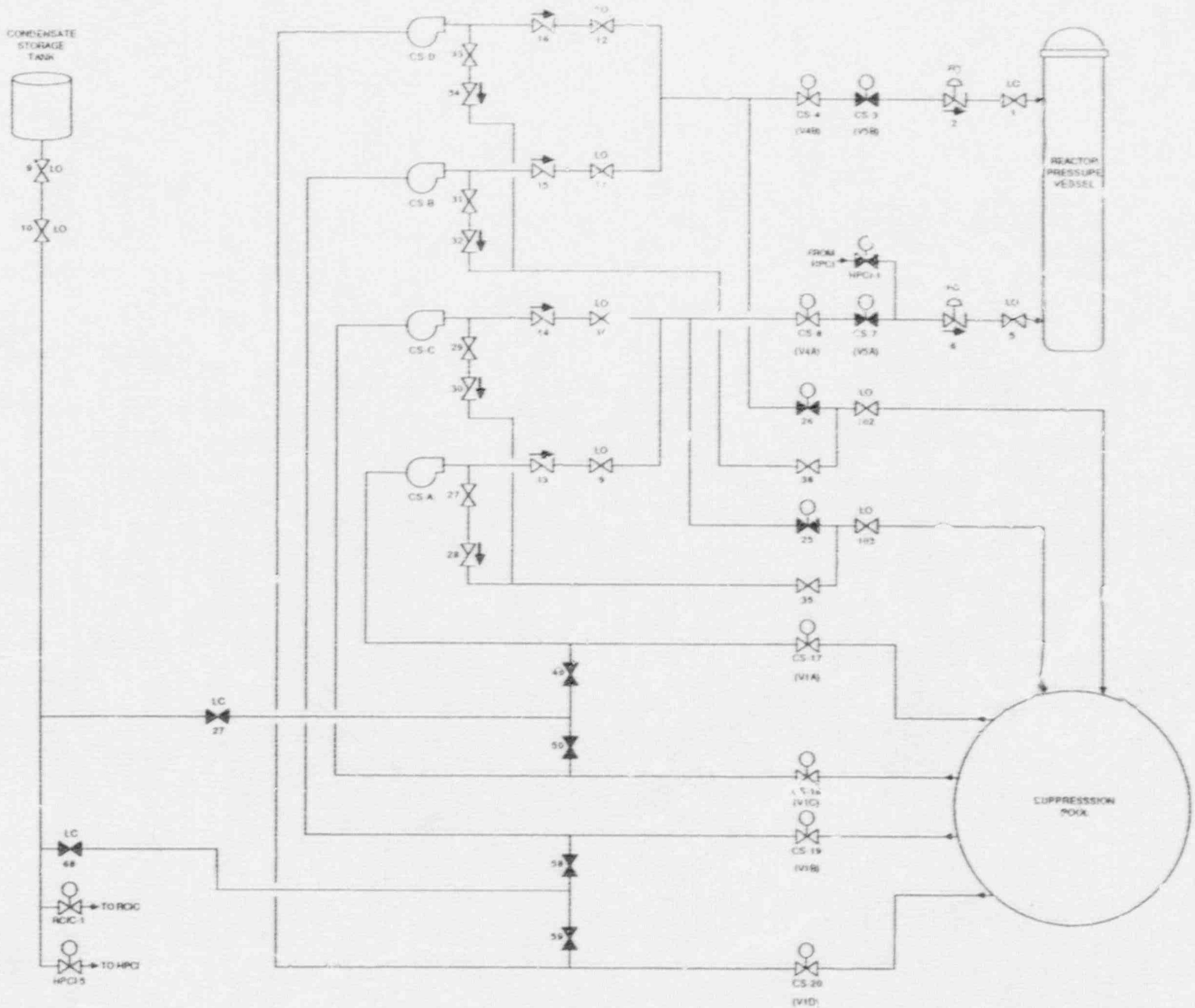


Figure 3.3-3. Hope Creek Core Spray System

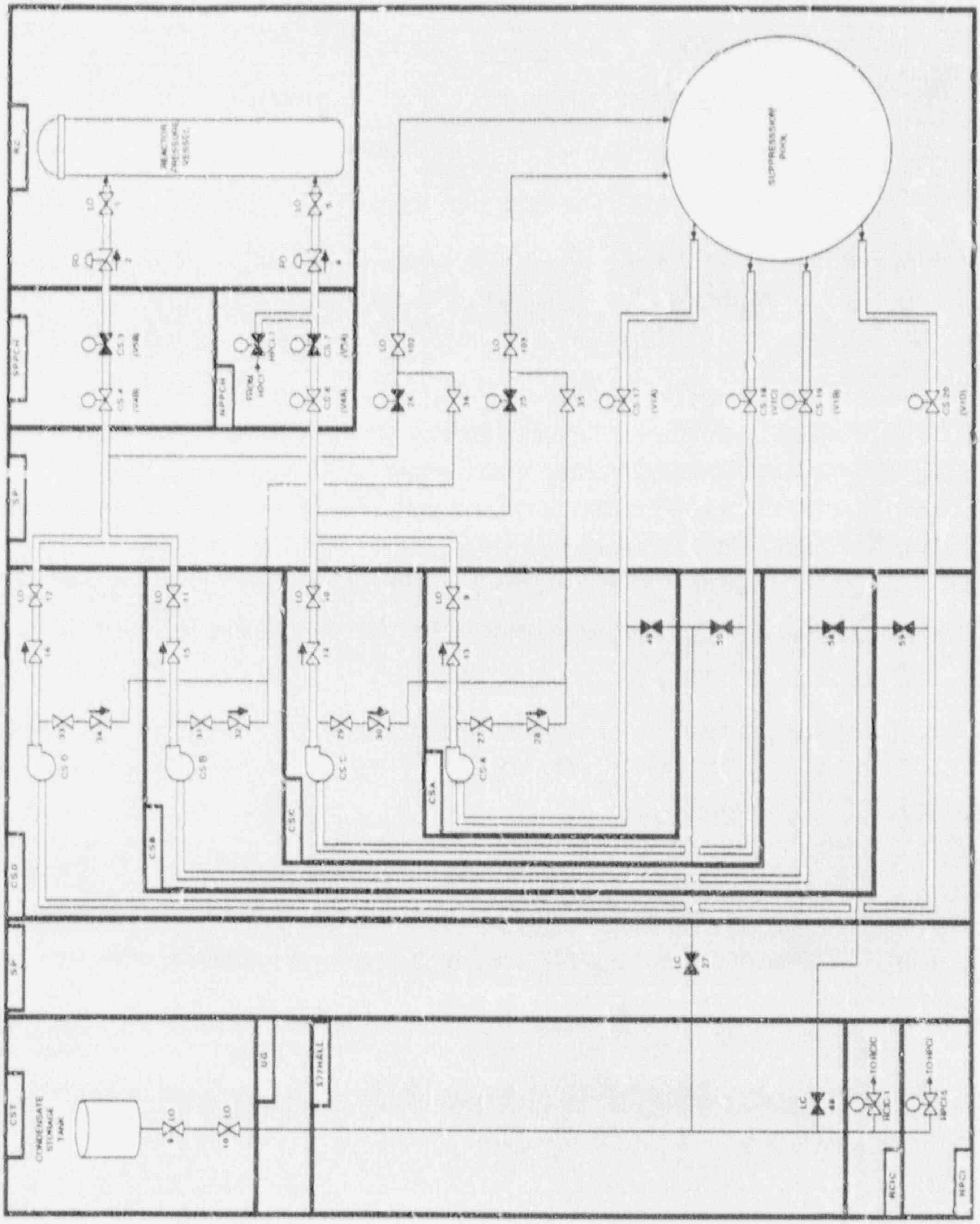


Figure 3.3-4. Hope Creek Core Spray System Showing Component Locations

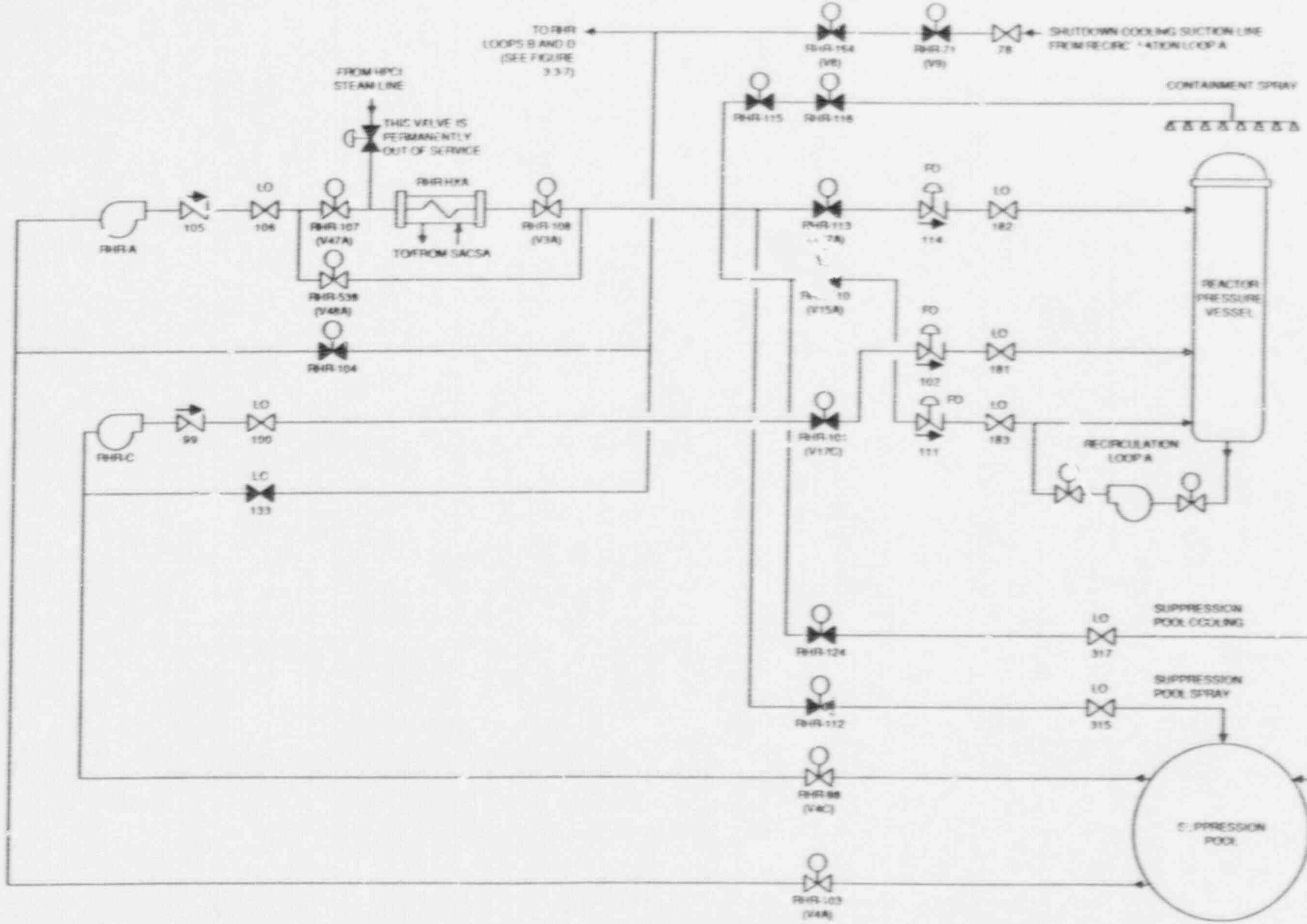


Figure 3.3-5. Hope Creek Residual Heat Removal System, Loops A and C

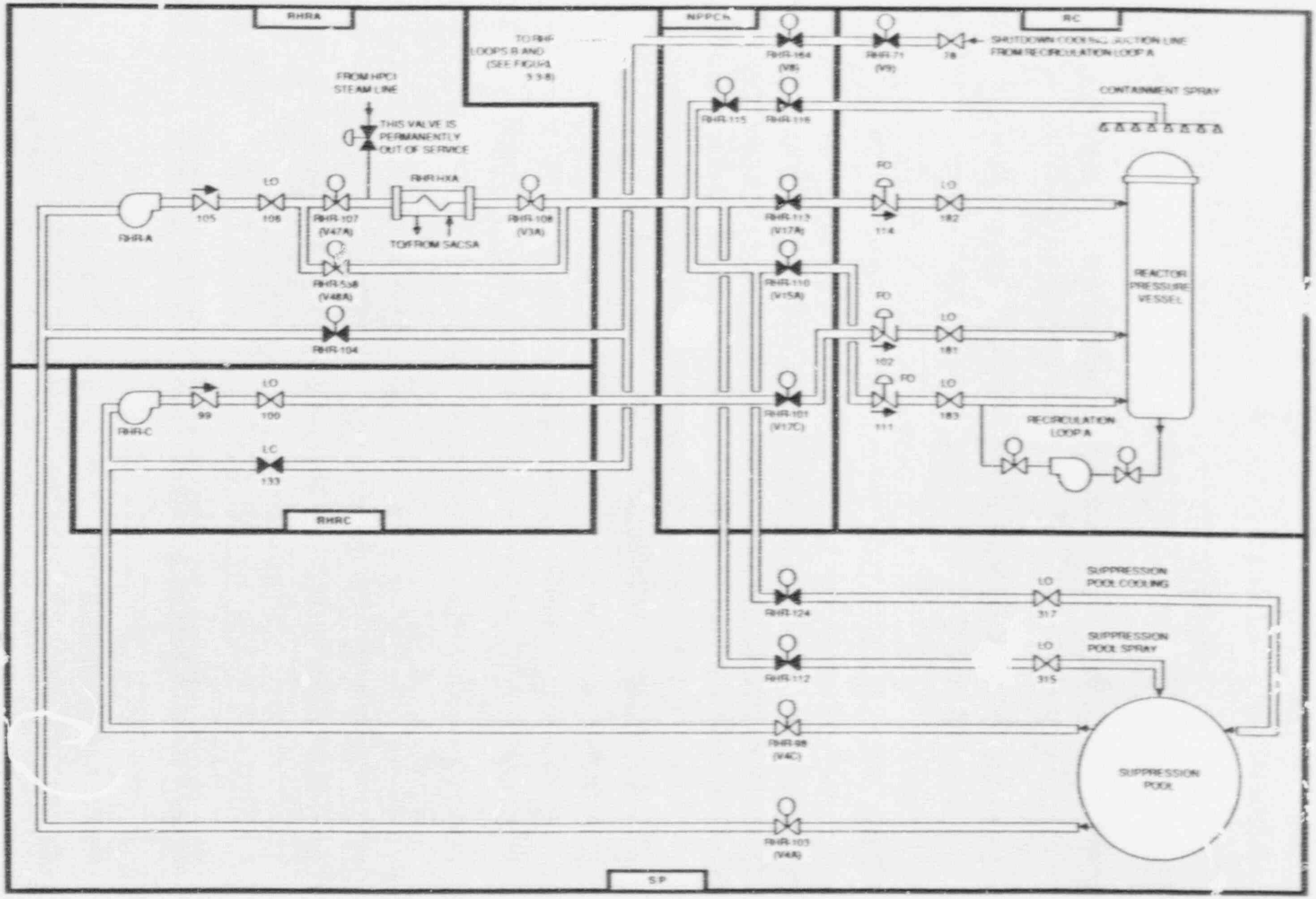
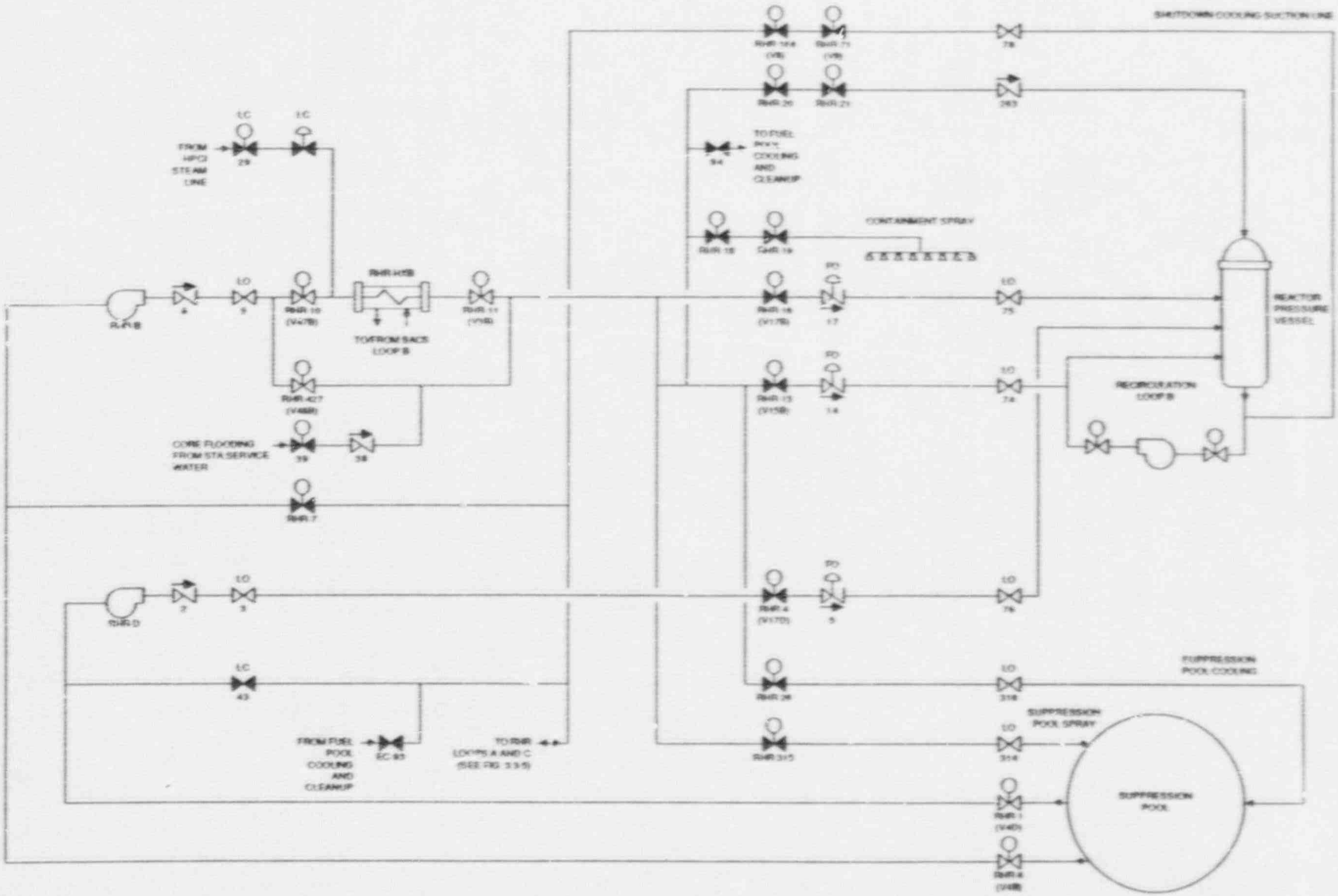
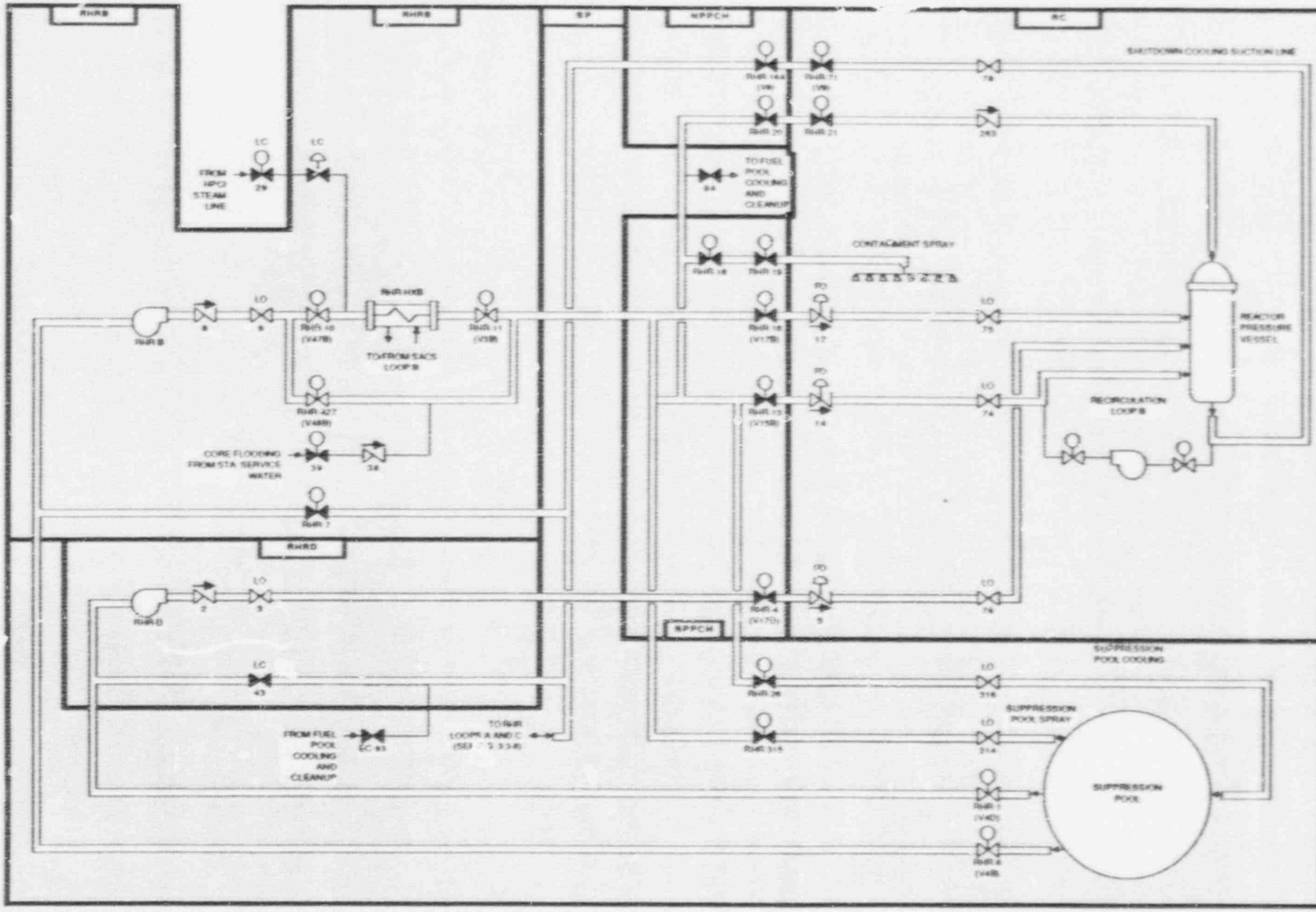


Figure 3.3-6. Hope Creek Residual Heat Removal System, Loops A and C, Showing Component Locations



NOTE: THE VALVES FROM THE HPCI STEAM LINE AND TO THE RCIC SYSTEM ARE PERMANENTLY OUT OF SERVICE (DISCONNECTED)

Figure 3.3-7. Hope Creek Residual Heat Removal System, Loops B and D



NOTE: THE VALVES FROM THE HPCI STEAM LINE AND TO THE ADC SYSTEM ARE PERMANENTLY OUT OF SERVICE (DISCONNECTED)

Figure 3.3-8. Hope Creek Residual Heat Removal System, Loops B and D, Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
	PP	RC				
CS PUMP A	MDP	CSA	BUS A401	4160	SGRMA	AC/A
CS PUMP B	MDP	CSB	BUS A402	4160	SGRMB	AC/B
CS PUMP C	MDP	CSC	BUS A403	4160	SGRMC	AC/C
CS PUMP D	MDP	CSD	BUS A404	4160	SGRMD	AC/D
CS-17	MOV	SP	MCC-B212	480	SACSA	AC/A
CS-18	MOV	SP	MCC-B232	480	RB102NE	AC/C
CS-19	MOV	SP	MCC-B222	480	RB102	AC/B
CS-20	MOV	SP	MCC-B242	480	E77HALL	AC/D
CS-3	MOV	SPPCH	MCC-B222	480	RB102	AC/B
CS-4	MOV	SPPCH	MCC-B222	480	RB102	AC/B
CS-7	MOV	NPPCH	MCC-B212	480	SACSA	AC/A
CS-8	MOV	NPPCH	MCC-B212	480	SACSA	AC/A
FD-1	MOV	RC	MCC-B232	480	RB102NE	AC/C
FD-2	MOV	HPCISTPCH	MCC-B212	480	SACSA	AC/A
FD-3	MOV	HPCI	MCC-D251	250	HPCIMCC	250A
FW-8	MOV	RC	MCC-B252	480	MCC252	NONE

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
HPCI TURB. STOP, TURB. CONTROLS	HOV	HPCI				
HPCI-1	MOV	NPPCH	MCC-D251	250	HPCIMCC	250A
HPCI-10	MOV	S7/HALL	MCC-D251	250	HPCIMCC	250A
HPCI-2	MOV	HPCI	MCC-D251	250	HPCIMCC	250A
HPCI-28	MOV	HPCI	MCC-D251	250	HPCIMCC	250A
HPCI-5	MOV	HPCI	MCC-D251	250	HPCIMCC	250A
HPCI-54	MOV	SP	MCC-D251	250	HPCIMCC	250A
HPCI-54	MOV	SP	MCC-D251	250	HPCIMCC	250A
PNL AD417	DIST. PNL	SGRMA	BUS D410	125	SGRMA	125A
RHR HX A	HX	RHRA				
RHR HX B	HX	RHRB				
RHR HX B	HX	RHRB				
RHR HXA	HX	RHRA				
RHR PUMP A	MDP	RHRA	BUS A401	4160	SGRMA	AC/A
RHR PUMP B	MDP	RHRB	BUS A402	4160	SGRMB	AC/B
RHR PUMP C	MDP	RHRC	BUS A403	4160	SGRMC	AC/C
RHR PUMP D	MDP	RHRD	BUS A404	4160	SGRMD	AC/D

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RHR-1	MOV	SP	MCC-B242	480	E77HALL	AC/D
RHR-10	MOV	RHRB	MCC-B222	480	RB102	AC/B
RHR-101	MOV	NPPCH	MCC-B232	480	RB102NE	AC/C
RHR-103	MOV	SP	MCC-B212	480	SACSA	AC/A
RHR-104	MOV	RHRA	MCC-B451	480	SGRMA	AC/A
RHR-107	MOV	RHRA	MCC-B212	480	SACSA	AC/A
RHR-108	MOV	RHRA	MCC-B212	480	SACSA	AC/A
RHR-11	MOV	RHRB	MCC-B222	480	RB102	AC/B
RHR-110	MOV	NPPCH	MCC-B481	480	SGRMD	AC/D
RHR-110	MOV	NPPCH	MCC-B481	480	SGRMD	AC/D
RHR-112	MOV	SP	MCC-B212	480	SACSA	AC/A
RHR-112	MOV	SP	MCC-B212	480	SACSA	AC/A
RHR-113	MOV	NPPCH	MCC-B212	480	SACSA	AC/A
RHR-113	MOV	NPPCH	MCC-B212	480	SACSA	AC/A
RHR-115	MOV	NPPCH	MCC-B212	480	SACSA	AC/A
RHR-115	MOV	NPPCH	MCC-B212	480	SACSA	AC/A
RHR-116	MOV	NPPCH	MCC-B451	480	SGRMA	AC/A

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RHR-116	MOV	NPPCH	MCC-B451	480	SGRMA	AC/A
RHR-124	MOV	SP	MCC-B212	480	SACSA	AC/A
RHR-124	MOV	SP	MCC-B212	480	SACSA	AC/A
RHR-13	MOV	SPPCH	MCC-B242	40	E77HALL	AC/D
RHR-13	MOV	SPPCH	MCC-B242	480	E77HALL	AC/D
RHR-16	MOV	SPPCH	MCC-B222	480	RB102	AC/B
RHR-16	MOV	SPPCH	MCC-B222	4890	RB102	AC/B
RHR-18	MOV	SPPCH	MCC-B222	480	RB102	AC/B
RHR-18	MOV	SPPCH	MCC-B222	480	RB102	AC/B
RHR-19	MOV	SPPCH	MCC-B222	480	RB102	AC/B
RHR-19	MOV	SPPCH	MCC-B222	480	RB102	AC/B
RHR-20	MOV	NPPCH	MCC-B242	480	E77HALL	AC/D
RHR-21	MOV	RC	MCC-B411	480	SGRMA	AC/A
RHR-26	MOV	SP	MCC-B222	480	RB102	AC/B
RHR-26	MOV	SP	MCC-B222	480	RB102	AC/B
RHR-315	MOV	SP	MCC-B222	480	RB102	AC/B
RHR-315	MOV	SP	MCC-B222	480	RB102	AC/B

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RHR-4	MOV	SPPCH	MCC-B242	480	E77HALL	AC/D
RHR-427	MOV	RHRB	MCC-B222	480	RB102	AC/B
RHR-427	MOV	RHRB	MCC-B222	480	RB102	AC/B
RHR-538	MOV	RHRA	MCC-B212	480	SACSA	AC/A
RHR-538	MOV	RHRA	MCC-B212	480	SACSA	AC/A
RHR-6	MOV	SP	MCC-B222	480	RB102	AC/B
RHR-7	MOV	RHRB	MCC-B222	480	RB102	AC/B
RHR-98	MOV	SP	MCC-B232	480	RB102NE	AC/C
SAC-23	MOV	RHRA	MCC-B212	480	SACSA	AC/A
SAC-26	MOV	RHRB	MCC-B222	480	RB102	AC/B
SRV	SRV	RC				

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), actuation logic and controls for various Engineered Safety Features (ESF) and Essential Auxiliary Supporting (EAS) systems, and systems for the display of plant information to the operators. The RPS and ESF actuation systems monitor the reactor plant, and alert the operator to take corrective action before specified limits are exceeded. The RPS will initiate an automatic reactor trip (scram) to rapidly shut down the reactor when plant conditions exceed one or more specified limits. The ESF actuation systems will automatically actuate selected safety systems based on the specific limits or combinations of limits that are exceeded.

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 Control Rod Drive Hydraulic System (see Section 3.6). The ESF and EAS actuation systems include independent sensor and transmitter units, logic units, and relays that interface with the control circuits for the many different components that can be actuated.

3.4.3 System Operation

A. RPS

The RPS consists two separate trip systems, A and B. Each trip system has two independent trip logic channels (A1, A2, B1 and B2). The trip logic channels are combined in a one-out-of-two logic arrangement in their associated trip system. The output of each logic arrangement controls a pilot scram valve solenoid for each control rod. Both trip systems must de-energize their associated pilot scram valve solenoid for the control rod to scram. Each pilot scram valve controls the air supply to its associated scram valve. Air pressure holds the scram valves shut. The scram valves control the supply and discharge paths for CRDHS water. There are also solenoid operated backup scram valves that are energized to open (scram) and require both A1 and A2 be tripped or both B1 and B2 be tripped.

The RPS monitors and automatically initiates a scram based on the following variables:

- Neutron monitoring (APRM) system
- Neutron monitoring (IRM) system
- Neutron monitoring (SRM) system
- Reactor vessel high pressure
- Reactor vessel low water level
- Main stop valve closure
- Turbine control valve fast closure
- Main steam line isolation valve closure
- Scram discharge volume high water level
- Primary containment high pressure
- Main steam line high radiation
- Mode switch in SHUTDOWN

In addition, a scram can be manually initiated. There are four scram pushbuttons, one for each trip logic channel. Depressing the A1 or A2 scram button de-energizes trip actuators A1 or A2 and opens corresponding contacts in trip system A. To effect a manual scram, one button for each trip system must be depressed. It is also possible to scram the reactor by interrupting power to the reactor protection system.

To restore the reactor protection system to normal operation following a scram or single trip system logic trip, each trip logic channel must be manually reset. Reset is possible only if the conditions that caused the trip or scram have been cleared and is accomplished by operating switches in the control room.

The Redundant Reactivity Control System (RRCS) has been added as a means of limiting the consequences of the unlikely occurrence of an anticipated transient without scram (ATWS) event. The RRCS trips the recirculation pumps, runs back feedwater, and inserts control rods on the occurrence of reactor vessel low water level or rea[illegible] pressure.

B. ESF and EAS Actuation System
ESF and EAS actuation systems have up to four input instrument channels for each sensed parameter, and two output trains. In general, each train controls equipment powered from different Class 1E electrical buses. The ESF and EAS systems that can be automatically actuated include the following (not a complete listing):

- Emergency Core Cooling System
- HPCI
- CS
- LPCI/RHR
- ADS
- Standby power systems
- Service water system
- ESF equipment area cooling systems
- Containment and RPV isolation systems
- Main control room HVAC system
- Safety Auxiliaries Cooling System

Details regarding ESF actuation logic are included in the system description for the actuated system.

C. Remote Shutdown
The capability is provided to shutdown the reactor and maintain it in a safe condition in the event the control room must be evacuated. In the event that the control room becomes uninhabitable, the reactor may be shut down by one of the following means:

- The reactor may be shut down by manual trip of RPS circuit breakers.
- The reactor protection system will function automatically to shut down the reactor on reactor high pressure, low water level, or loss of power to the RPS MG sets. Two channels are provided so that even with the loss of one of these, the reactor would be shut down safely.
- The reactor may be shut down by tripping the turbine. This puts the RPS into operation.
- The reactor may be shut down by cutting off power to the RPS MG sets at the motor control centers feeding them.

The reactor would then be maintained in a safe shutdown condition by operating the RCIC or HPCI system in conjunction with the safety/relief valves. The RHR, SACS and SSWS systems would also be required for suppression pool heat removal. These system may be operated from outside the control room at the Remote Shutdown Panel, at local panels such as motor control centers, or manually, as appropriate.

The Remote Shutdown Panel (RSP) has controls and instrumentation for the following systems:

- RCIC
- ADS
- RHR (loop B)
- SACS (loop B)
- SSWS (loop B)
- ESF equipment cooling
- RPV, containment and suppression pool instrumentation

In addition, the other systems can be operated or monitored outside the main control room that are not part of the RSP. These include:

- HPCI
- ADS
- RHR (loop A)
- SACS (loop A)
- SSWS (loop A)
- Alternate RPV containment and suppression pool instrumentation
- ESF equipment cooling
- HVAC

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 Hope Creek 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 Hope Creek 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 from the 115 VAC RPS system supplied by motor generator sets. Alternate 120 VAC power is available from a non-Class 1E MCC.
2. Other Actuation and Control Systems
The control power interfaces for the various front line safety systems at Hope Creek are summarized in Table 3.4-1.
3. Operator Instrumentation
Operator instrumentation displays are normally powered from 120 VAC panels through transformers from the 480 VAC motor control centers B451, B461, B471 and B481. Backup power is supplied through transformers from 480 VAC motor control centers B411, B421, B431 and B441. Alternate power is supplied through inverters from the 125 VDC buses.

Table 3.4-1. Matrix of Hope Creek Control Power Sources

SYSTEM	125 VDC POWER SOURCE			
	AD417	BD417	CD417	DD417
RCIC		X		
RCIC STEAM MOVs (FC)		X		X
ADS		X		X
CS LOOP A	X			
CS LOOP B		X		
CS LOOP C	X		X	
CS LOOP D		X		X
LPCI (RHR) LOOP A	X			
LPCI (RHR) LOOP B		X		
LPCI (RHR) LOOP C			X	
LPCI (RHR) LOOP D				X
HPCI	X			
HPCI STEAM MOVs (FD)	X		X	
RPS TRIP SYST VERT BD	X	X		
REMOTE SHUTDOWN PANEL		X		X
AC TRAIN A	X			
AC TRIAN B		X		
AC TRAIN C			X	
AC TRAIN D				X
REDUNDANT REACTIVITY CNTRL SYS	X	X		

NOTE: AD417 = 125 VDC Distribution Panel 1AD417
BD417 = 125 VDC Distribution Panel 1BD417
CD417 = 125 VDC Distribution Panel 1CD417
DD417 = 125 VDC Distribution Panel 1DD417

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 electric power system consists of four independent 4160 and 480 VAC trains, denoted channels A, B, C and D. Each AC power division has a standby diesel generator which serves as the AC power source when the normal source of offsite power is unavailable.

The DC Class 1E system consists of four 125 VDC divisions denoted A, B, C and D and two 250 VDC buses denoted channels A and B. The 125 VDC buses are each supplied by two battery chargers and a battery. The two battery chargers are supplied from separate 480 VAC buses. The 250 VDC buses are supplied by one battery charger and one battery each.

The 120 VAC system consists of four instrument buses, supplied by the 480 VAC system through transformers or from the 125 VDC system through inverters.

Simplified one-line diagrams of the electric power system are shown in Figures 3.5-1 to 3.5-13. A summary of data on selected electric power system components is presented in Table 3.5-1.

3.5.3 System Operation

Each Class 1E 4160 VAC bus is provided with two offsite power feeders and one standby diesel generator. The normal power source for buses 401, 402, 403 and 404 is a 13.8 KVAC ring bus via transformers. Details of the station electric power system are shown in Figures 3.5-1, 3.5-2 and 3.5-3.

The four standby diesel generators are started upon loss of offsite power at the 4.16 kV bus, or a ECCS signal, manual initiation of the Core Spray system or manual actuation, either locally or in the control room. Diesel generators A, B, C and D are connected to the 4160 VAC safeguard buses 401, 402, 403 and 404, respectively. Each diesel is connected to only one bus. In turn, each 4160 VAC safeguard bus supplies power to two 480 VAC buses through transformers. Details of the 4160 and 480 VAC systems are shown in Figures 3.5-4 to 3.5-7.

The Class 1E 250 VDC system consists of two independent divisions, channel A and channel B. Each channel is supplied by a battery charger powered from a Class 1E 480 VAC motor control center and a 250 VDC motor control center. The channel A motor control center (MCC D251) supplies HPCI system valves. The channel B motor control center (MCC D261) supplies RCIC system valves. It is not known how long the batteries can supply their loads without recharging. Details of the 250 VDC system are shown in Figures 3.5-8 and 3.5-9.

The Class 1E 125 VDC system consists of four independent divisions. Each 125 VDC system is comprised of a set of one 125 V battery, and two chargers. Each battery has a nominal manufacturer's eight hour rating of 1800 ampere hours to a minimum battery terminal voltage of 105V. The batteries can supply design loads without recharging for only 4 hours. Details of the 125 VDC systems are shown in Figures 3.5-10 and 3.5-11.

Instrument power is provided by four independent Class 1E 120 VAC buses. The instrument buses receive normal and backup power from 480 VAC motor control centers (MCCs) through transformers. Alternate power is supplied from the 125 VDC systems via inverters. Details of the system are shown in Figures 3.5-12 and 3.5-13.

Redundant safeguards equipment such as motor driven pumps and motor operated valves are supplied by different buses or MCCs. For the purpose of discussion, this equipment has been grouped into "load groups". Load group "AC/A" contains components receiving electric power either directly of indirectly from 4160 bus 401. Load group "AC/B" contains components powered either directly or indirectly from 4160 bus 402. Load group "AC/C" contains components powered either directly or indirectly from 4160 bus 403. Load group "AC/D" contains components powered either directly or indirectly from 4160 bus 404. Components receiving 125 VDC power are assigned to load groups "125A", "125B", "125C" or "125D", based on the battery source. Components receiving 250 VDC power are assigned to load groups "250A" or 250B" depending on their battery source. Selected loads and components supplied by the Class 1E electric power system are listed in Table 3.5-2.

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 A, B, C, D
   1. Continuous power rating: 4430 kW
   2. Rated voltage: 4160 VAC
   3. Manufacturer: Colt-Pielstick

B. Station batteries AD411, BD411, CD411, DD411
   1. Type: lead-calcium
   2. Rated voltage: 125 VDC
   3. Rated capacity: 4 hours with design loads

C. Station Batteries D421, D431
   1. Type: lead-calcium
   2. Rated voltage: 250 VDC
   3. Rated capacity: unknown

3.5.6 Support Systems and Interfaces

A. Control Signals

1. Automatic
   The standby diesel generators are automatically started upon loss of voltage on their associated 4160 VAC bus, on a ECCS signal, or on start of the core spray (CS) system.
2. Remote manual
   The diesel generators can be started, and many distribution circuit breakers can be operated from the main control room.
3. Local manual
   The diesel generators can be started locally.

B. Diesel Generator Auxiliary Systems

The following auxiliaries are provided for each emergency diesel generator:

- Cooling
  Each diesel has a self contained cooling water system which is in turn cooled by the Safety Auxiliaries Cooling System (see Section 3.7).
- Fueling
  An independent day tank with 1-3/4 hour fuel is provided for each diesel. Long-term fuel tanks are located below the diesel generator rooms at the 54 foot elevation.
- Lubrication
  Each diesel generator has a self-contained lubrication system.
- Starting
  Two independent starting air receivers are provided for each diesel generator.
- Control power
  Each diesel generator is dependent on the 125 VDC power system for control power.
- Diesel room ventilation fans provide room cooling during diesel operation. Intake and exhaust is also provided for each diesel separately.

C. Switchgear and Battery Room Ventilation

Ventilation capabilities for the essential switchgear rooms and battery rooms have not be determined.

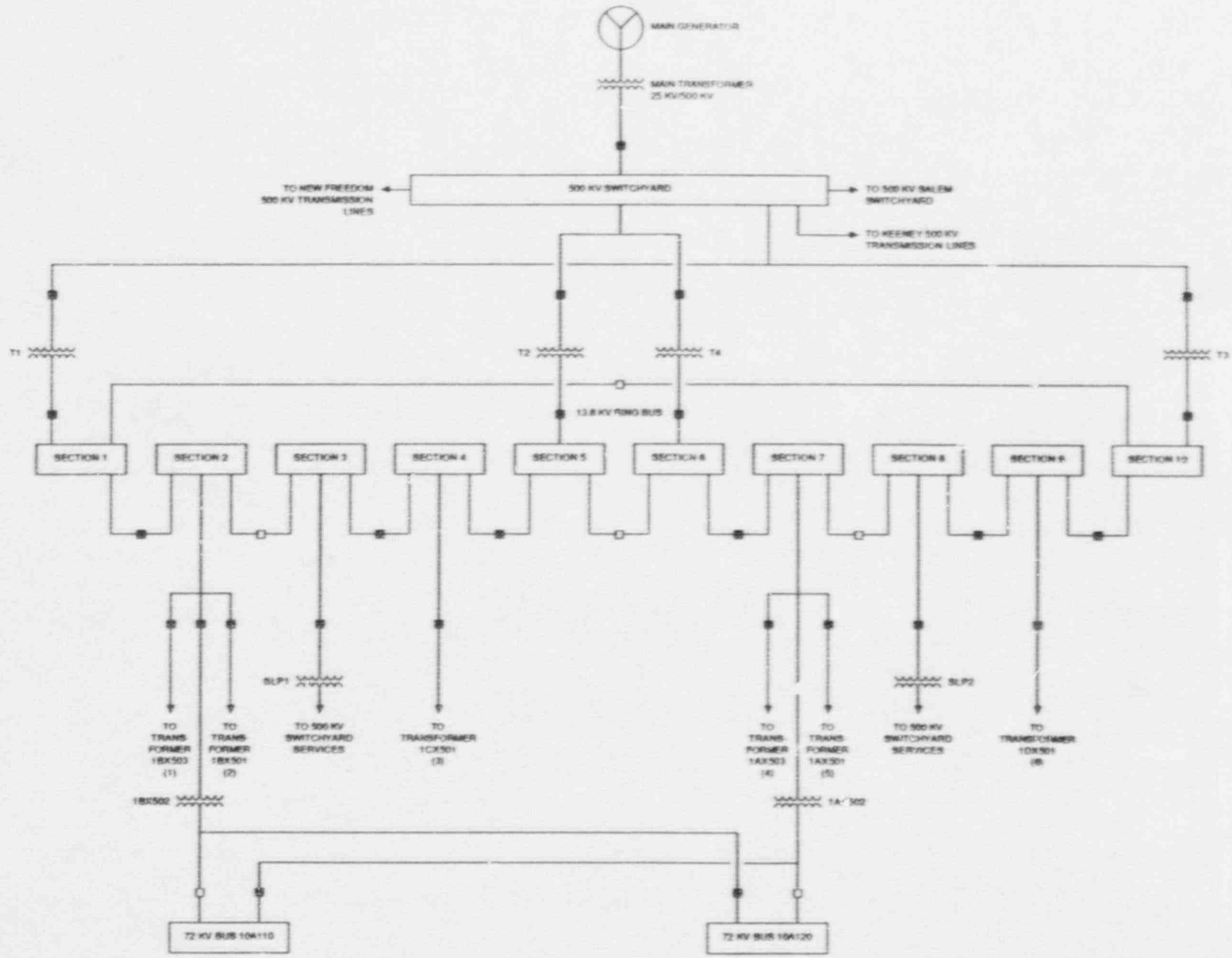


Figure 3.5-1. Hope Creek Electric Po ver Distribution System

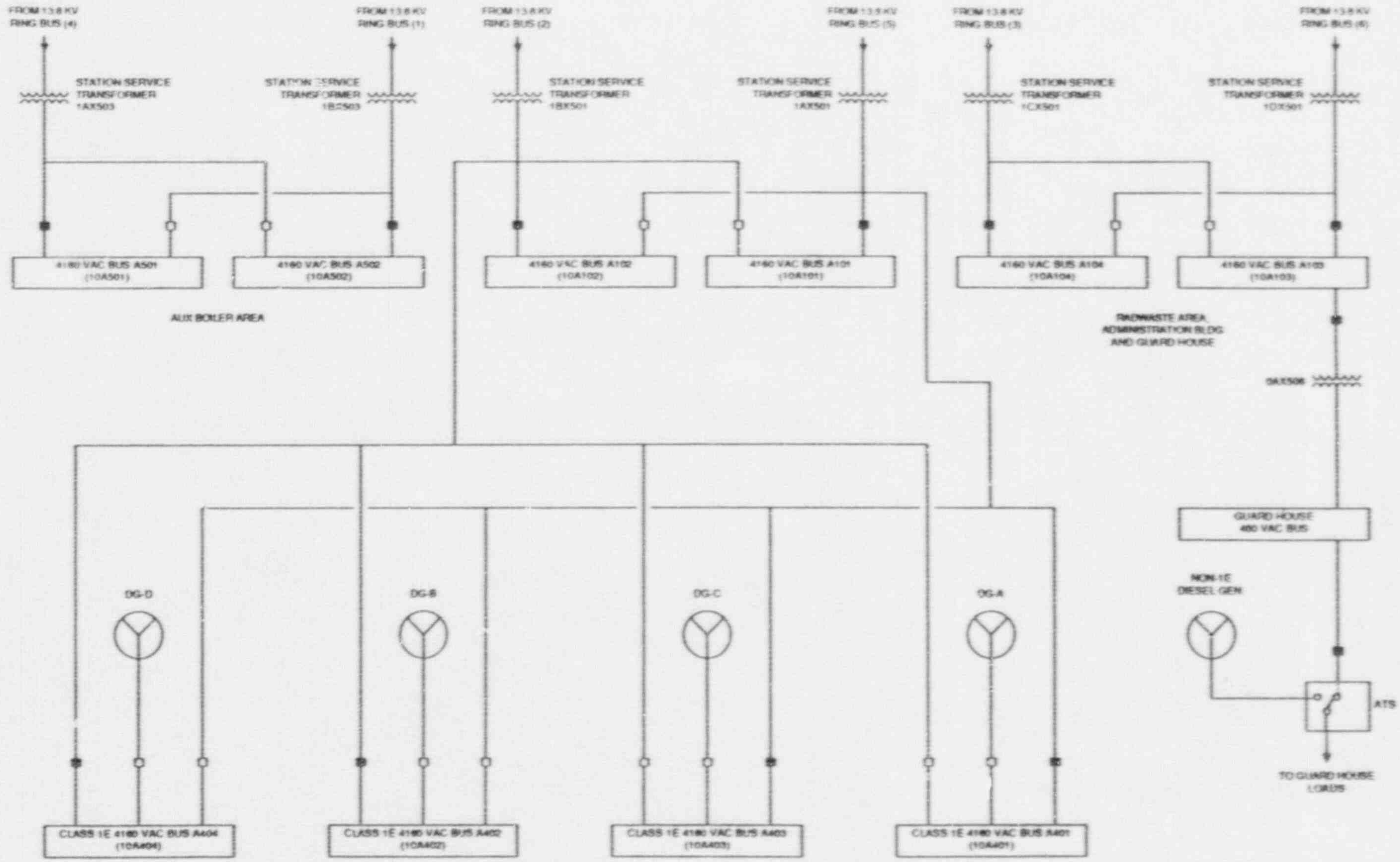
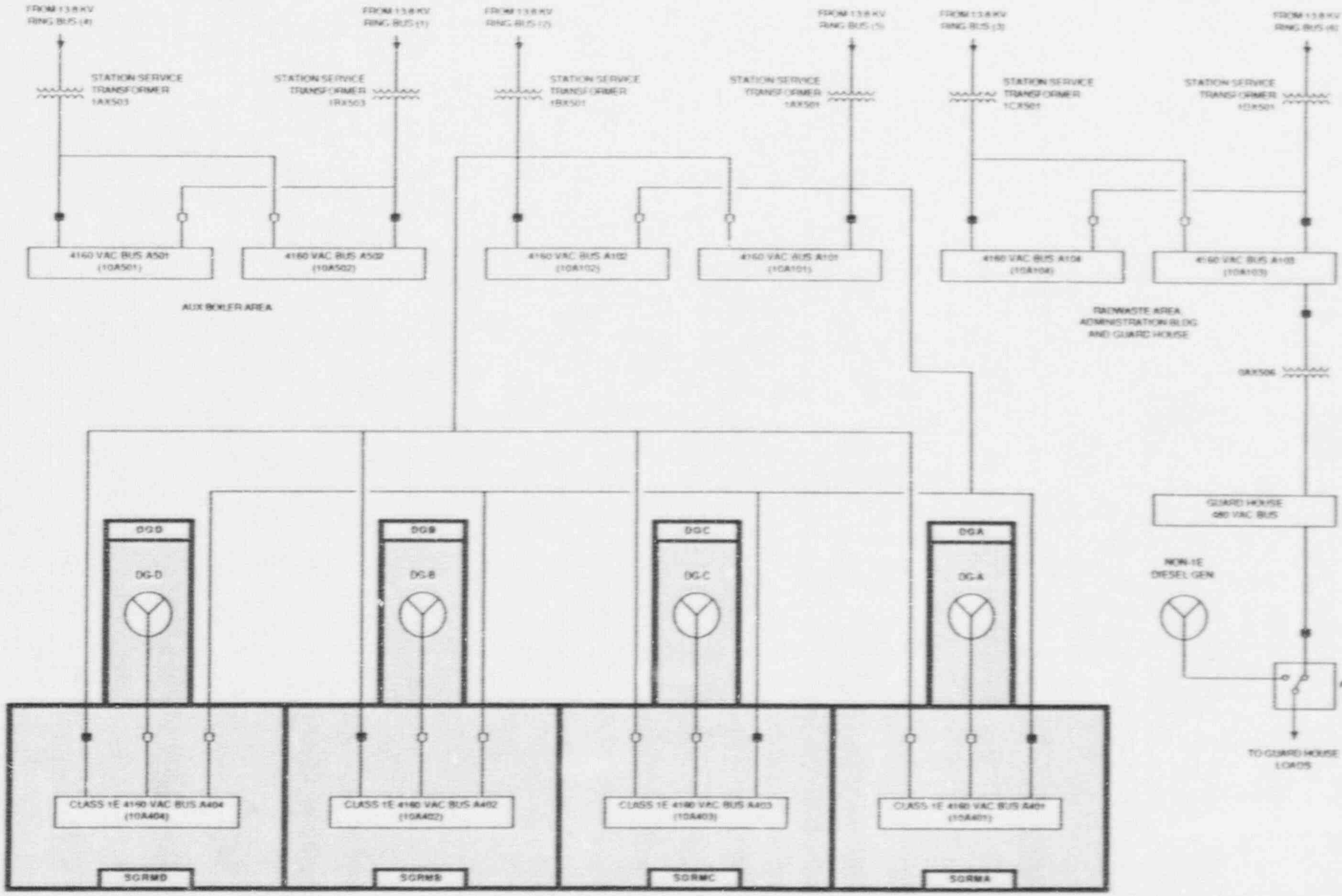
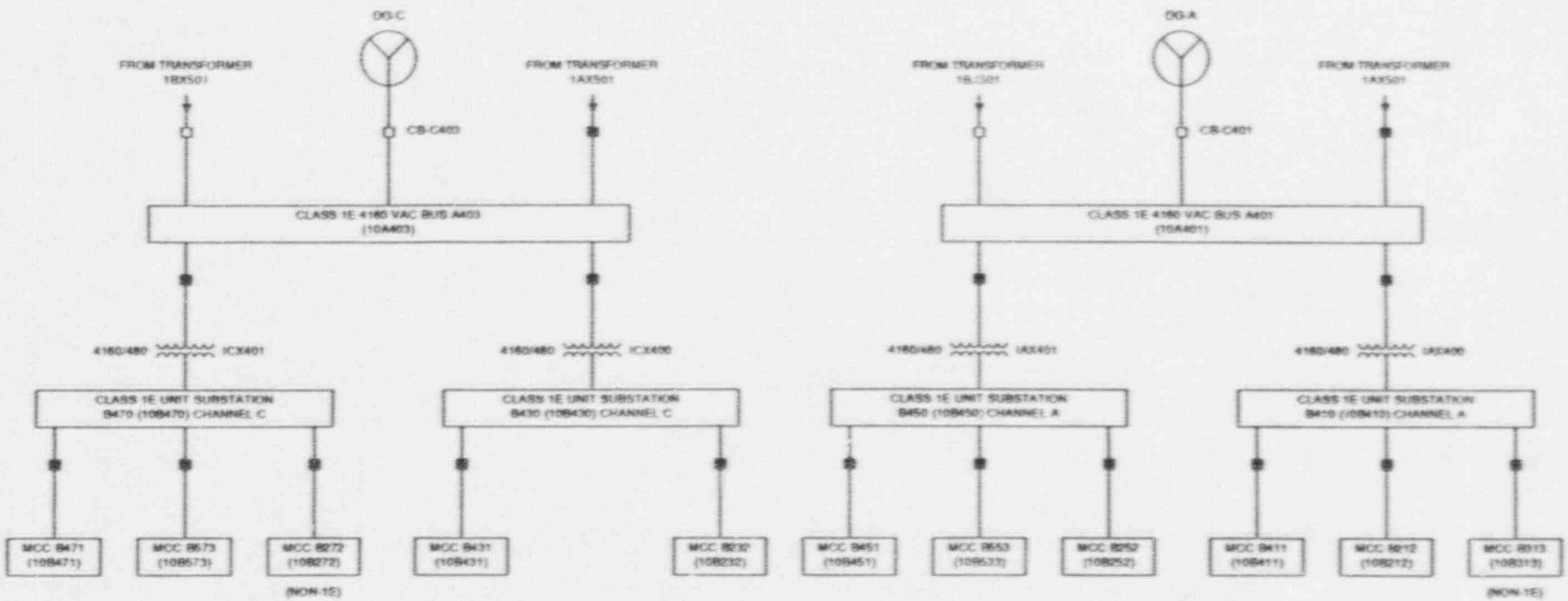


Figure 3.5-2. Hope Creek 4160 VAC Electric Power Distribution System

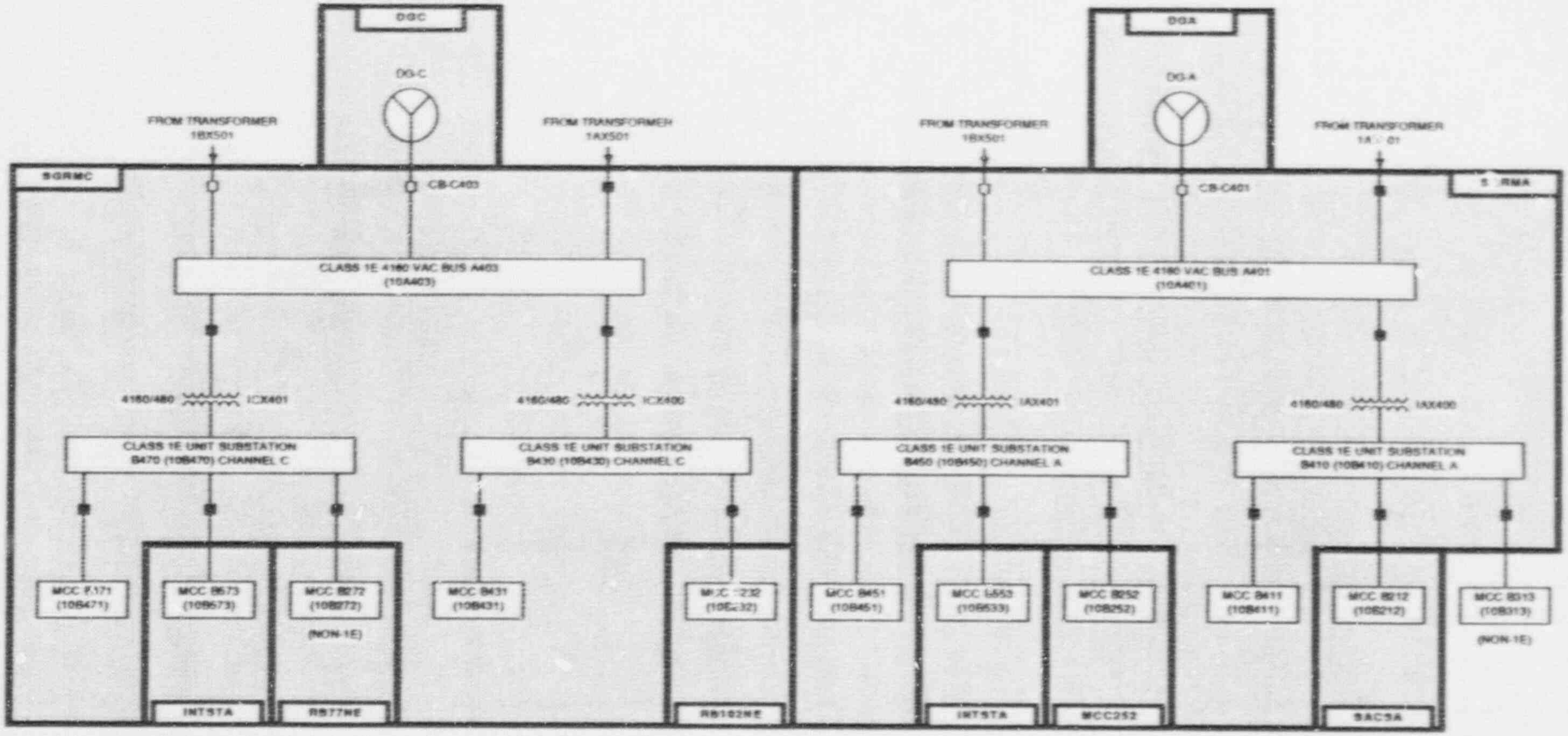


NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-3. Hope Creek 4160 VAC Electric Power Distribution System Showing Component Locations



Figu'e 3.5-4. Hope Creek 4160/480 VAC Electric Power System Channels A and C



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-5. Hope Creek 4160/480 VAC Electric Power System Channels A and C Showing Component Locations

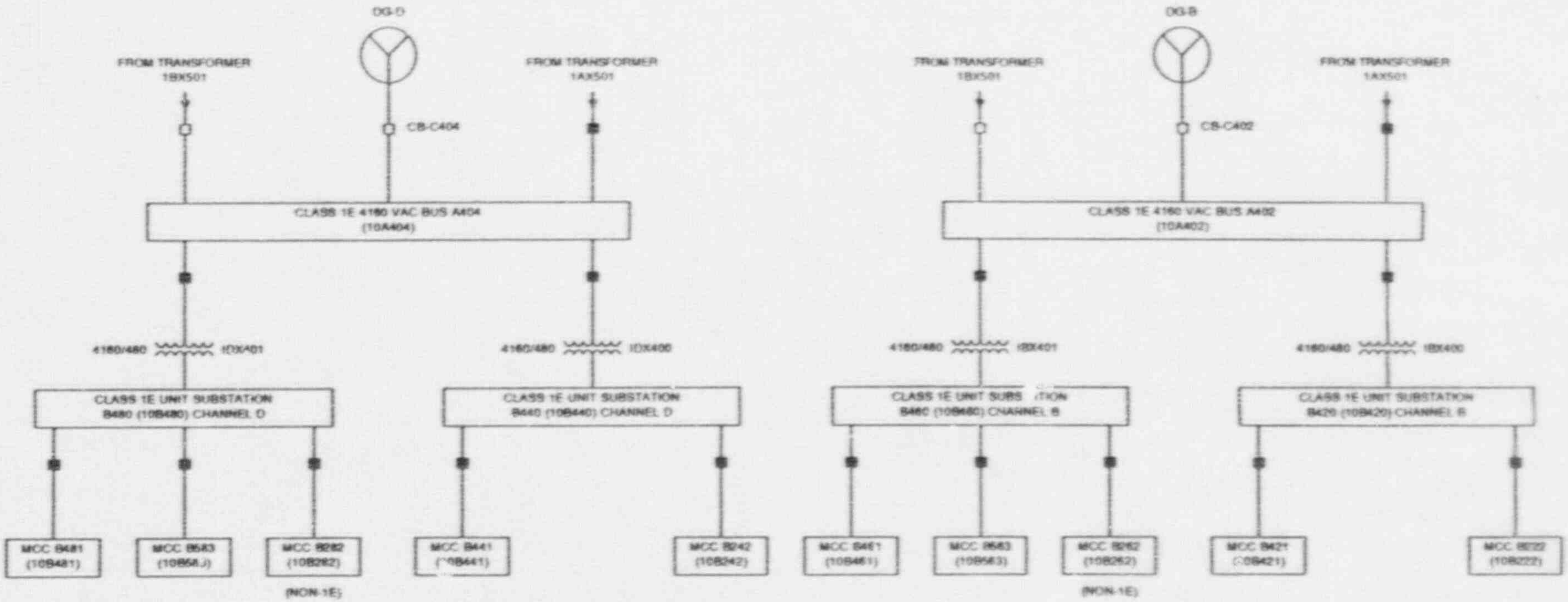
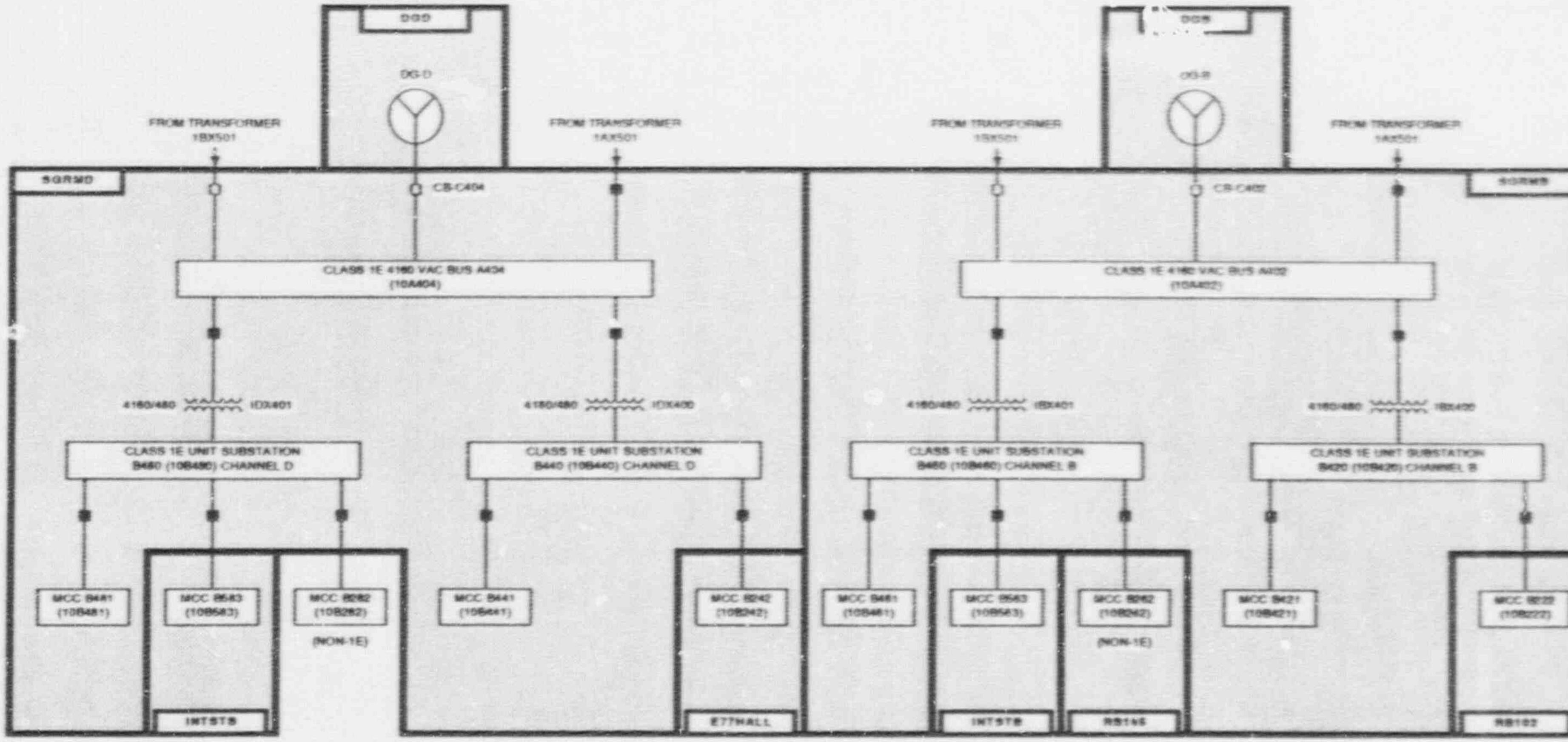


Figure 3.5-6. Hope Creek 4160/480 VAC Electric Power System Channels B and D



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-7. Hope Creek 4160/480 VAC Electric Power System Channels B and D Showing Component Locations

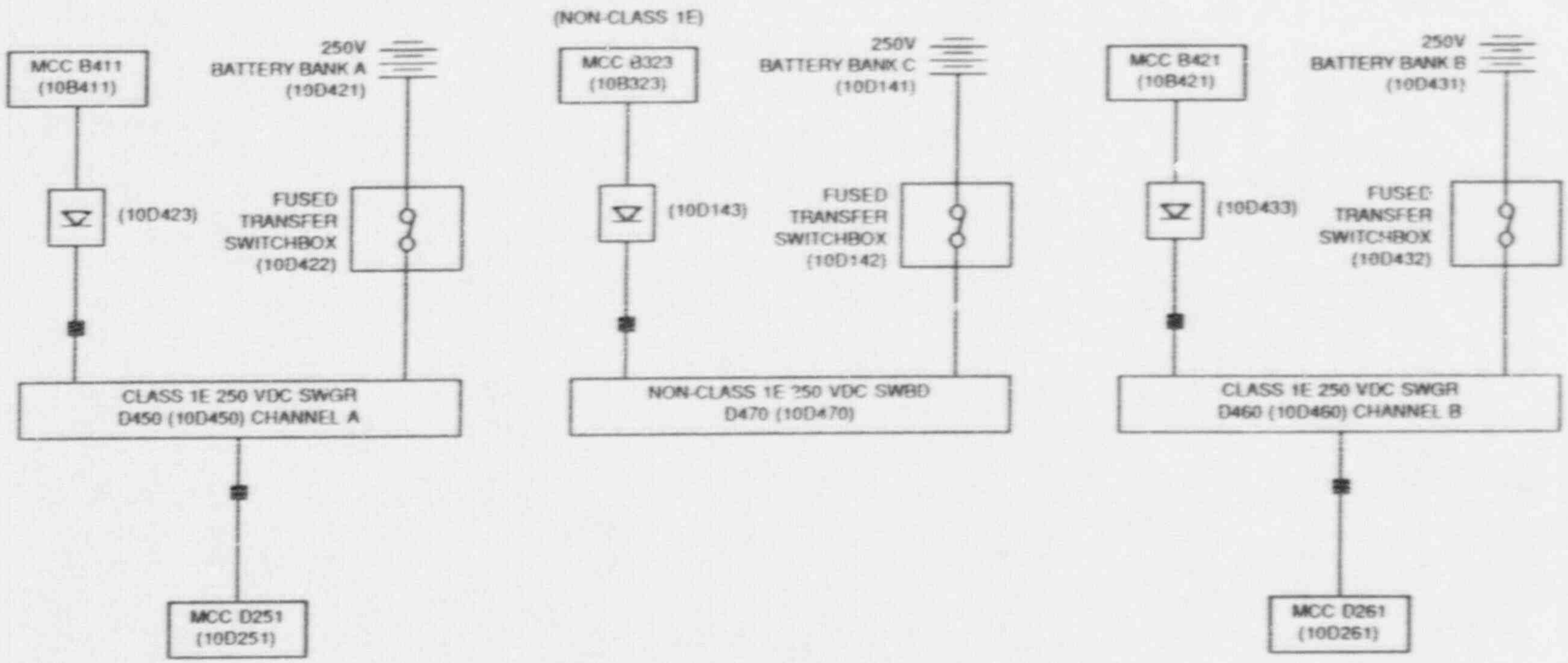
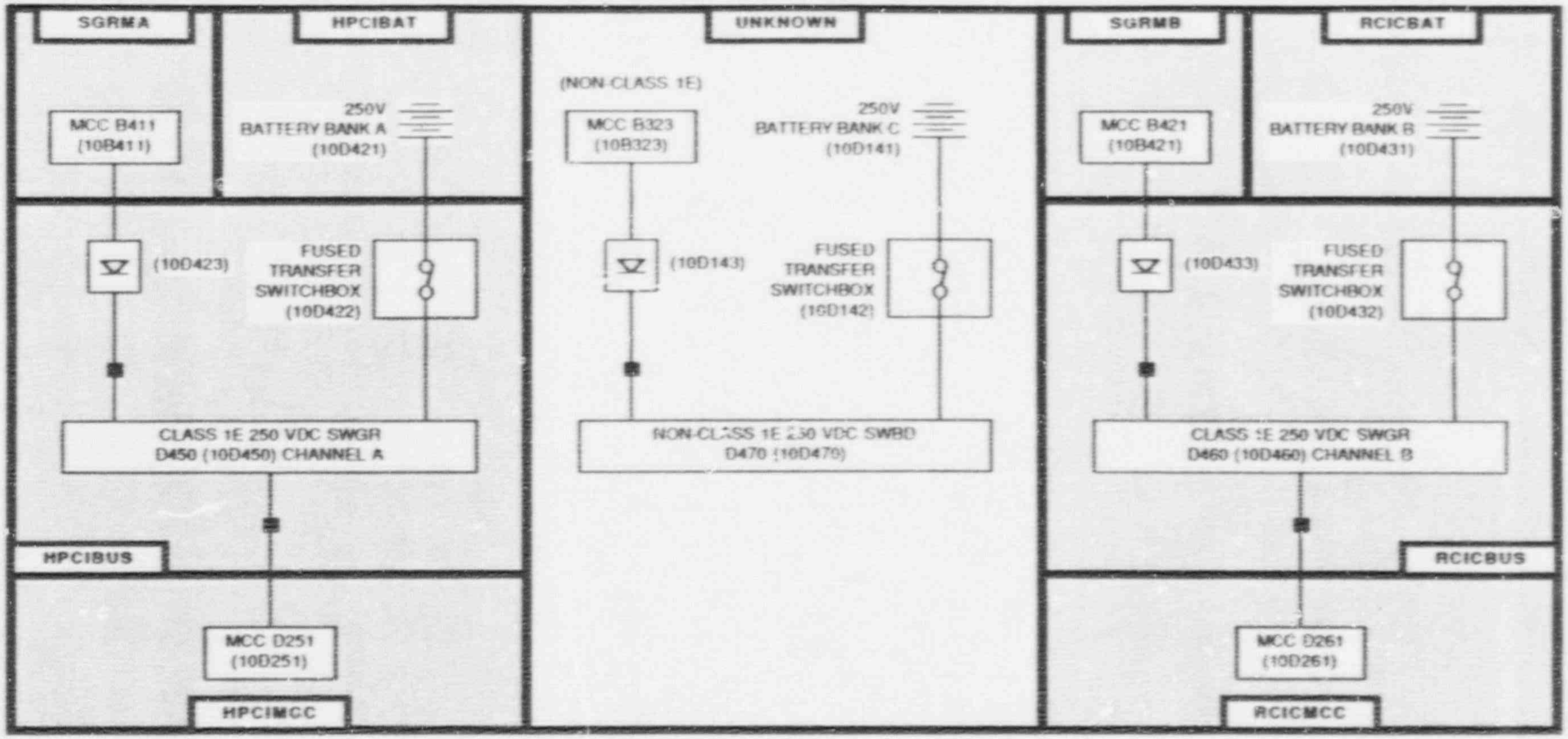


Figure 3.5-8. Simplified One Line Diagram of Hope Creek 250 VDC Electric Power System



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-9. Simplified One Line Diagram of Hope Creek 250 VDC Electric Power System Showing Component Locations

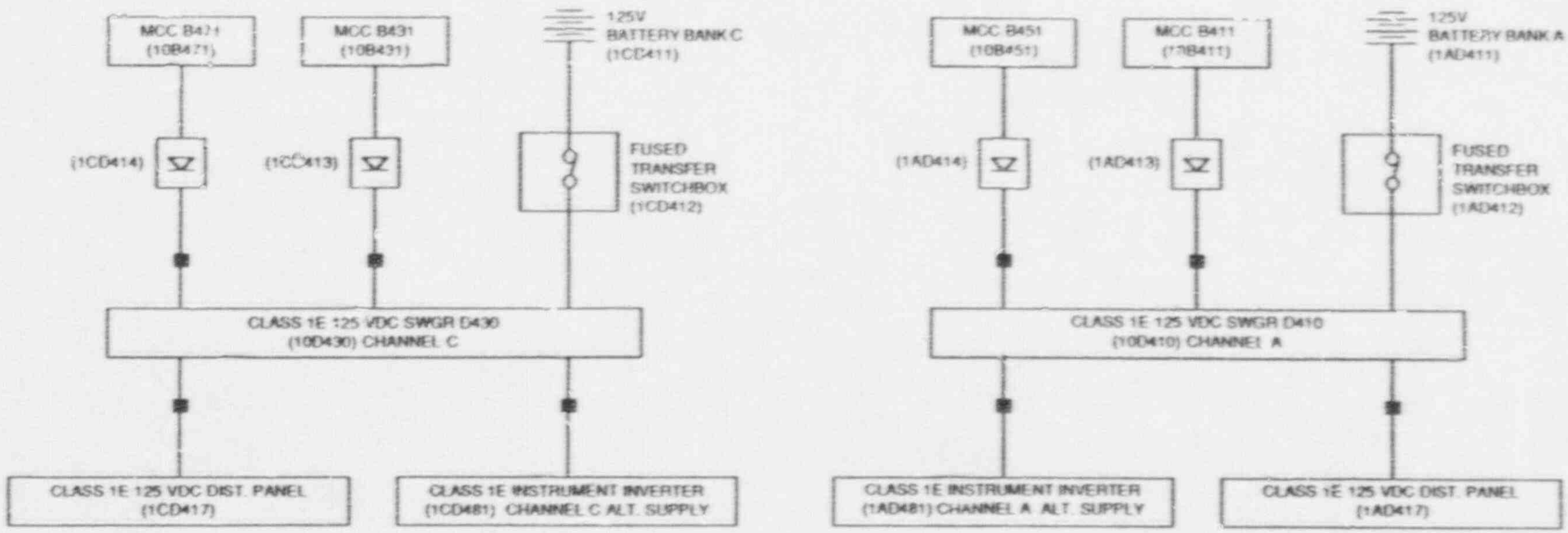


Figure 3.5-10. Simplified One Line Diagram of Hope Creek 125 VDC Electric Power System (Page 1 of 2)

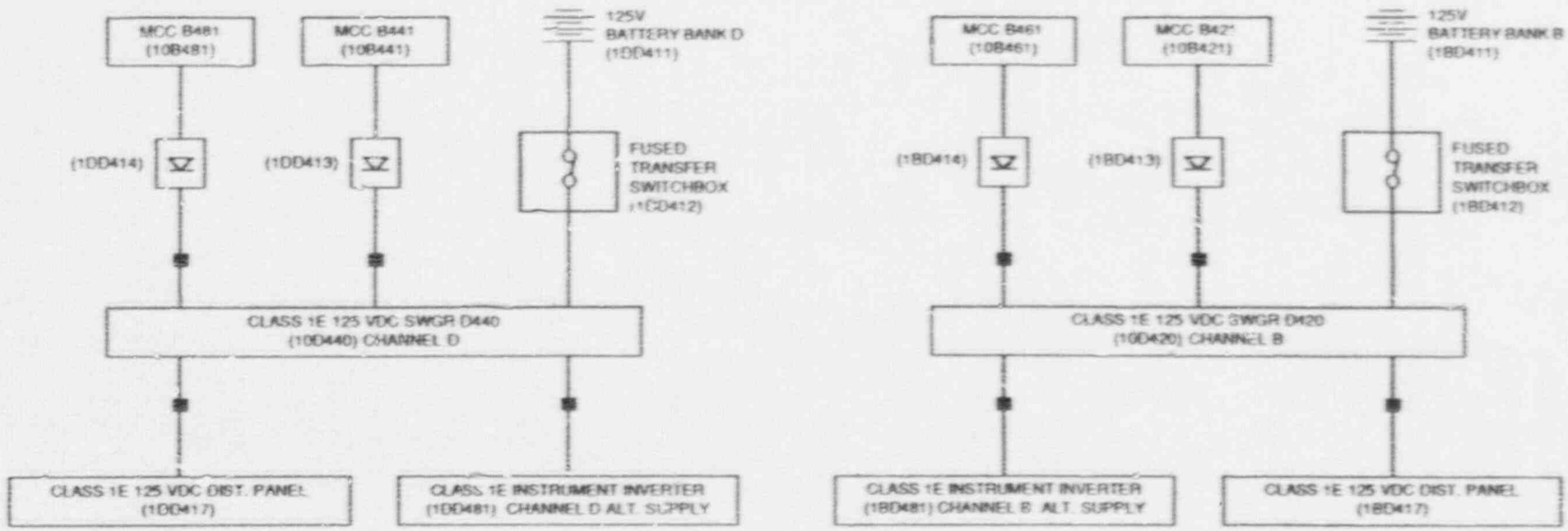
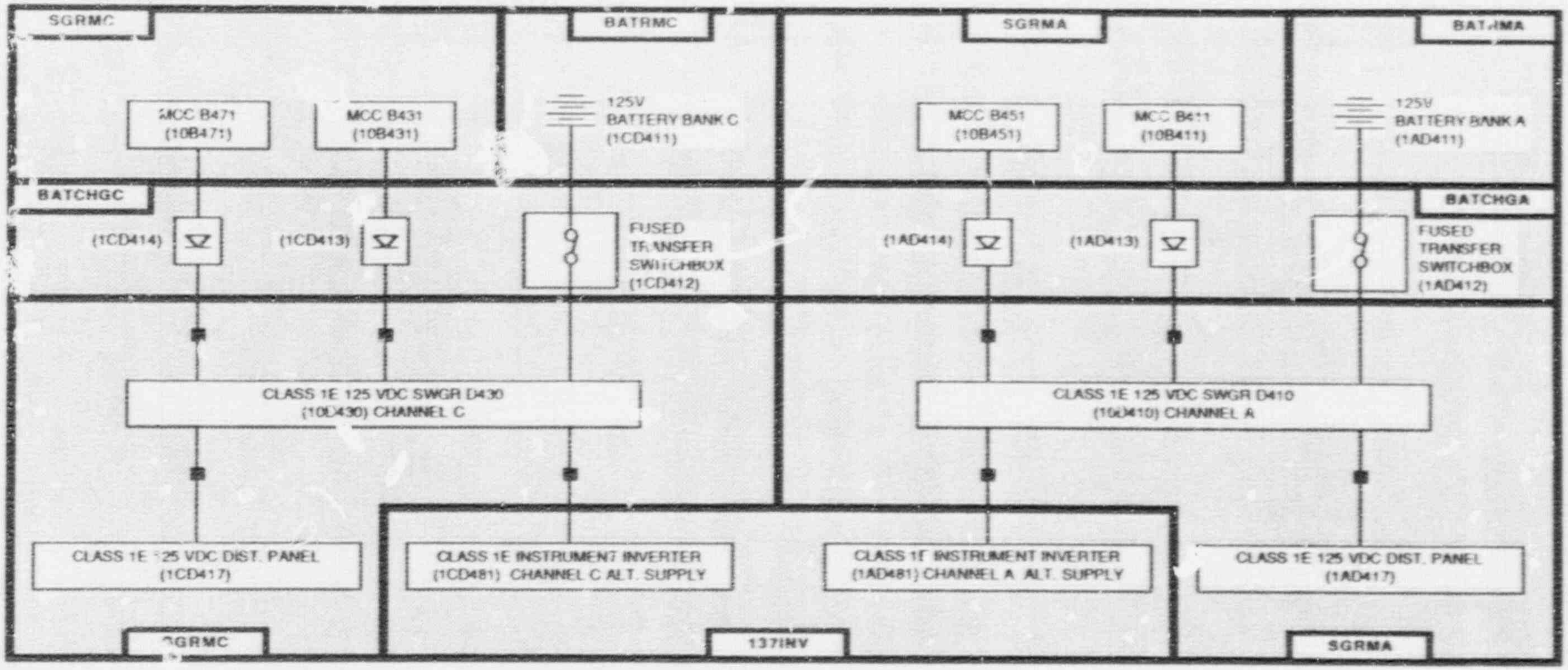
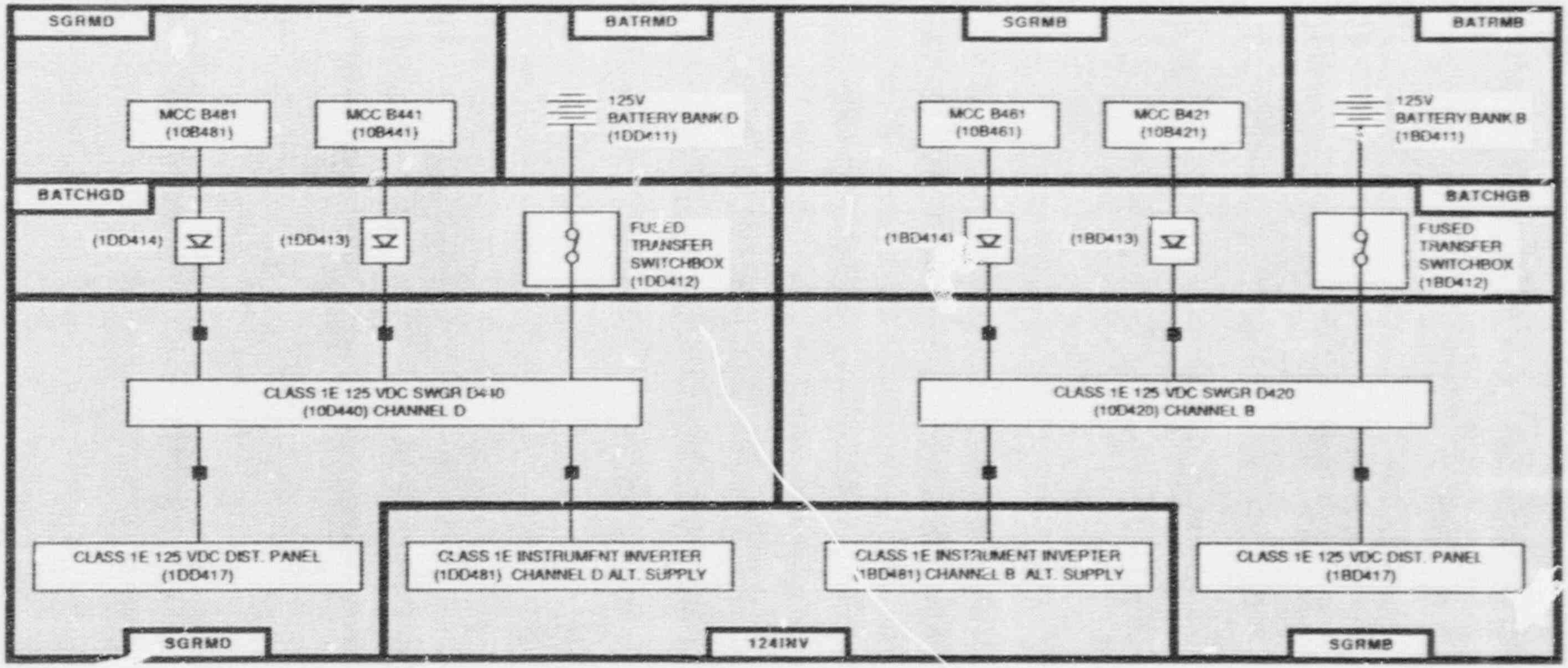


Figure 3.5-10. Simplified One Line Diagram of Hope Creek 125 VDC Electric Power System (Page 2 of 2)



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-11. Simplified One Line Diagram of Hope Creek 125 VDC Electric Power System Showing Component Locations (Page 1 of 2)



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-11. Simplified One Line Diagram of Hope Creek 125 VDC Electric Power System Showing Component Locations (Page 2 of 2)

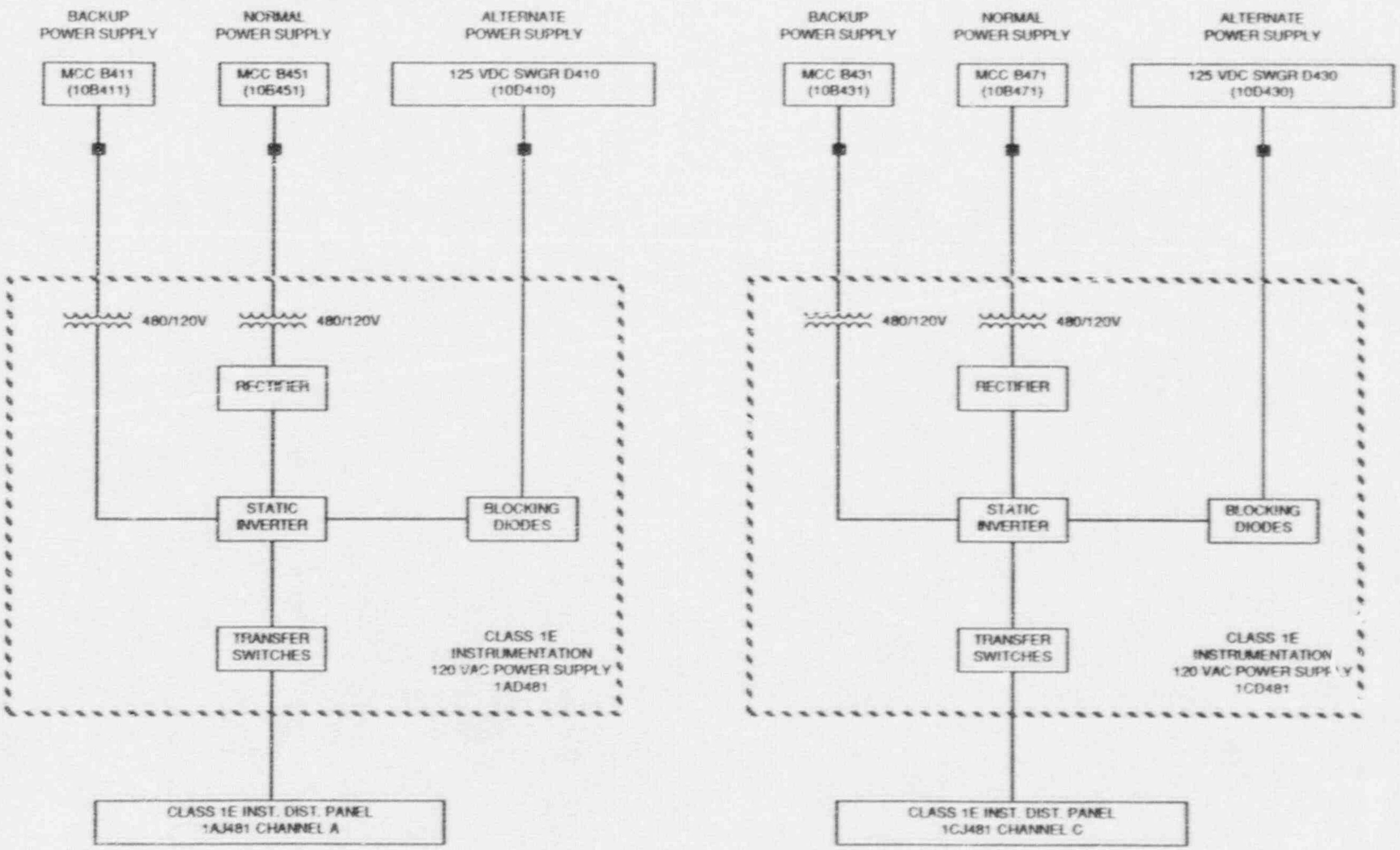


Figure 3.5-12. Hope Creek 120 VAC Electric Power (Page 1 of 2)

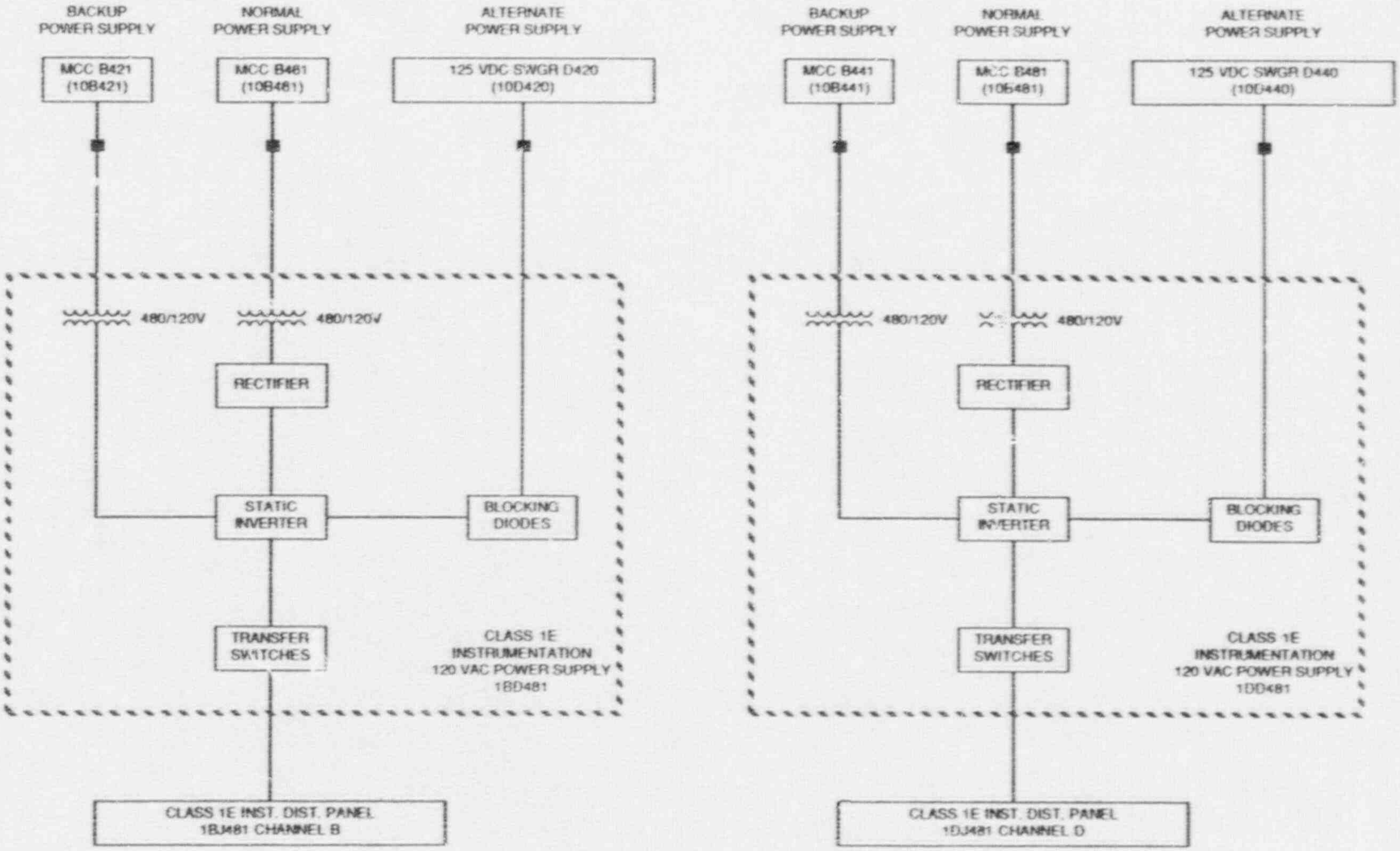
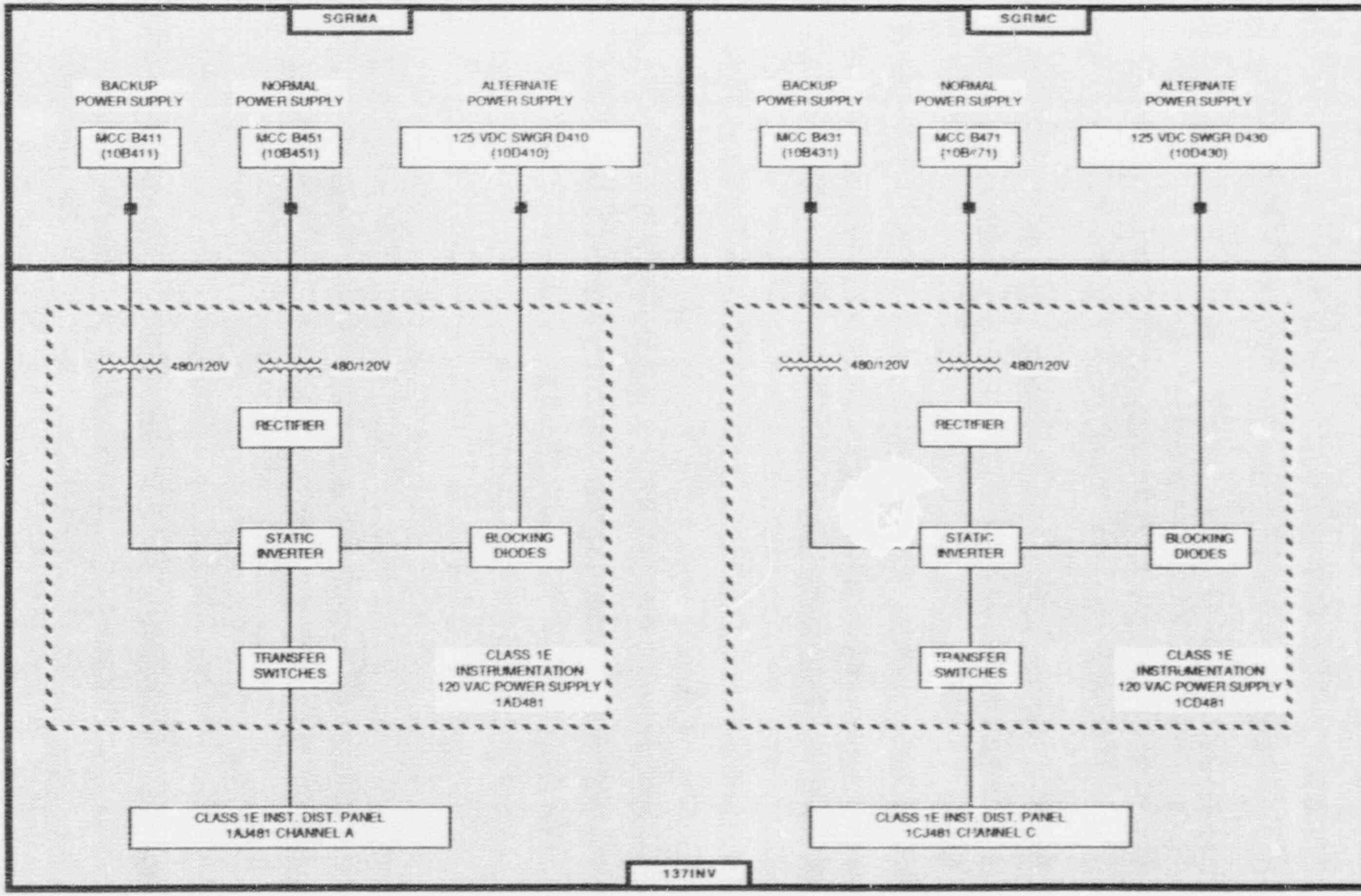
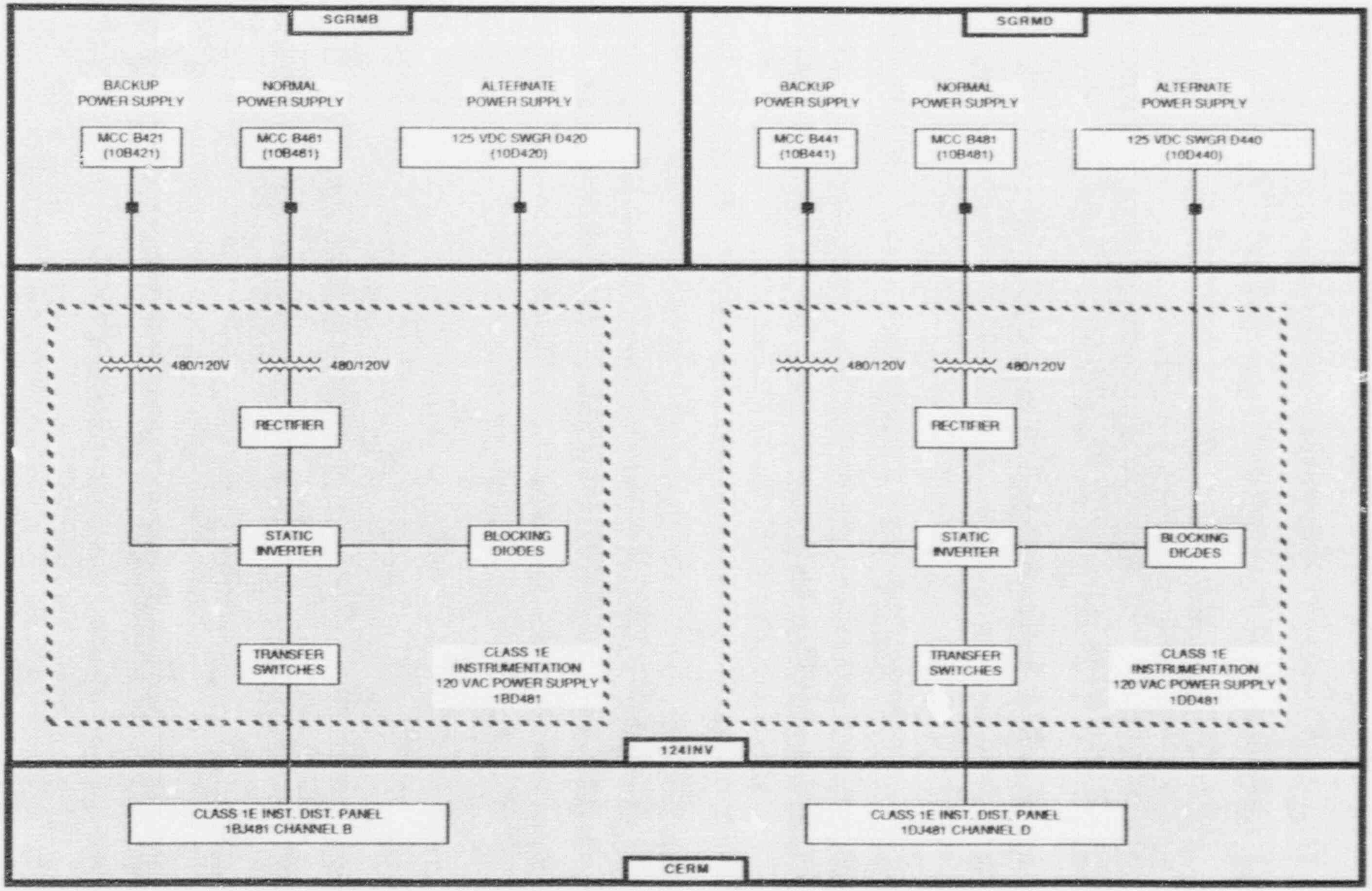


Figure 3.5-12. Hope Creek 120 VAC Electric Power System (Page 2 of 2)



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-13. Hope Creek 120 VAC Electric Power System Showing Component Locations (Page 1 of 2)



NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS

Figure 3.5-13. Hope Creek 120 VAC Electric Power System Showing Component Locations (Page 2 of 2)

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
BUS B420	BUS	SGRMB	BX400	480	SGRMB	AC/B
D423	BC	HPCIBUS	MCC-B411	480	SGRMA	250A
AD413	BC	BATCHGA	MCC-B411	480	SGRMA	125A
AD414	BC	BATCHGA	MCC-B451	480	SGRMA	125A
AX400	TRAN	SGRMA	BUS A401	4160	SGRMA	AC/A
AX401	TRAN	SGRMA	BUS A401	4160	SGRMA	AC/A
BATTERY A	BAT	BATRMA		125		AC/A
BATTERY B	BAT	BATRMB		125		AC/B
BATTERY C	BAT	BATRMC		125		AC/C
BATTERY D	BAT	BATRMD		125		AC/D
BC D433	BC	RCICBUS	MCC-B421	480	SGRMB	250B
BD413	BC	BATCHGB	MCC-B421	480	SGRMB	125B
BD414	BC	BATCHGB	MCC-B461	480	SGRMB	125B
BUS A401	BUS	SGRMA	DG A	4160	DGA	AC/A
BUS A402	BUS	SGRMB	DG B	4160	DGB	AC/B
BUS A403	BUS	SGRMC	DG C	4160	DGC	AC/C
BUS A404	BUS	SGRMD	DG D	4160	DGD	AC/D

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
BUS A460	BUS	SGRMB	BX401	480	SGRMB	AC/B
BUS B410	BUS	SGRMA	AX400	480	SGRMA	AC/A
BUS B430	BUS	SGRMC	CX400	480	SGRMC	AC/C
BUS B440	BUS	SGRMD	DX400	480	SGRMD	AC/D
BUS B450	BUS	SGRMA	AX401	480	SGRMA	AC/A
BUS B470	BUS	SGRMC	CX401	480	SGRMC	AC/C
BUS B480	BUS	SGRMD	DX401	480	SGRMD	AC/D
BUS D410	BUS	SGRMA	BATTERY A	125	BATRMA	125A
BUS D420	BUS	SGRMB	BATTERY B	125	BATRMB	125B
BUS D430	BUS	SGRMC	BATTERY C	125	BATRMC	125C
BUS D440	BUS	SGRMD	BATTERY D	125	BATRMD	125D
BUS D450	BUS	HPCIBUS	HPCI BATTERY	250	HPCIBAT	250A
BUS D460	BUS	RCICBUS	RCIC BATTERY	250	RCICBAT	250B
BX400	TRAN	SGRMB	BUS A402	4160	SGRMB	AC/B
BX401	TRAN	SGRMB	BUS A402	4160	SGRMB	AC/B
CB-C401	CB	SGRMA				AC/A
CB-C402	CB	SGRMB				AC/B

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
CB-C403	CB	SGRMC				AC/C
CB-C404	CB	SGRMD				AC/D
CD413	BC	BATCHGC	MCC-B431	480	SGRMC	125C
CD414	BC	BATCHGC	MCC-B471	480	SGRMC	125C
CX400	TRAN	SGRMC	BUS A403	4160	SGRMC	AC/C
CX401	TRAN	SGRMC	BUS A403	4160	SGRMC	AC/C
DD413	BC	BATCHGD	MCC-B441	480	SGRMD	125D
DD414	BC	BATCHGD	MCC-B481	480	SGRMD	125D
DG A	DG	DGA				AC/A
DG B	DG	DGB				AC/B
DG C	DG	DGC				AC/C
DG D	DG	DGD				AC/D
DX400	TRAN	SGRMD	BUS A404	4160	SGRMD	AC/D
DX401	TRAN	SGRMD	BUS A404	4160	SGRMD	AC/D
HPCI BATTERY	BAT	HPCIBAT	BC-D423	250	HPCIBUS	250A
MCC-B212	MCC	SACSA	BUS B410	480	SGRMA	AC/A
MCC-B222	MCC	RB102	BUS B420	480	SGRMB	AC/B

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
MCC-B232	MCC	RB102NE	BUS B430	480	SGRMC	AC/C
MCC-B242	MCC	E77HALL	BUS B440	480	SGRMD	AC/D
MCC-B252	MCC	MCC252	BUS B450	480	SGRMA	NONE
MCC-B411	MCC	SGRMA	BUS B410	480	SGRMA	AC/A
MCC-B421	MCC	SGRMB	BUS B420	480	SGRMB	AC/B
MCC-B131	MCC	SGRMC	BUS B430	480	SGRMC	AC/C
MCC-B441	MCC	SGRMD	BUS B440	480	SGRMD	AC/D
MCC-B451	MCC	SGRMA	BUS B450	480	SGRMA	AC/A
MCC-B461	MCC	SGRMB	BUS B460	480	SGRMB	AC/B
MCC-B471	MCC	SGRMC	BUS B470	480	SGRMC	AC/C
MCC-B481	MCC	SGRMD	BUS B480	480	SGRMD	AC/D
RCIC BATTERY	BAT	RCICBAT	BAT CHGER D433	250	RCICBUS	250B

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
AX400	480	AC/A	SGRMA	EP	BUS B410	BUS	SGRMA
AX401	480	AC/A	SGRMA	EP	BUS B450	BUS	SGRMA
BAT CHGER D433	250	250B	RCICBUS	EP	RCIC BATTERY	BAT	RCICBAT
BATTERY A	125	AC/A	BATRMA	EP		SWGR	BATCHGA
BATTERY A	125	125A	BATRMA	EP	BUS D410	BUS	SGRMA
BATTERY B	125	AC/B	BATRMB	EP		SWGR	BATCHGB
BATTERY B	125	125B	BATRMB	EP	BUS D420	BUS	SGRMB
BATTERY C	125	AC/C	BATRMC	EP		SWGR	BATCHGC
BATTERY C	125	125C	BATRMC	EP	BUS D430	BUS	SGRMC
BATTERY D	125	AC/D	BATRMB	EP		SWGR	BATCHGD
BATTERY D	125	125D	BATRMD	EP	BUS D440	BUS	SGRMD
BC-D423	250	250A	HPCIBUS	EP	HPCI BATTERY	BAT	HPCIBAT
BUS A401	4160	AC/A	SGRMA	ECCS	CS PUMP A	MDP	CSA
BUS A401	4160	AC/A	SGRMA	ECCS	RHR PUMP A	MDP	RHRA
BUS A401	4160	AC/A	SGRMA	EP	AX400	TRAN	SGRMA
BUS A401	4160	AC/A	SGRMA	EP	AX401	TRAN	SGRMA
BUS A401	4160	AC/A	SGRMA	SACS	PUMP A	MDP	SACSA
BUS A401	4160	AC/A	SGRMA	SWS	SWS PUMP A	MDP	INTSTA
BUS A402	4160	AC/B	SGRMB	ECCS	CS PUMP B	MDP	CSB
BUS A402	4160	AC/B	SGRMB	ECCS	RHR PUMP B	MDP	RHRB
BUS A402	4160	AC/B	SGRMB	EP	BX400	TRAN	SGRMB
BUS A402	4160	AC/B	SGRMB	EP	BX401	TRAN	SGRMB
BUS A402	4160	AC/B	SGRMB	SACS	PUMP B	MDP	SACSB
BUS A402	4160	AC/B	SGRMB	SWS	SWS PUMP B	MDP	INTSTB
BUS A403	4160	AC/C	SGRMC	ECCS	CS PUMP C	MDP	CSC
BUS A403	4160	AC/C	SGRMC	ECCS	RHR PUMP C	MDP	RHRC
BUS A403	4160	AC/C	SGRMC	EP	CX400	TRAN	SGRMC
BUS A403	4160	AC/C	SGRMC	EP	CX401	TRAN	SGRMC
BUS A403	4160	AC/C	SGRMC	SACS	PUMP C	MDP	SACSA
BUS A403	4160	AC/C	SGRMC	SWS	SWS PUMP C	MDP	INTSTA
BUS A404	4160	AC/D	SGRMD	ECCS	CS PUMP D	MDP	CSD

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BUS A404	4160	AC/D	SGRMD	ECCS	RHR PUMP D	MDP	RHRD
BUS A404	4160	AC/D	SGRMD	EP	DX400	TRAN	SGRMD
BUS A404	4160	AC/D	SGRMD	EP	DX401	TRAN	SGRMD
BUS A404	4160	AC/D	SGRMD	SACS	PUMP D	MDP	SACSB
BUS A404	4160	AC/D	SGRMD	SWS	SWS PUMP D	MDP	INTSTB
BUS B410	480	AC/A	SGRMA	EP	MCC-B212	MCC	SACSA
BUS B410	480	AC/A	SGRMA	EP	MCC-B411	MCC	SGRMA
BUS B420	480	AC/B	SGRMB	EP	MCC-B222	MCC	RB102
BUS B420	480	AC/B	SGRMB	EP	MCC-B421	MCC	SGRMB
BUS B430	480	AC/C	SGRMC	EP	MCC-B232	MCC	RB102NE
BUS B430	480	AC/C	SGRMC	EP	MCC-B431	MCC	SGRMC
BUS B440	480	AC/D	SGRMD	EP	MCC-B242	MCC	E77HALL
BUS B440	480	AC/D	SGRMD	EP	MCC-B441	MCC	SGRMD
BUS B450	480	NONE	SGRMA	EP	MCC-B252	MCC	MCC252
BUS B450	480	AC/A	SGRMA	EP	MCC-B451	MCC	SGRMA
BUS B460	480	AC/B	SGRMB	EP	MCC-B461	MCC	SGRMB
BUS B470	480	AC/C	SGRMC	EP	MCC-B471	MCC	SGRMC
BUS B480	480	AC/D	SGRMD	EP	MCC-B481	MCC	SGRMD
BUS D410	125	125A	SGRMA	ECCS	PNL AD417	DIST. PNL	SGRMA
BUS D420	125	125B	SGRMB	RCIC	PNL BD417	DIST. PNL	SGRMB
BX400	480	AC/B	SGRMB	EP	BUS B420	BUS	SGRMB
BX401	480	AC/B	SGRMB	EP	BUS A460	BUS	SGRMB
CX400	480	AC/C	SGRMC	EP	BUS B4[illegible]	BUS	SGRMC
CX401	480	AC/C	SGRMC	EP	BUS B470	BUS	SGRMC
DG A	4160	AC/A	DGA	EP	BUS A401	BUS	SGRMA
DG B	4160	AC/B	DGB	EP	BUS A402	BUS	SGRMB
DG C	4160	AC/C	DGC	EP	BUS A403	BUS	SGRMC
DG D	4160	AC/D	DGD	EP	BUS A404	BUS	SGRMD
DX400	480	AC/D	SGRMD	EP	BUS B440	BUS	SGRMD
DX401	480	AC/D	SGRMD	EP	BUS B480	BUS	SGRMD
HPCI BATTERY	250	250A	HPCIBAT	EP	BUS D450	BUS	HPCIBUS

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-B212	480	AC/A	SACSA	ECCS	CS-17	MOV	SP
MCC-B212	480	AC/A	SACSA	ECCS	CS-7	MOV	NPPCH
MCC-B212	480	AC/A	SACSA	ECCS	CS-8	MOV	NPPCH
MCC-B212	480	AC/A	SACSA	ECCS	FD-2	MOV	HPCISTPCH
MCC-B212	480	AC/A	SACSA	ECCS	RHR-103	MOV	SP
MCC-B212	480	AC/A	SACSA	ECCS	RHR-107	MOV	RHRA
MCC-B212	480	AC/A	SACSA	ECCS	RHR-108	MOV	RHRA
MCC-B212	480	AC/A	SACSA	ECCS	RHR-112	MOV	SP
MCC-B212	480	AC/A	SACSA	ECCS	RHR-112	MOV	SP
MCC-B212	480	AC/A	SACSA	ECCS	RHR-113	MOV	NPPCH
MCC-B212	480	AC/A	SACSA	ECCS	RHR-113	MOV	NPPCH
MCC-B212	480	AC/A	SACSA	ECCS	RHR-115	MOV	NPPCH
MCC-B212	480	AC/A	SACSA	ECCS	RHR-115	MOV	NPPCH
MCC-B212	480	AC/A	SACSA	ECCS	RHR-124	MOV	SP
MCC-B212	480	AC/A	SACSA	ECCS	RHR-124	MOV	SP
MCC-B212	480	AC/A	SACSA	ECCS	RHR-538	MOV	RHRA
MCC-B212	480	AC/A	SACSA	ECCS	RHR-538	MOV	RHRA
MCC-B212	480	AC/A	SACSA	ECCS	SAC-23	MOV	RHRA
MCC-B212	480	AC/A	SACSA	RCS	FD-2	MOV	HPCISTPCH
MCC-B212	480	AC/A	SACSA	RCS	MS-39	MOV	RC
MCC-B212	480	AC/A	SACSA	RCS	RCUW-1	MOV	RC
MCC-B212	480	AC/A	SACSA	SACS	SAC-3	MOV	SACSA
MCC-B212	480	AC/A	SACSA	SACS	SW-349	MOV	SACSA
MCC-B212	480	AC/A	SACSA	SWS	SW-357	MOV	SACSA
MCC-B212	480	AC/A	SACSA	SWS	SW-357	MOV	SACSA
MCC-B222	480	AC/B	RB102	ECCS	CS-19	MOV	SP
MCC-B222	480	AC/B	RB102	ECCS	CS-3	MOV	SPPCH
MCC-B222	480	AC/B	RB102	ECCS	CS-4	MOV	SPPCH
MCC-B222	480	AC/B	RB102	ECCS	RHR-10	MOV	RHRB
MCC-B222	480	AC/B	RB102	ECCS	RHR-11	MOV	RHRB
MCC-B222	480	AC/B	RB102	ECCS	RHR-16	MOV	SPPCH

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-B222	4890	AC/B	RB102	ECCS	RHR-16	MOV	SPPCH
MCC-B222	480	AC/B	RB102	ECCS	RHR 18	MOV	SPPCH
MCC-B222	480	AC/B	RB102	ECCS	RHR-1[illegible]	MOV	SPPCH
MCC-B222	480	AC/B	RB102	ECCS	RHR-19	MOV	SPPCH
MCC-B222	480	AC/B	RB102	ECCS	RHR-19	MOV	SPPCH
MCC-B222	480	AC/B	RB102	ECCS	RHR-26	MOV	SP
MCC-B222	480	AC/B	RB102	ECCS	RHR-26	MOV	SP
MCC-B222	480	AC/B	RB102	ECCS	RHR-315	MOV	SP
MCC-B222	480	AC/B	RB102	ECCS	RHR-315	MOV	SP
MCC-B222	480	AC/B	RB102	ECCS	RHR-427	MOV	RHRB
MCC-B222	480	AC/B	RB102	ECCS	RHR-427	MOV	RHRB
MCC-B222	480	AC/B	RB102	ECCS	RHR-6	MOV	SP
MCC-B222	480	AC/B	RB102	ECCS	RHR-7	MOV	RHRB
MCC-B222	480	AC/B	RB102	ECCS	SAC-26	MOV	RHRB
MCC-B222	480	AC/B	RB102	RCIC	FC-2	MOV	RCICSTPCH
MCC-B222	480	AC/B	RB102	RCS	FC-2	MOV	RCICSTPCH
MCC-B222	480	AC/B	RB102	SACS	SAC-7	MOV	SACSB
MCC-B222	480	AC/B	RB102	SACS	SW-355	MOV	SACSB
MCC-B222	480	AC/B	RB102	SWS	SW-358	MOV	SACSB
MCC-B222	480	AC/B	RB102	SWS	SW-358	MOV	SACSB
MCC-B232	480	AC/C	RB102NE	ECCS	CS-18	MOV	SP
MCC-B232	480	AC/C	RB102NE	ECCS	FD-1	MOV	RC
MCC-B232	480	AC/C	RB102NE	ECCS	RHR-101	MOV	NPPCH
MCC-B232	480	AC/C	RB102NE	ECCS	RHR-98	MOV	SP
MCC-B232	480	AC/C	RB102NE	RCS	FD-1	MO[illegible]	RC
MCC-B232	480	AC/C	RB102NE	SACS	SAC-4	MOV	SACSA
MCC-B232	480	AC/C	[illegible]B102NE	SACS	SW-346	MOV	SACSA
MCC-B232	480	AC/C	RB102NE	SWS	SW-381	MOV	SACSA
MCC-B242	480	AC/D	E77HALL	ECCS	CS-20	MOV	SP
MCC-B242	480	AC/D	E77HALL	ECCS	RHR-1	MOV	SP
MCC-B242	40	AC/D	E77HALL	ECCS	RHR-13	MOV	SPPCH

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-B242	480	AC/D	E77HALL	ECCS	RHR-13	MOV	SPPCH
MCC-B242	480	AC/D	E77HALL	ECCS	RHR-20	MOV	NPPCH
MCC-B242	480	AC/D	E77HALL	ECCS	RHR-4	MOV	SPPCH
MCC-B242	480	AC/D	E77HALL	RCIC	FC-1	MOV	RC
MCC-B242	480	AC/D	E77HALL	RCS	FC-1	MOV	RC
MCC-B242	480	AC/D	E77HALL	RCS	MS-40	MOV	STMTNL
MCC-B242	480	AC/D	E77HALL	RCS	RCUW-2	MOV	SPPCH
MCC-B242	480	AC/D	E77HALL	RCS	RHR-164	MOV	NPPCH
MCC-B242	480	AC/D	E77HALL	SACS	SAC-8	MOV	SACSB
MCC-B242	480	AC/D	E77HALL	SACS	SW-352	MOV	SACSB
MCC-B252	480	NONE	MCC252	ECCS	FW-8	MOV	RC
MCC-B411	480	AC/A	SGRMA	ECCS	RHR-21	MOV	RC
MCC-B411	480	250A	SGRMA	EP	D423	BC	HPCIBUS
MCC-B411	480	125A	SGRMA	EP	AD413	BC	BATCHGA
MCC-B421	480	250B	SGRMB	EP	BC D433	BC	RCICBUS
MCC-B421	480	125B	SGRMB	EP	BD413	BC	BATCHGB
MCC-B431	480	125C	SGRMC	EP	CD413	BC	BATCHGC
MCC-B441	480	125D	SGRMD	EP	DD413	BC	BATCHGD
MCC-B451	480	AC/A	SGRMA	ECCS	RHR-104	MOV	RHRA
MCC-B451	480	AC/A	SGRMA	ECCS	RHR-116	MOV	NPPCH
MCC-B451	480	AC/A	SGRMA	ECCS	RHR-116	MOV	NPPCH
MCC-B451	480	125A	SGRMA	EP	AD414	BC	BATCHGA
MCC-B451	480	AC/A	SGRMA	RCS	RHR-71	MOV	RC
MCC-B461	480	125B	SGRMB	EP	BD414	BC	BATCHGB
MCC-B471	480	125C	SGRMC	EP	CD414	BC	BATCHGC
MCC-B481	480	AC/D	SGRMD	ECCS	RHR-110	MOV	NPPCH
MCC-B481	480	AC/D	SGRMD	ECCS	RHR-110	MOV	NPPCH
MCC-B481	480	125D	SGRMD	EP	DD414	BC	BATCHGD
MCC-B553	480	AC/A	INTSTA	SWS	SW-473	MOV	INTSTA
MCC-B563	480	AC/B	INTSTB	SWS	SW-475	MOV	INTSTB
MCC-B573	480	AC/C	INTSTA	SWS	SW-474	MOV	INTSTA

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC-B583	480	AC/D	INTSTB	SWS	SW-476	MOV	INTSTB
MCC-D251	250	250A	HPCIMCC	ECCS	FD-3	MOV	HPCI
MCC-D251	250	250A	HPCIMCC	ECCS	HPCI-1	MOV	NPPCH
MCC-D251	250	250A	HPCIMCC	ECCS	HPCI-10	MOV	S77HALL
MCC-D251	250	250A	HPCIMCC	ECCS	HPCI-2	MOV	HPCI
MCC-D251	250	250A	HPCIMCC	ECCS	HPCI-28	MOV	HPCI
MCC-D251	250	250A	HPCIMCC	ECCS	HPCI-5	MOV	HPCI
MCC-D251	250	250A	HPCIMCC	ECCS	HPCI-54	MOV	SP
MCC-D251	250	250A	HPCIMCC	ECCS	HPCI-54	MOV	SP
MCC-D251	250	250A	HPCIMCC	ECSS	HPCI-9	MOV	SP
MCC-D261	250	250B	RCICMCC	RCIC	FC-21	MOV	RCIC
MCC-D261	250	250B	RCICMCC	RCIC	FC-22	MOV	RCIC
MCC-D261	250	250B	RCICMMC	RCIC	RCIC-1	MOV	RCIC
MCC-D261	250	250B	RCICMCC	RCIC	RCIC-11	MOV	RCIC
MCC-D261	250	250B	RCICMCC	RCIC	RCIC-12	MOV	RCIC
MCC-D261	250	250B	RCICMCC	RCIC	RCIC-2	MOV	SP
MCC-D261	250	250B	RCICMCC	RCIC	RCIC-22	MOV	RCIC
MCC-D261	250	250B	RCICMCC	RCIC	RCIC-5	MOV	STMTNL
PNL BD417	125	250B	SGRMB	RCIC	SV-19	SOV	RCIC
RCIC BATTERY	250	250B	RCICBAT	EP	BUS D460	BUS	RCICBUS
UNKNOWN	480	NONE	RB145	RCIC	FW-4	MOV	RC

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 two high-head, low-flow CRD supply pumps, piping, filters, control valves, one hydraulic control unit for each control rod drive mechanism, and instrumentation. Water is supplied from the condensate treatment system or the condensate storage tanks. The CRDHS also includes scram valves, scram accumulators, and a scram discharge volume.

Details of the scram portion of a typical BWR CRDHS is shown in Figure 3.6-1.

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 the scram accumulator. An outlet scram valve opens to vent the opposite side of each CRDM to the scram discharge volume. This coordinated action results in rapid insertion of control rods into the reactor.

The control rod drive accumulators are necessary to scram the control rods within the required time. It should be noted that each drive has an internal ball check valve which allows reactor pressure to be admitted under the drive piston. If reactor pressure exceeds the supply pressure at the drive, the ball check valve ensures rod insertion in the event that the scram accumulator is not charged or the inlet scram valve fails to open. The insertion time, however, will be slower than the scram time with a properly functioning scram system.

Although not intended as a makeup system, the CRDHS can provide a source of cooling water to the RCS during vessel isolation. In BWR/4 plants, 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 is about 200 gpm with both pumps operating (Ref. 1).

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 (2)
   1. Rated capacity: 100% (for control rod drive function)
   2. Type: centrifugal

B. Scram Accumulator
   1. Normal pressure: 1400 to 1500 psig

C. Scram Discharge Volume
   1. Normal pressure: Atmospheric

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
   The control rod drive pumps are Class 1E AC loads that can be supplied from the emergency diesel generator as described in Section 3.5.

3.6.7 Section 3.6 References

1. Harrington, R.M., and Ott, L.J., "The Effect of Small-Capacity, High-Pressure Injection Systems on TQUV Sequences at Browns Ferry Unit One," NUREG/CR-3179, Oak Ridge National Laboratory, September 1983.

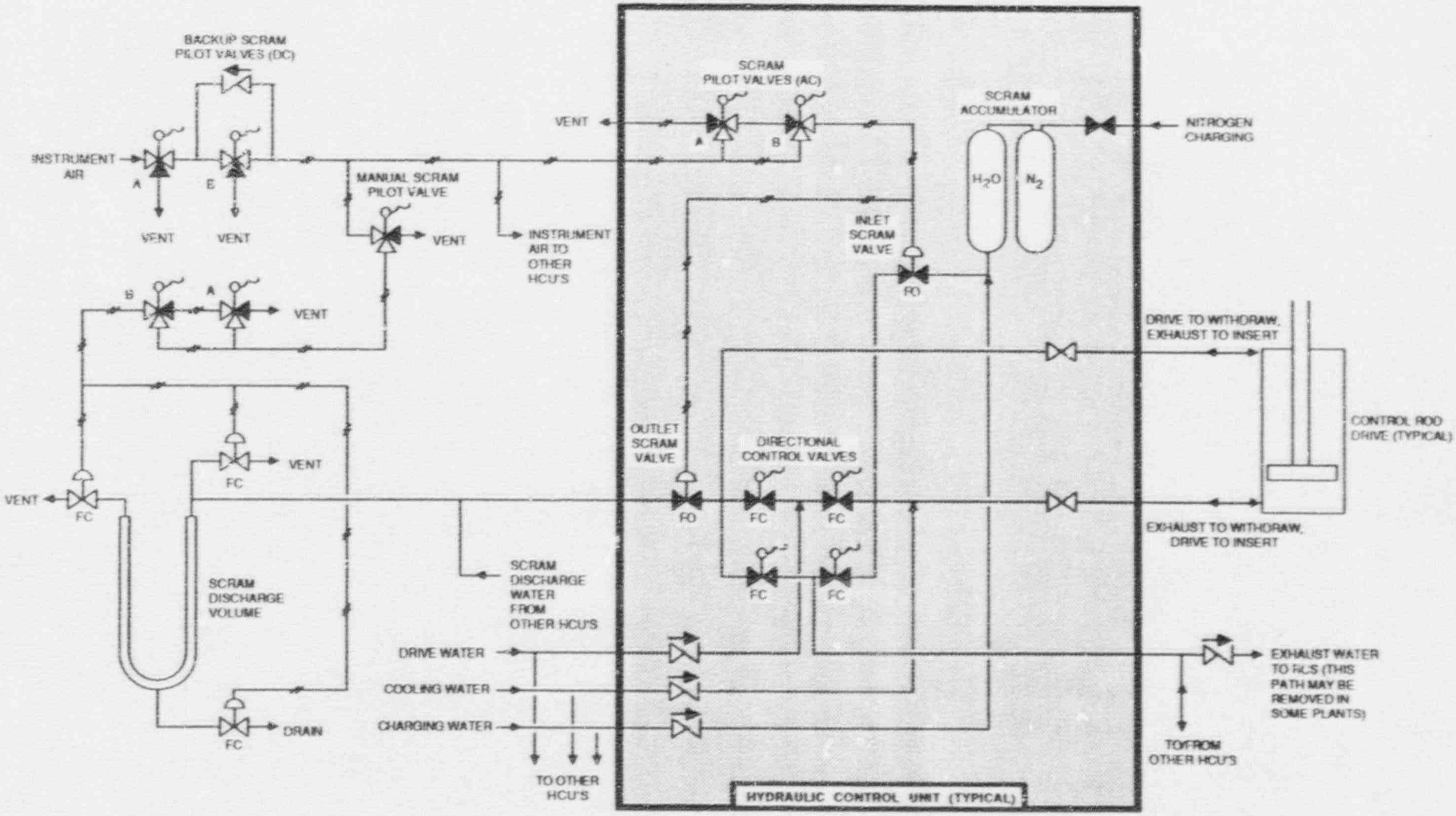


Figure 3.6-1. Simplified Diagram Of Portions Of The Control Rod Drive Hydraulic System That Are Related To The Scram Function

3.7 SAFETY AUXILIARIES COOLING SYSTEM (SACS)

3.7.1 System Function

The Safety Auxiliaries Cooling System (SACS) is a subsystem of the Safety and Turbine Auxiliaries Cooling System (TACS). The SACS is designed to operate under normal, shutdown and design basis accident conditions. During all conditions, the SACS provides cooling water to the ESF equipment, including the RHR heat exchangers, diesel generator coolers, and RHR pump seal and bearing coolers. During accident conditions, the SACS is isolated from the Turbine Auxiliary Cooling System (TACS). The SACS cools the following components:

- Emergency diesel engine coolers
- RHR heat exchangers
- RHR, Core Spray, RCIC and HPCI pump room coolers
- RHR pump seal coolers
- RHR pump bearing coolers
- Fuel pool heat exchangers
- Control room chillers
- Filtration, Recirculation and Ventilation System (FRVS) cooling coils

The SACS is in turn cooled by the Station Service Water System.

3.7.2 System Definition

The STACS is divided into two closed loops, A and B, with two pumps, two heat exchangers and one expansion tank in each loop. On receipt of a LOCA signal, loss of power, or a low-low-low expansion tank level, the TACS portion is automatically isolated from the SACS loops by the closure of two hydraulically operated butterfly valves in the supply header and two motor operated valves in the return header of each loop. Two hydraulic TACS supply valves also shut.

The two SACS loops normally operate independently. The loops can be cross-connected by the TACS isolation valves. Simplified drawings of both SACS loops are shown in Figures 3.7-1 and 3.7-2. Note that individual valves have more than one identification number in the original Hope Creek source drawings. Secondary valve identification numbers are indicated in parentheses in Figures 3.7-1 and 3.7-2. A summary of selected SACS components is presented in Table 3.7-1.

3.7.3 System Operation

SACS water is supplied by four pumps, two per loop. Cooling is supplied by two SACS heat exchangers per loop. During normal operation, one pump and one heat exchanger per loop provide cooling to all components of the SACS and TACS subsystems. Loop A normally supplies all TACS loads. During normal shutdown operation, both heat exchangers and both pumps in each loop are used, although one loop can provide sufficient cooling.

The SACS portion is protected from the hydrodynamic effects of pipe breaks in the TACS by hydropneumatic accumulators in the TACS supply and return headers.

Following a LOCA, the TACS is automatically isolated. SACS Loop A provides cooling to RHR heat exchanger A, RHR pumps A and C seal coolers and bearing coolers, Core Spray pump A and C room unit coolers, RHR pump A and C room unit coolers, HPCI pump room unit coolers, diesel generators A and C coolers and control room A chillers. SACS Loop B supplies cooling to RHR heat exchanger B, RHR pumps B and D seal coolers and bearing coolers, Core Spray pumps B and D room unit coolers, RHR pumps B and B room unit coolers, RCIC pump room unit coolers, diesel generators B and D coolers and control room B chillers. The pump room unit coolers, RHR pump seal and bearing coolers and the diesel generator coolers can be supplied from the other SACS loop by means of normally closed manual supply and return cross-tie valves.

Following a LOCA, one pump and one heat exchanger are required for each SACS loop. In the short term, both loops are required. In the long term, one loop with both pumps operating in it can supply all heat loads. Cooling is automatically supplied to RHR pump seal and motor bearing coolers on pump start. Cooling to the RHR heat exchangers must be manually initiated.

3.7.4 System Success Criteria

The success criteria for each SACS loop are that at least one pump must be providing flow to ESF components and at least one heat exchanger provides cooling of the SACS water using service water.

The Hope Creek UFSAR (Ref. 1) defines the success criteria following a LOCA as one pump and one heat exchanger operating in each SACS loop in the short term injection phase. Long term success criteria are also satisfied by one loop with both pumps operating.

3.7.5 Component Information

A. Safety and Turbine Auxiliaries Cooling System Pumps A, B, C, D
   1. Rated flow: 11,600 gpm @ 160 ft. head (69 psid)
   2. Type: horizontal centrifugal

B. SACS Heat Exchangers A-1, A-2, B-1, B-2
   1. Design heat transfer: 110×10^6 Btu/hr

C. SACS Expansion Tanks A and B
   1. Capacity: 8600 gallons

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      a. In the event of a LOCA, loss of offsite power, or large TACS leakage, the TACS portion is automatically isolated.
      b. In the event of a LOCA coincident with a loss of power, all four SACS pumps start and all four heat exchangers inlet valves open.
      c. During normal operation, a leak in the operating loop exceeding the make-up system's capacity causes the system to switch to the standby loop on low-low-low expansion tank level.
   2. Remote Manual
      The SAC pumps and motor operated valves can be activated from the control room. SACS loop B pumps and valves can also be controlled from the remote shutdown panel.

B. Motive Power
   The SACS pumps and motor operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.5.

C. Other
   1. The Station Service Water System (SSWS) transfers heat from the SACS heat exchangers to the environment (see Section 3.8).

2. Lubrication and cooling are assumed to be provided locally for the SACS pumps.
3. The demineralized water supply system provides makeup water to the SACS as needed to maintain expansion tank level.

3.7.7 Section 3.7 References

1. Hope Creek Updated Final Safety Analysis Report, Section 9.2.2.

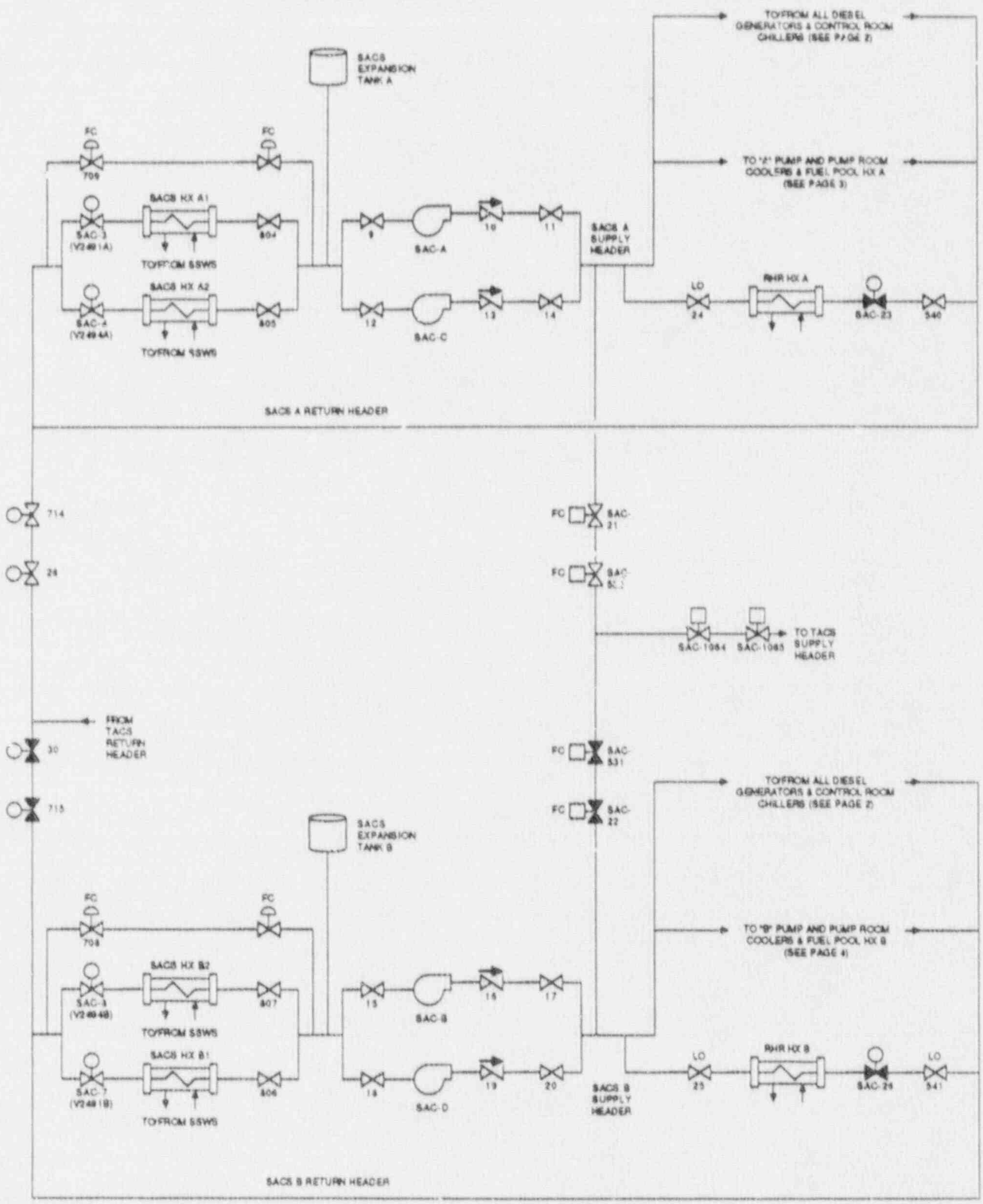


Figure 3.7-1. Hope Creek Safety Auxiliaries Cooling System (Page 1 of 4)

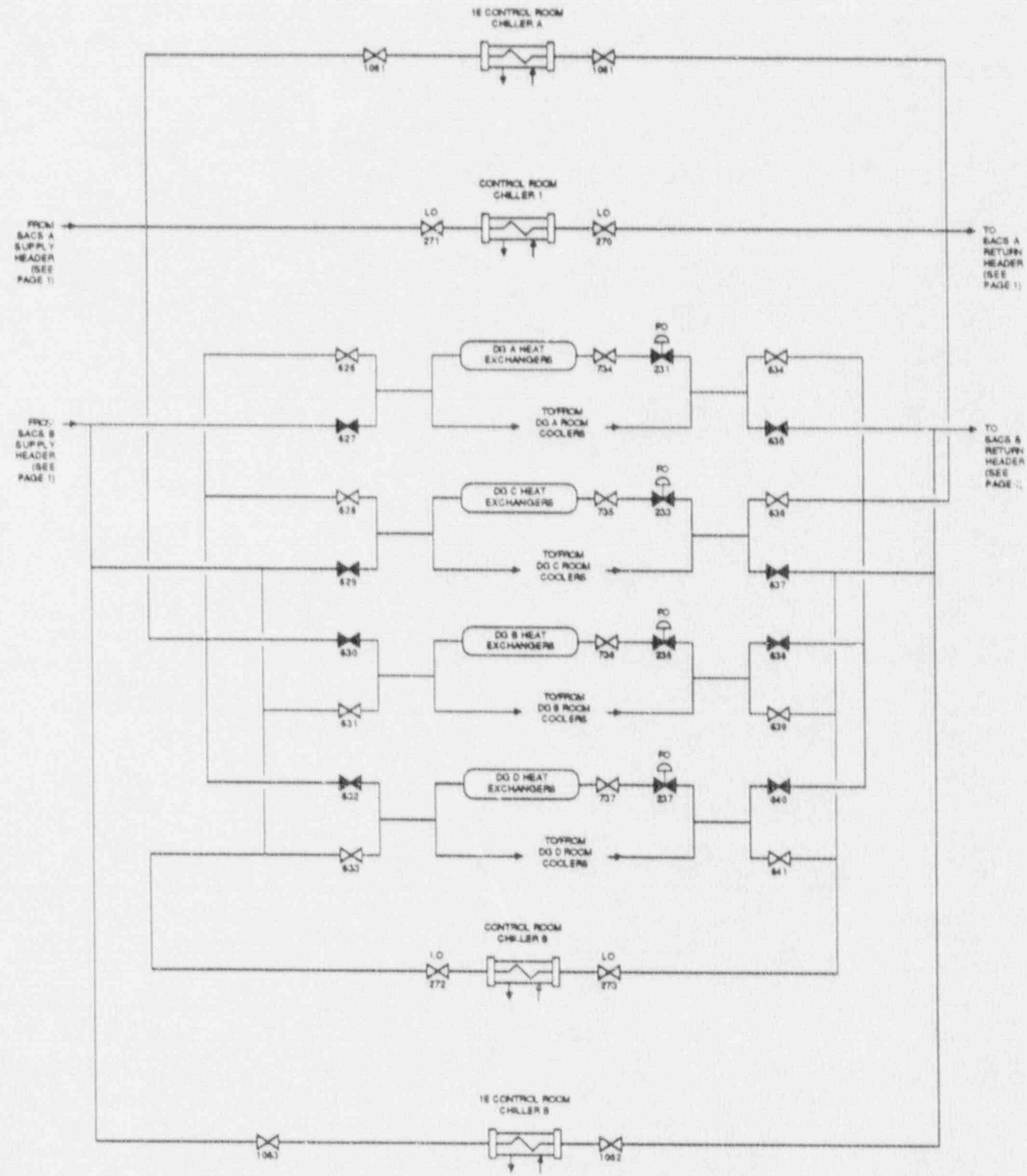


Figure 3.7-1. Hope Creek Safety Auxiliaries Cooling System (Page 2 of 4)

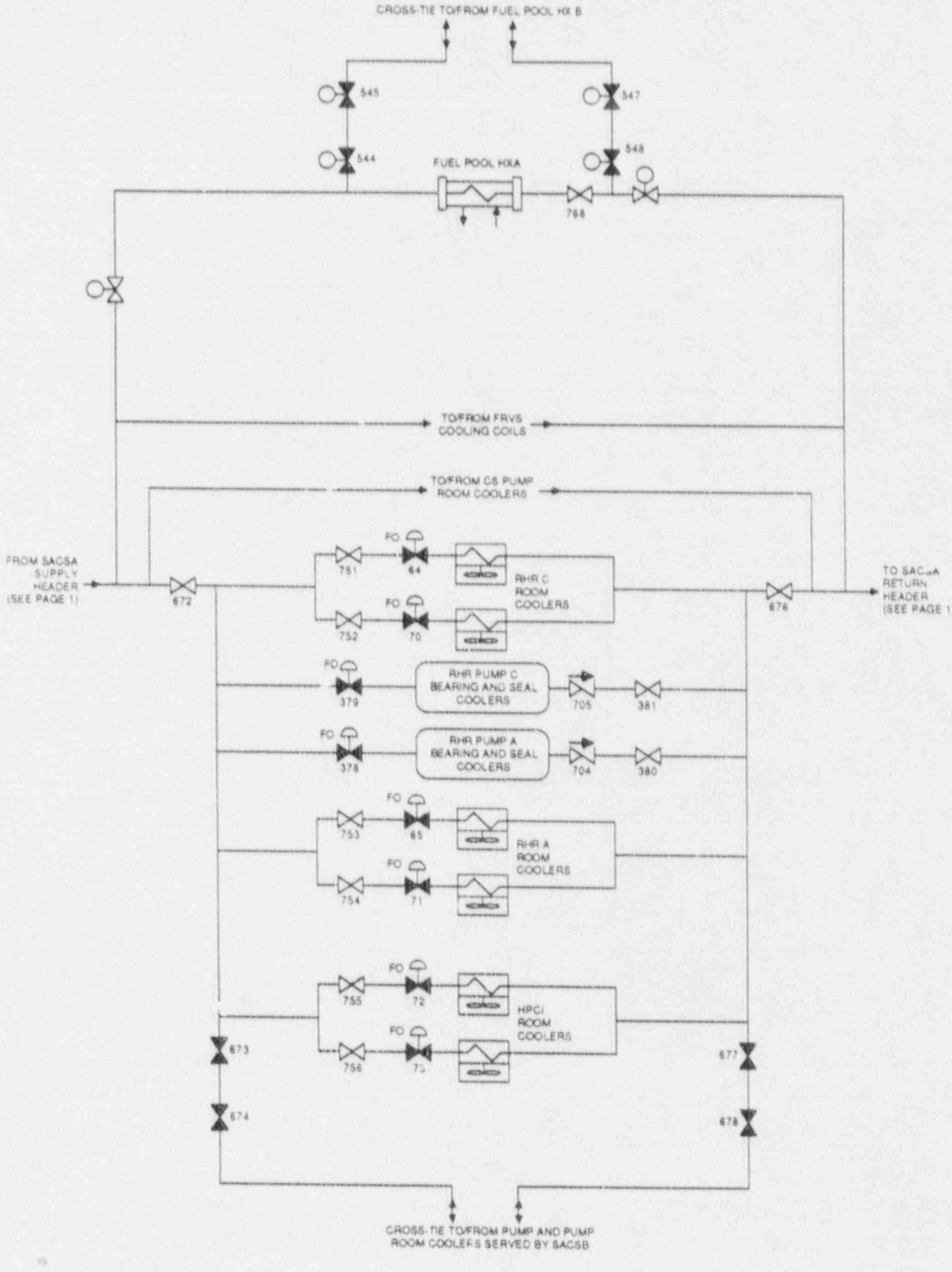


Figure 3.7-1. Hope Creek Safety Auxiliaries Cooling S· .em (Page 3 of 4)

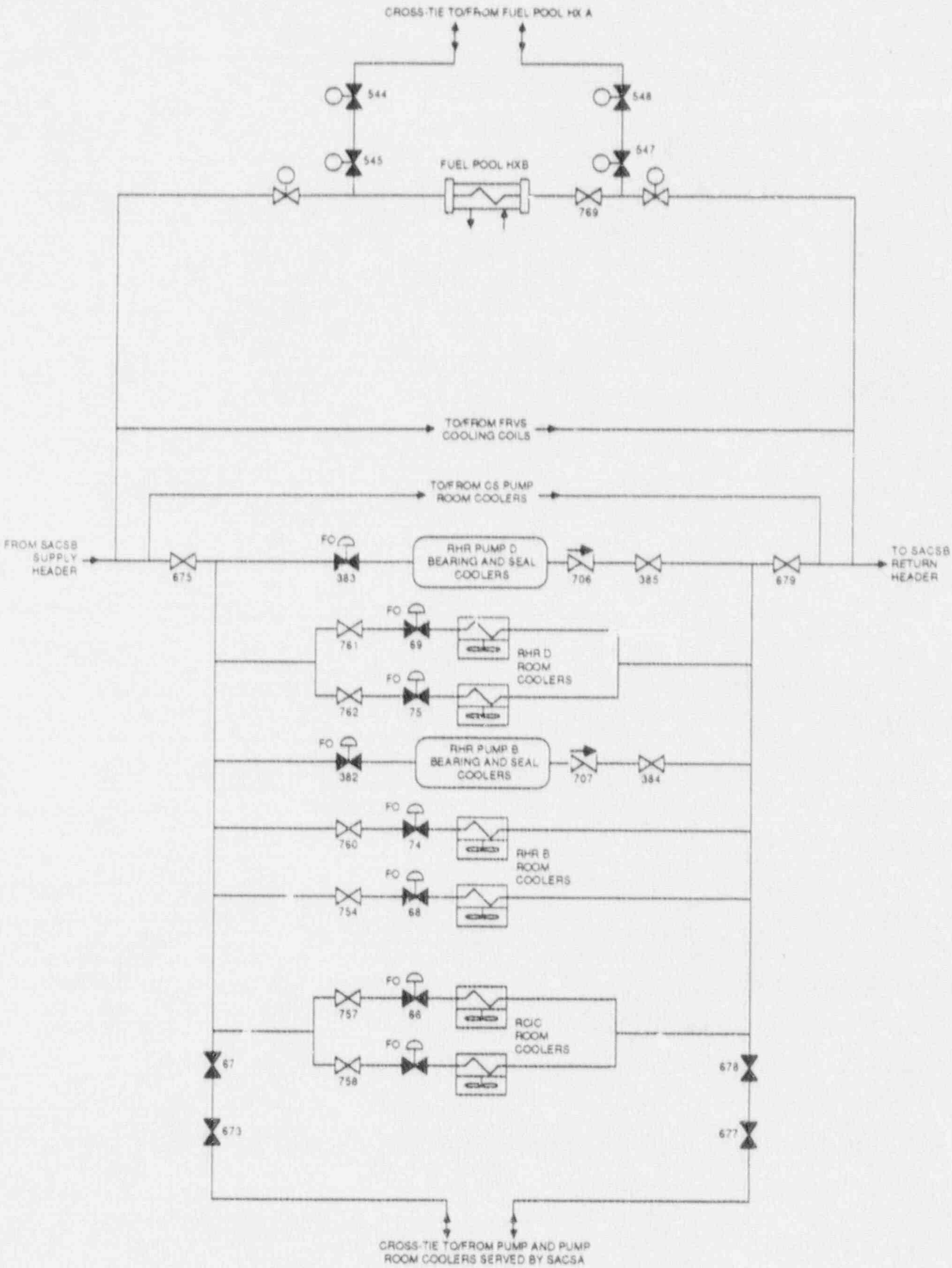


Figure 3.7-1. Hope Creek Safety Auxiliaries Cooling System (Page 4 of 4)

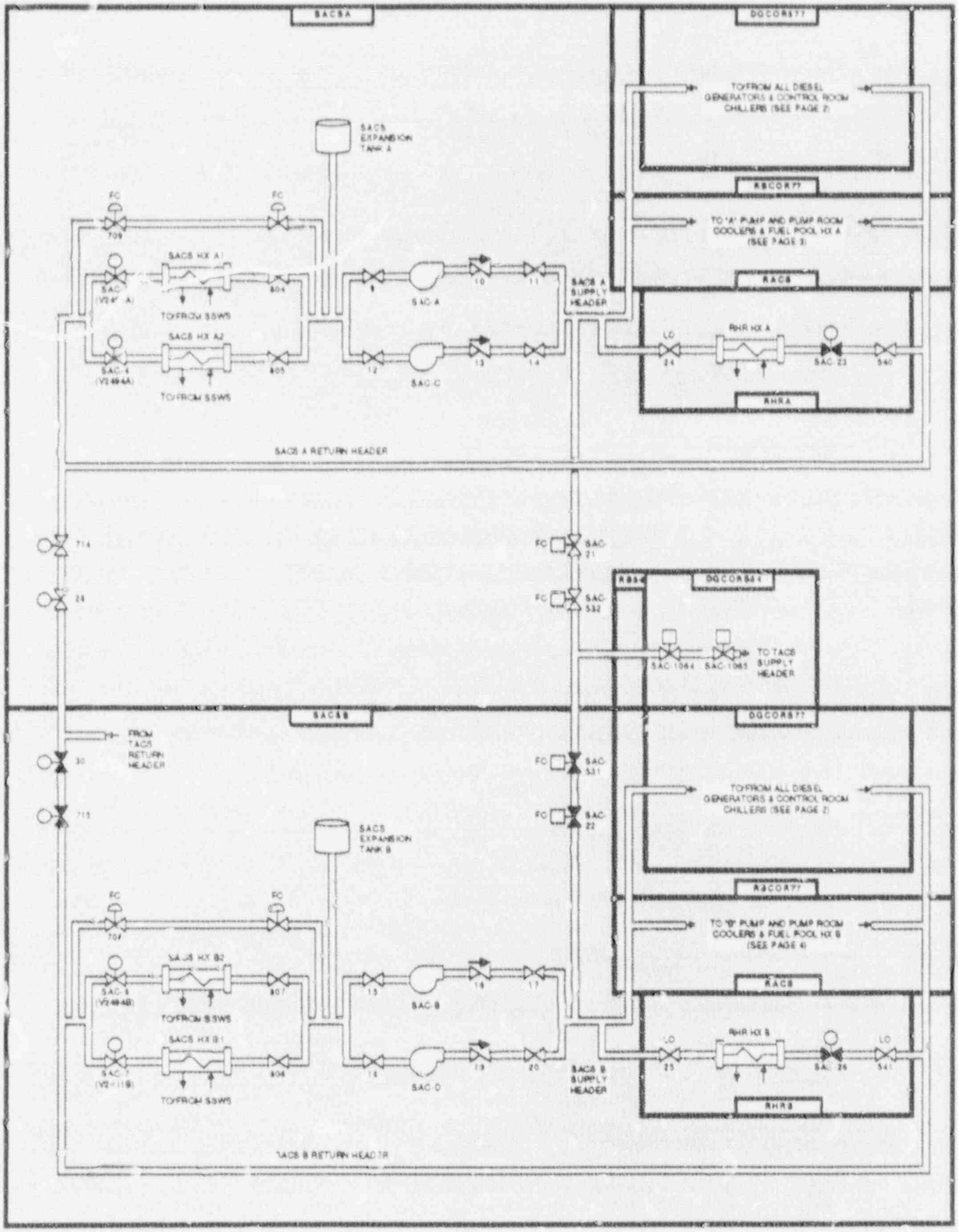


Figure 3.7-2. Hope Creek Safety Auxiliaries Cooling System Showing Component Locations (Page 1 of 4)

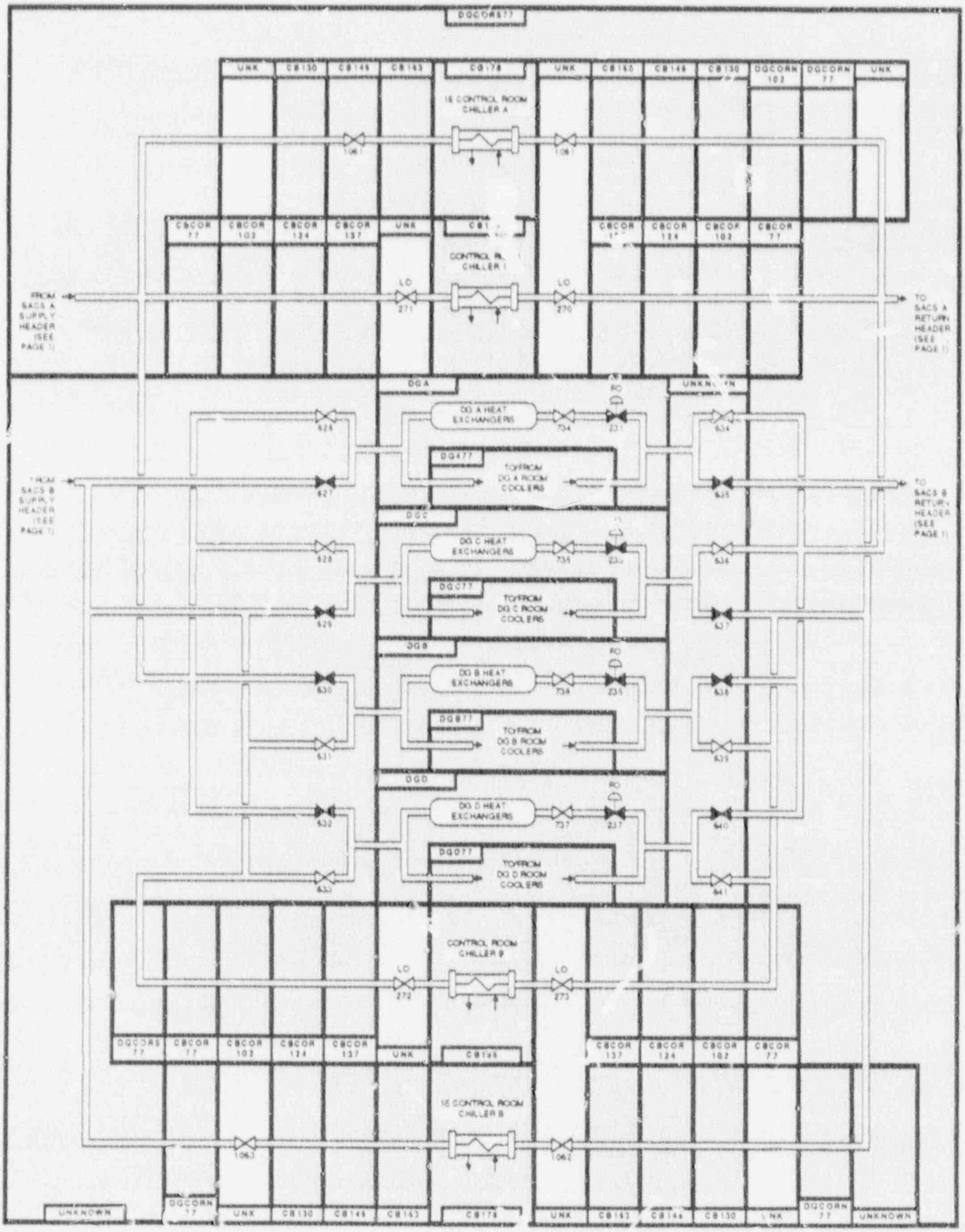


Figure ?.7-2. Hope Creek Safety Auxiliaries Cooling System Showing Component Locations (Page 2 of 4)

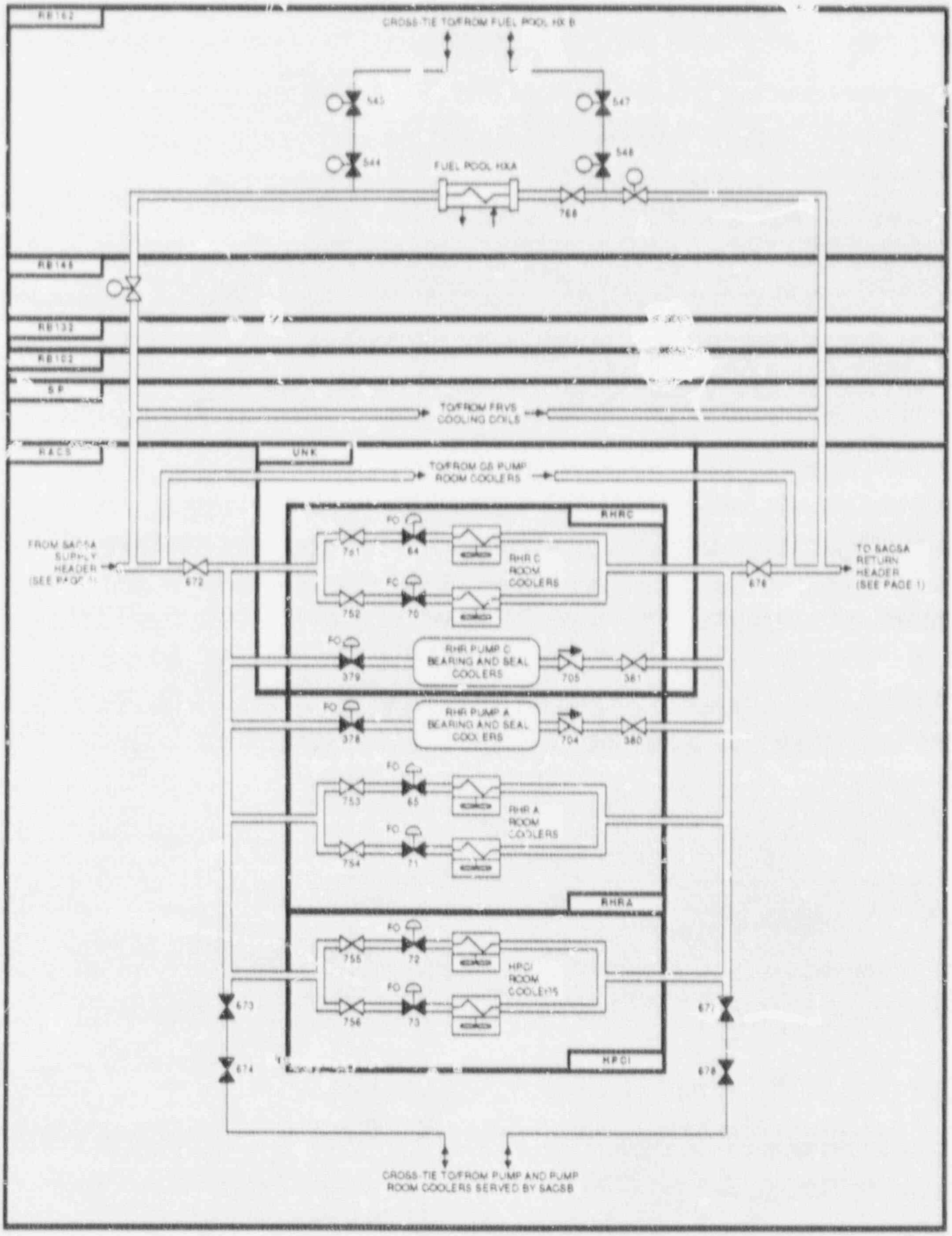


Figure 3.7-2. Hope Creek Safety Auxiliaries Cooling System Showing Component Locations (Page 3 of 4)

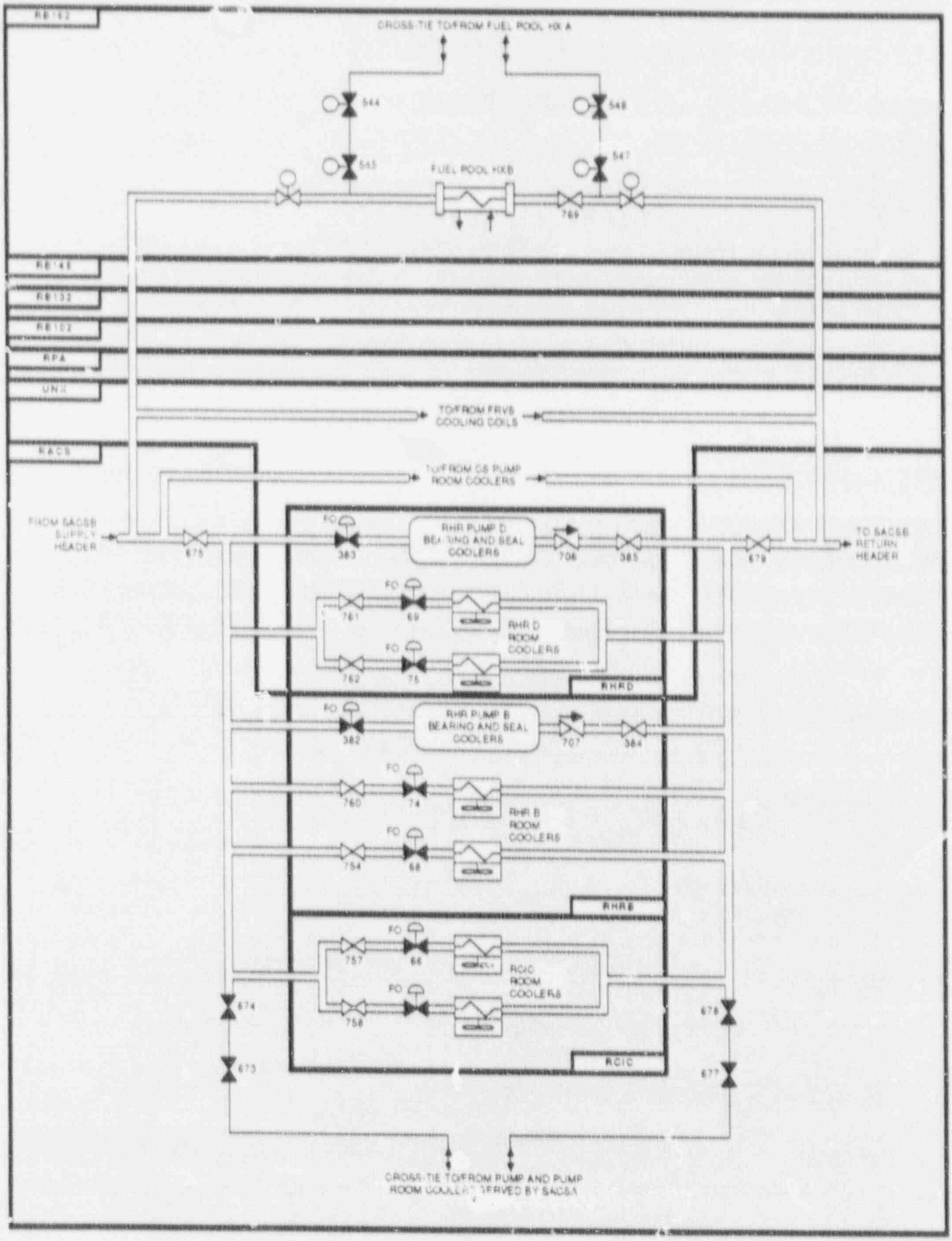


Figure 3.7-2. Hope Creek Safety Auxiliaries Cooling System Showing Component Locations (Page 4 of 4)

Table 3.7-1. Hope Creek Safety Auxiliaries Cooling System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
PUMP A	MDP	SACSA	BUS A401	4160	SGRMA	AC/A
PUMP B	MDP	SACSB	BUS A402	4160	SGRMB	AC/B
PUMP C	MDP	SACSA	BUS A403	4160	SGRMC	AC/C
PUMP D	MDP	SACSB	BUS A404	4160	SGRMD	AC/D
SAC-1064	HOV	RB54				
SAC-1065	HOV	DGCORS54				
SAC-21, SAC-532	HOV	SACSA				
SAC-3	MOV	SACSA	MCC-B212	480	SACSA	AC/A
SAC-4	MOV	SACSA	MCC-B232	480	RB102NE	AC/C
SAC-531, SAC-22	HOV	SACSB				
SAC-7	MOV	SACSB	MCC-B222	480	RB102	AC/B
SAC-8	MOV	SACSB	MCC-B242	480	E77HALL	AC/D
SW-346	MOV	SACSA	MCC-B232	480	RB102NE	AC/C
SW-349	MOV	SACSA	MCC-B212	480	SACSA	AC/A
SW-352	MOV	SACSB	MCC-B242	480	E77HALL	AC/D
SW-355	MOV	SACSB	MCC-B222	480	RB102	AC/B

3.8 STATION SERVICE WATER SYSTEM (SSWS)

3.8.1 System Function

The Station Service Water System (SSWS) provides cooling water from the ultimate heat sink to the Safety Auxiliaries Cooling System (SACS) heat exchangers and the Reactor Auxiliaries Cooling System (RACS) heat exchangers during normal operation and during a loss of offsite power. Following a LOCA or other design basis accident, cooling is supplied only to the SACS heat exchangers.

3.8.2 System Definition

The Station Service Water System consists of two loops with two motor-driven pumps per loop. Each SSWS loop cools a separate SACS loop, and either SSWS loop can provide cooling for the RACS heat exchangers. The source of cooling water is the Delaware River. Traveling water screens, strainers and a trash rack remove impurities from the river water prior to its entering the SSWS pumps.

Simplified system drawings are shown in Figures 3.8-1 and 3.8-2. Note that individual valves have more than one identification number in the original Hope Creek source drawings. Secondary valve identification numbers are indicated in parentheses in Figures 3.8-1 and 3.8-2. A summary of data on selected SSWS components is presented in Table 3.8-1.

3.8.3 System Operation

During normal operation, one SSWS pump is operating in each loop. The second pump in each loop is in standby and will start if the first pump fails. The only essential loads required for safe shutdown are the SACS heat exchangers. SACS heat exchangers A1 and A2 are normally cooled by SSWS loop A, and SACS heat exchangers B1 and B2 are normally cooled by SSWS loop B. Motor operated cross-tie valves provide a flow path to the RACS heat exchangers during normal operation and a means of cross-connecting the SSWS loops for SACS heat exchanger supply. Normally, the effluent from the heat exchangers discharges to a common header outside the Reactor Building and from there to the cooling tower discharge canal. Should this line become blocked, motor-operated valves can be opened to direct the effluent from the SACS heat exchangers to the yard. The effluent will then drain back into the river. If the motor-operated valves fail to function, or the blockage is sudden, rupture discs will blow out allowing SACS heat exchanger effluent to be directed to the yard.

During normal shutdown, all four pumps initially supply all four SACS heat exchangers and the two RACS heat exchangers. In the long term, two SSWS pumps supply two SACS heat exchangers and the RACS heat exchangers. Normal shutdown can be achieved with only one SSWS loop operating.

Following a loss of power, all four pumps start. However, one loop with two pumps is all that is required to safely shutdown the plant. Following a LOCA, all four pumps also start. Again, only one SSWS loop with the associated SACS loop is required for safe shutdown. Following a LOCA, the SSWS loops are automatically isolated from each other and from the RACS heat exchangers.

In the containment cooling mode, one SSWS loop with two pumps supplying one SACS loop is needed. The SSWS system can also be used to flood the containment.

3.8.4 System Success Criteria

The SSWS success criteria for each loop are:

- One SSWS pump operating taking a suction on the Delaware River (can be a pump in the opposite loop)
- The pump's discharge passing through the loop's associated SACS heat exchanger

3.8.5 Component Information

A. Service Water Pumps A, B, C, D
   1. Design flow: 16,500 gpm @ 150 ft. head (65 psid)
   2. Type: Vertical, single stage, wet pit centrifugal

B. Ultimate Heat Sink - Delaware River and cooling tower discharge canal

C. SACS Heat Exchangers A1, A2, B1, B2
   1. Design flow-tube side: 10,500 gpm

3.8.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      a. The SSWS pumps automatically start on a loss of offsite power, a LOCA, or when the operating pump in the loop fails.
      b. The SSWS cross-tie valves and RACS heat exchanger supply valve automatically close on a LOCA.
   2. Remote Manual
      The SSWS pumps and motor operated valves can be actuated from the control room. Loop B pumps and valves can be actuated from the remote shutdown panel as well.

B. Motive Power
   The SSWS pumps and motor operated valves are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.5.

C. Other
   1. Lubrication and cooling are provided locally for SSWS pumps.
   2. Systems for pump room ventilation have not been identified.

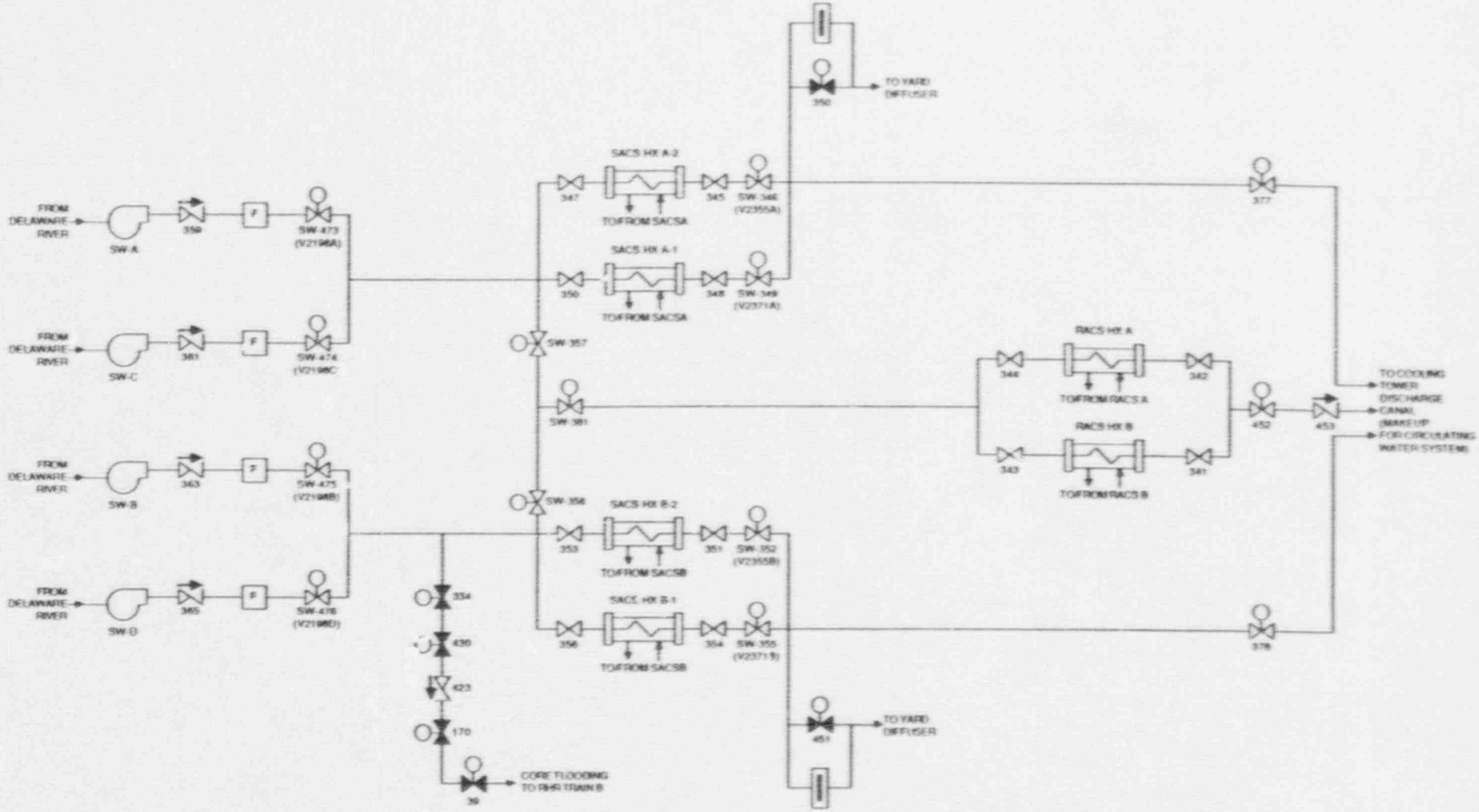


Figure 3.8-1. Hope Creek Service Water System

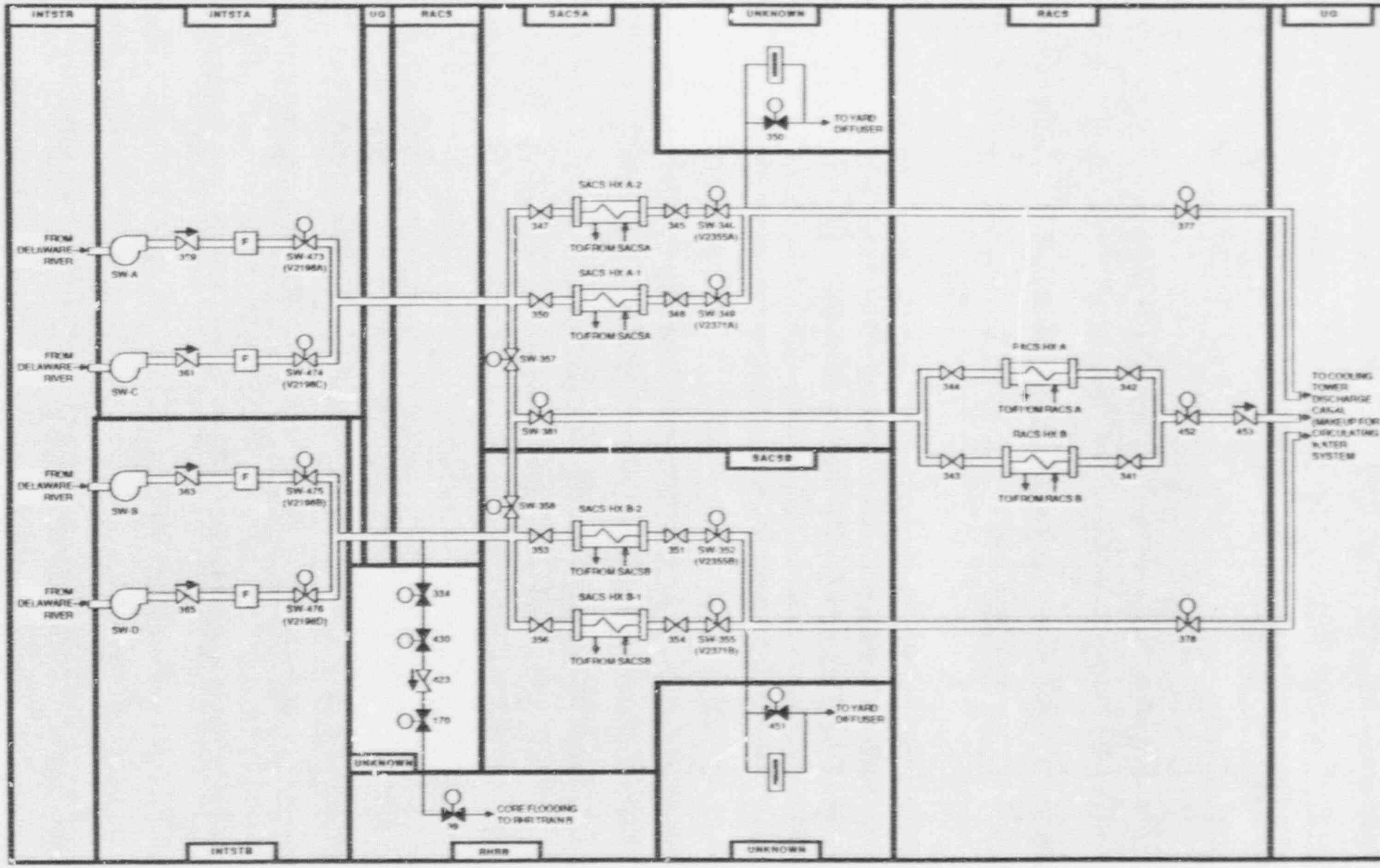


Figure 3.8-2. Hope Creek Service Water System Showing Component Locations

Table 3.8-1. Hope Creek Station Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SACS HXA1,A2	HX	SACSA				
SACS HXB1,B2	HX	SACSB				
SW-357	MOV	SACSA	MCC-B212	480	SACSA	AC/A
SW-357	MOV	SACSA	MCC-B212	480	SACSA	AC/A
SW-358	MOV	SACSB	MCC-B222	480	RB102	AC/B
SW-358	MOV	SACSB	MCC-B222	480	RB102	AC/B
SW-381	MOV	SACSA	MCC-B232	480	RB102NE	AC/C
SW-473	MOV	INTSTA	MCC-B553	480	INTSTA	AC/A
SW-474	MOV	INTSTA	MCC-B573	480	INTSTA	AC/C
SW-475	MOV	INTSTB	MCC-B563	480	INTSTB	AC/B
SW-476	MOV	INTSTB	MCC-B583	480	INTSTB	AC/D
SWS PUMP A	MDP	INTSTA	BUS A401	4160	SGRMA	AC/A
SWS PUMP B	MDP	INTSTB	BUS A402	4160	SGRMB	AC/B
SWS PUMP C	MDP	INTSTA	BUS A403	4160	SGRMC	AC/C
SWS PUMP D	MDP	INTSTB	BUS A404	4160	SGRMD	AC/D

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Hope Creek site is located in the southwestern portion of New Jersey in Salem Country on the Delaware River, approximately eighteen miles south of Wilmington, Delaware. The 530 acre site contains one operating BWR/4 plant with structures for another which has not been built. The operational plant was to have been Unit 1 of a two unit site.

The two reactor buildings are separated by an auxiliary building containing control and diesel areas. The southern reactor building houses the operational plant. The norther reactor building is unoccupied. A service and radwaste building is adjacent to the east side of the reactor buildings. The turbine building is east of and adjacent to the service and radwaste building.

A general view of the site is shown in Figure 4-1 (from Ref. 1) and a more detailed site plan is shown in Figure 4-2.

The containment is surrounded by the reactor building. The HPCI, RCIC, core spray, RHR, Safety Auxiliaries Cooling, reactor water cleanup systems, and the CRD hydraulic control units are located on various elevations of the reactor building. The spent fuel storage pool is on the 162 foot elevation. Access to the containment is from a personnel entry point at the 77 foot elevation and two removal paths at the 102 foot elevation of the reactor building.

The control and diesel building, located between the two reactor buildings, contains the control room, cable spreading room, battery rooms, remote shutdown panel and control equipment room. The control room is on the 137 foot elevation of the control building. Four diesel generators and 4160 VAC Class 1E switchgear are located in the control and diesel building. The long-term fuel oil storage tanks are below the diesel generators in the same building.

The service water pumps are located on the Delaware River on the west side of the site in the intake structure building. The discharge is to the cooling tower discharge canal on the north side of the site.

The switchyard is located to the east of the turbine building. The condensate storage tank (CST) is to the south of the reactor building. Personnel and vehicle access to the protected area is through an access control point connecting the site to the New Jersey side of the Delaware River at the southwest corner of the site.

4.2 FACILITY LAYOUT DRAWINGS

Figures 4-3 is an elevation view of the Hope Creek plant. Figures 4-4 through 4-11 are simplified building layout drawings for the Hope Creek reactor building. The control/diesel building is shown in Figures 4-12 to 4-18. The turbine building, service/radwaste building, administration, facility, and intake structure are not shown on these drawings. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings, however, many interior walls have been omitted for clarity. Labels printed in uppercase correspond to the location codes listed in Table 4-1 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

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

4.3 SECTION 4 REFERENCES

1. Heddleson, F.A. "Design Data and Safety Features of Commercial Nuclear Power Plants," ORNL-NSIC-55, Volume II, Oak Ridge National Laboratory, Nuclear Safety Information Center, January 1972.

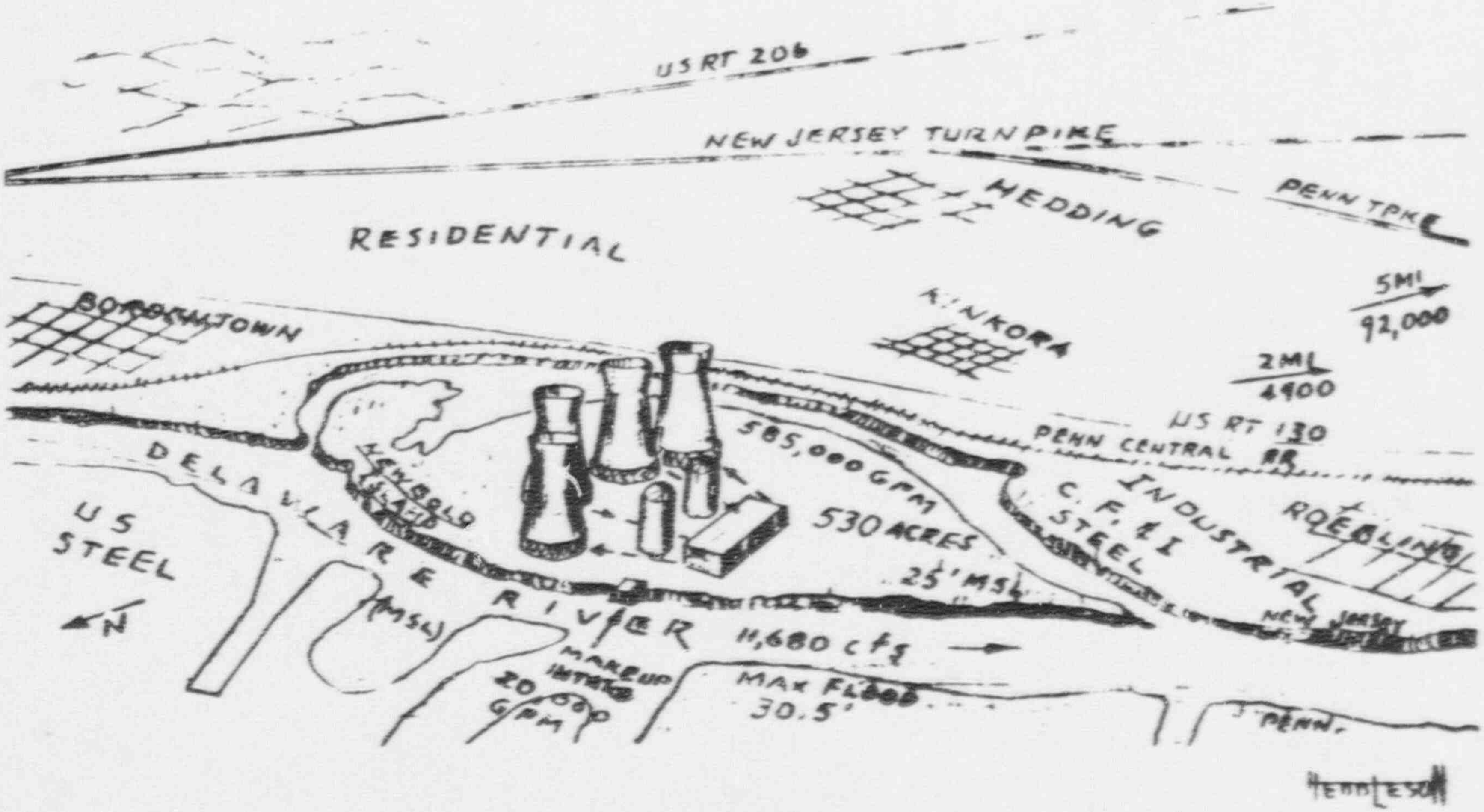


Figure 4-1. General View of the Hope Creek Site and Vicinity

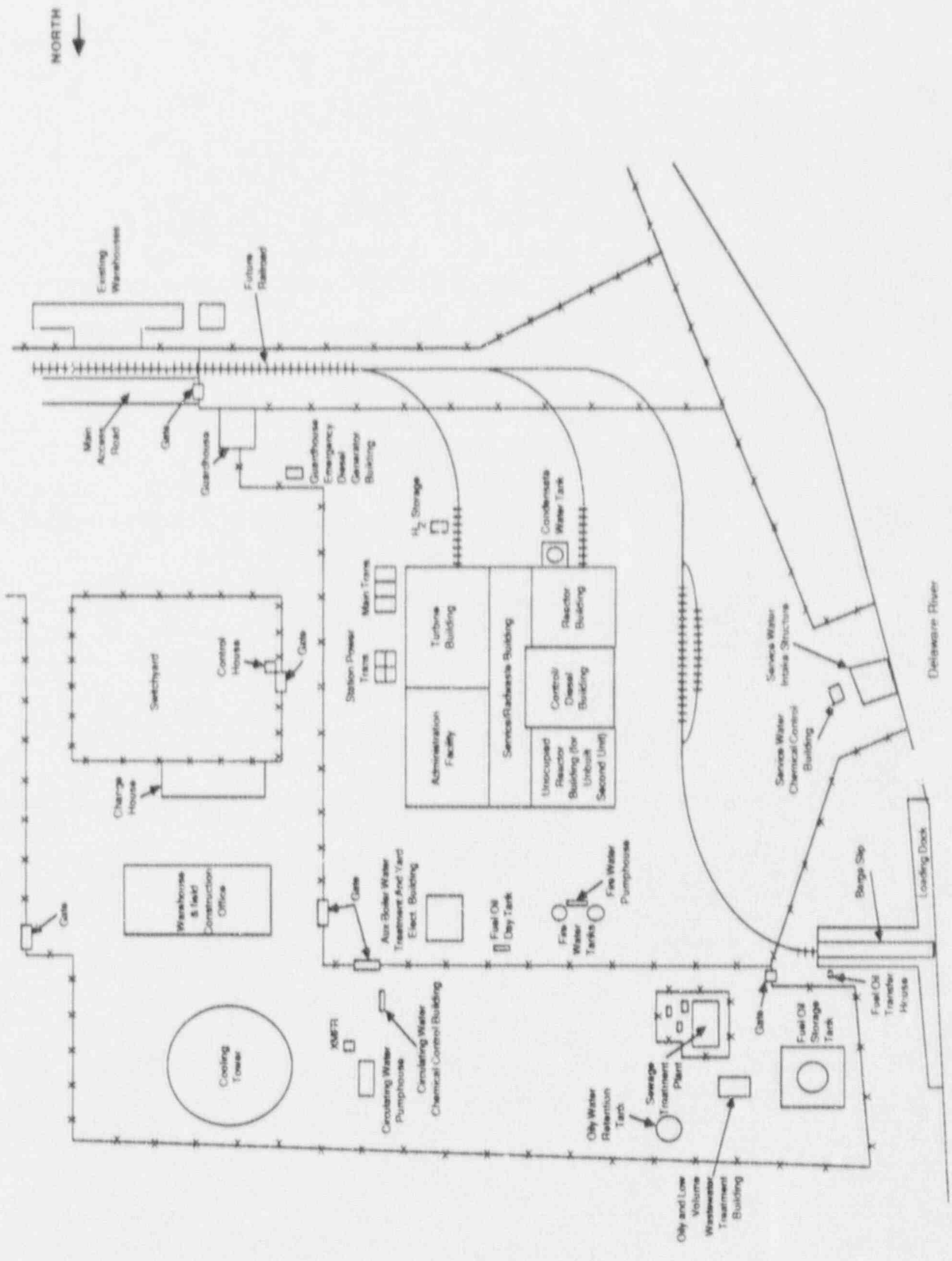


Figure 4-2. Hope Creek Simplified Site Plan

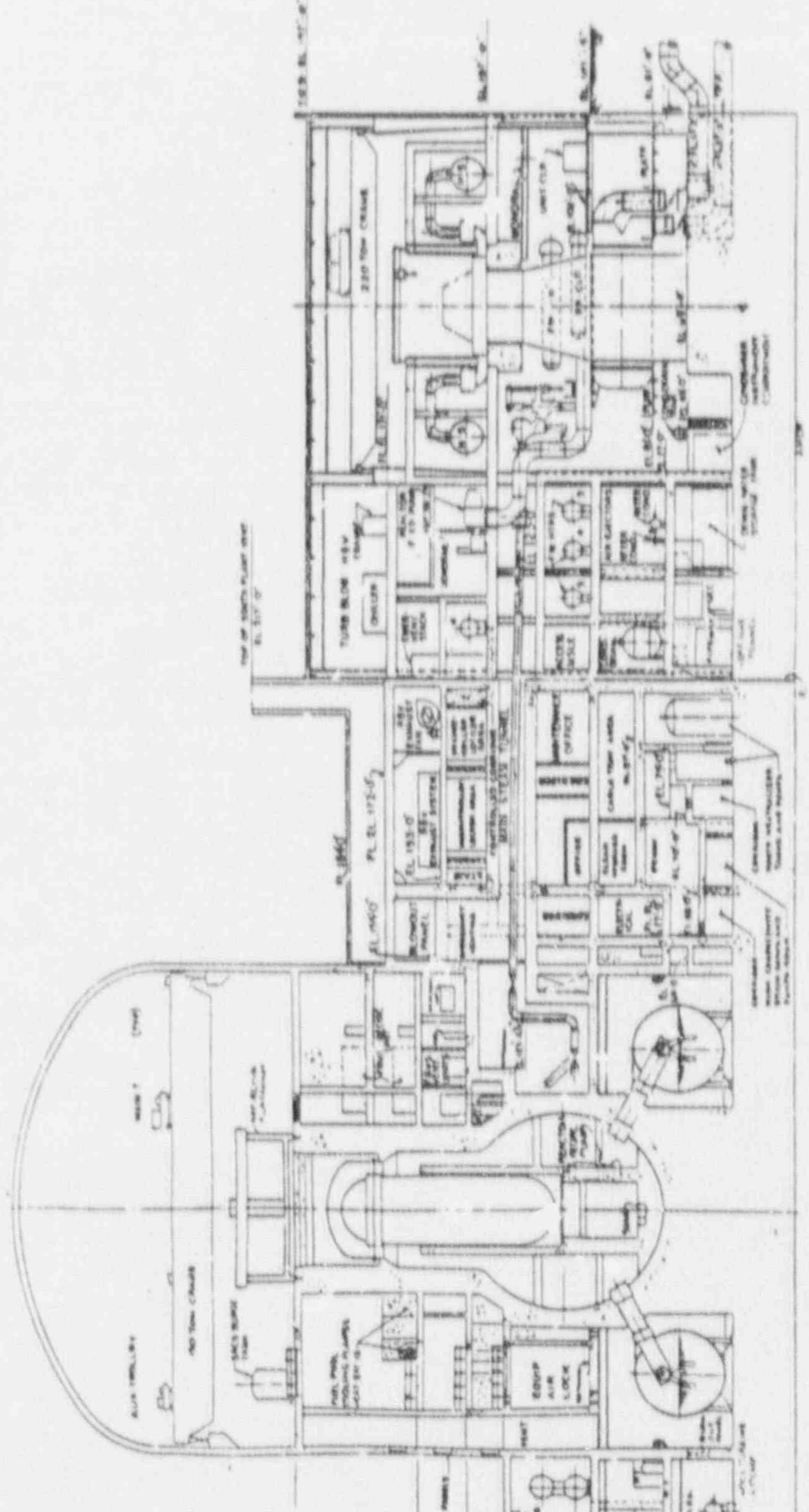


Figure 4-3. Hope Creek Reactor Building Section, Looking North

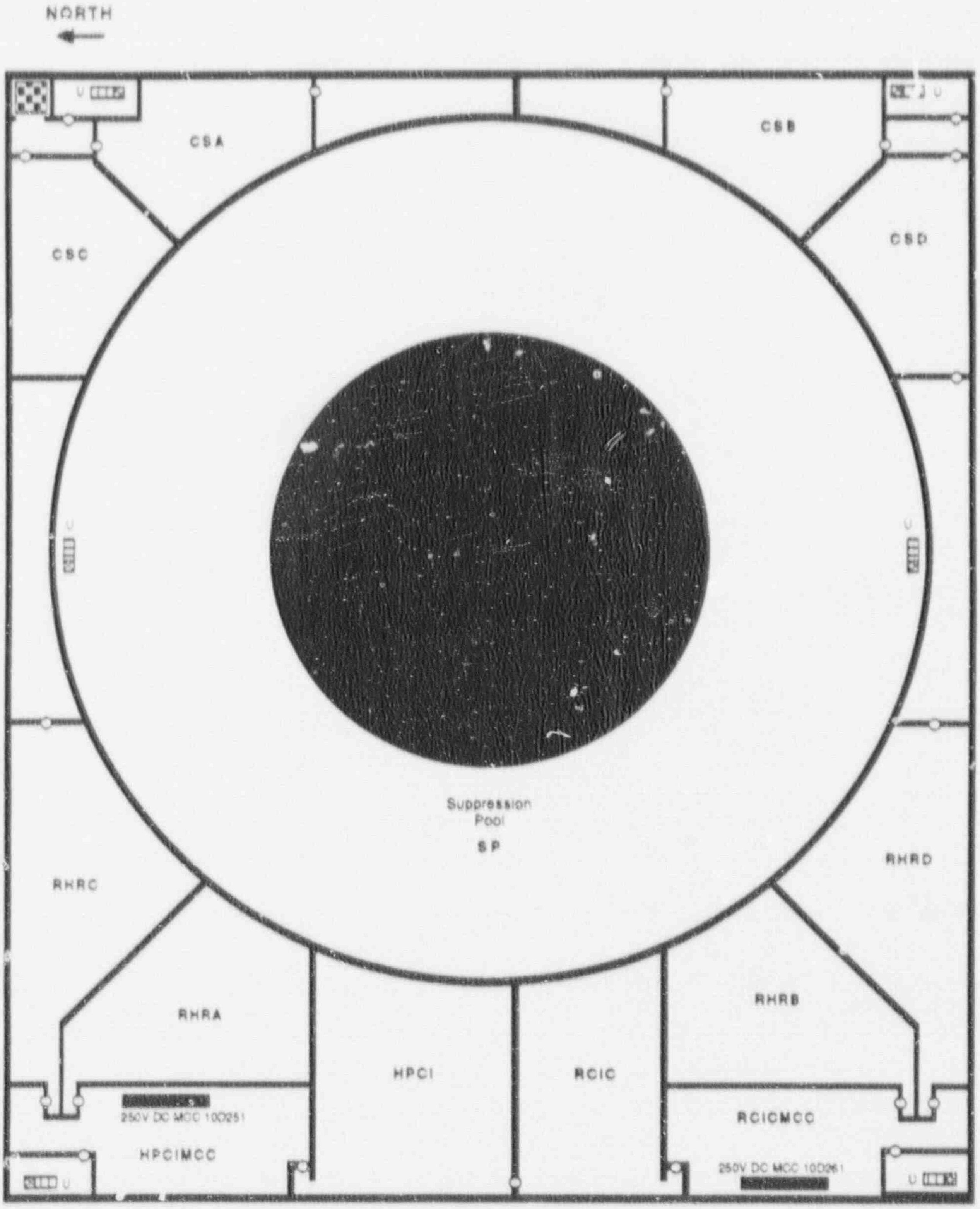


Figure 4-4. Hope Creek Reactor Building Elevation 54'-0"

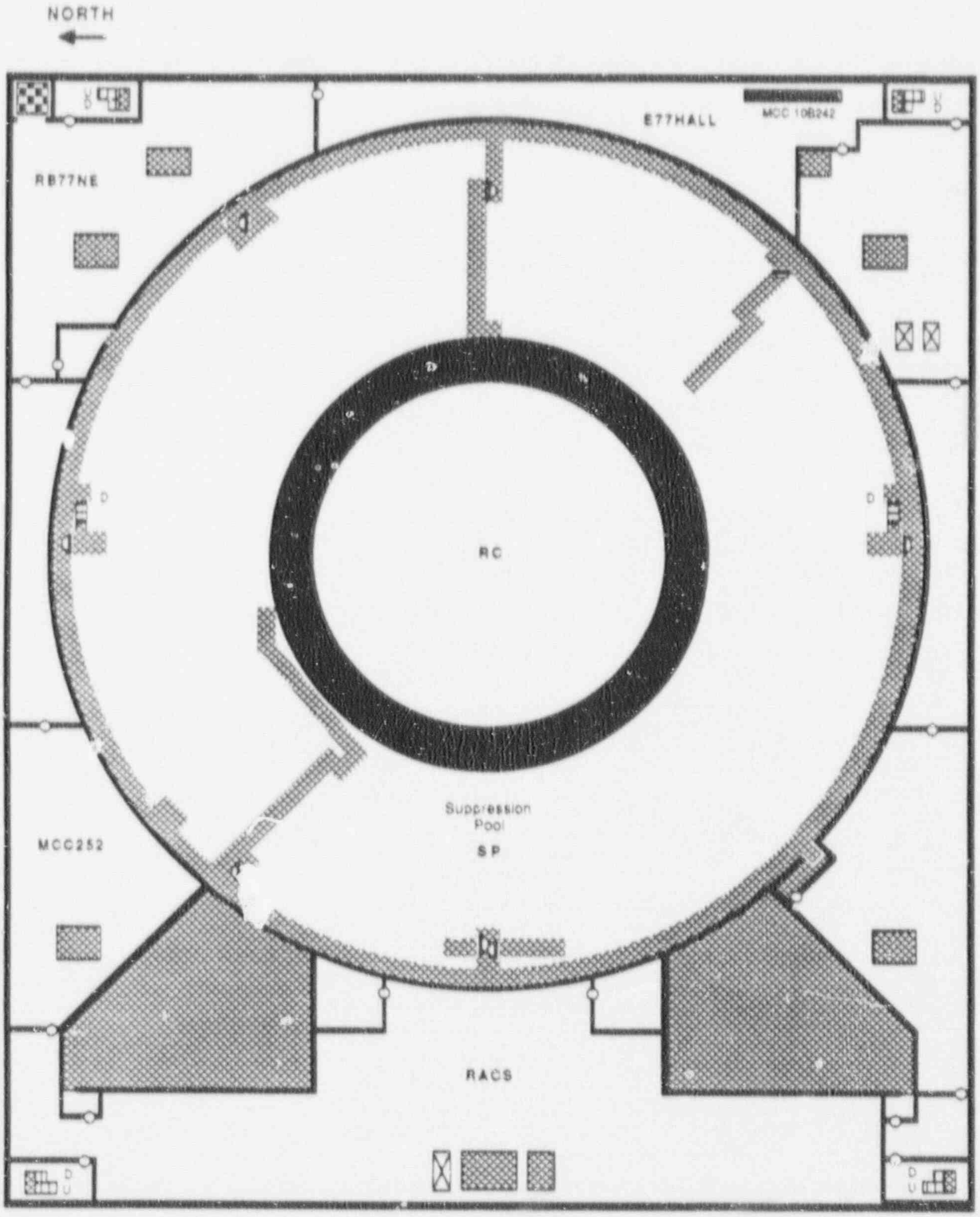


Figure 4-5. Hope Creek Reactor Building Elevation 77'-0"

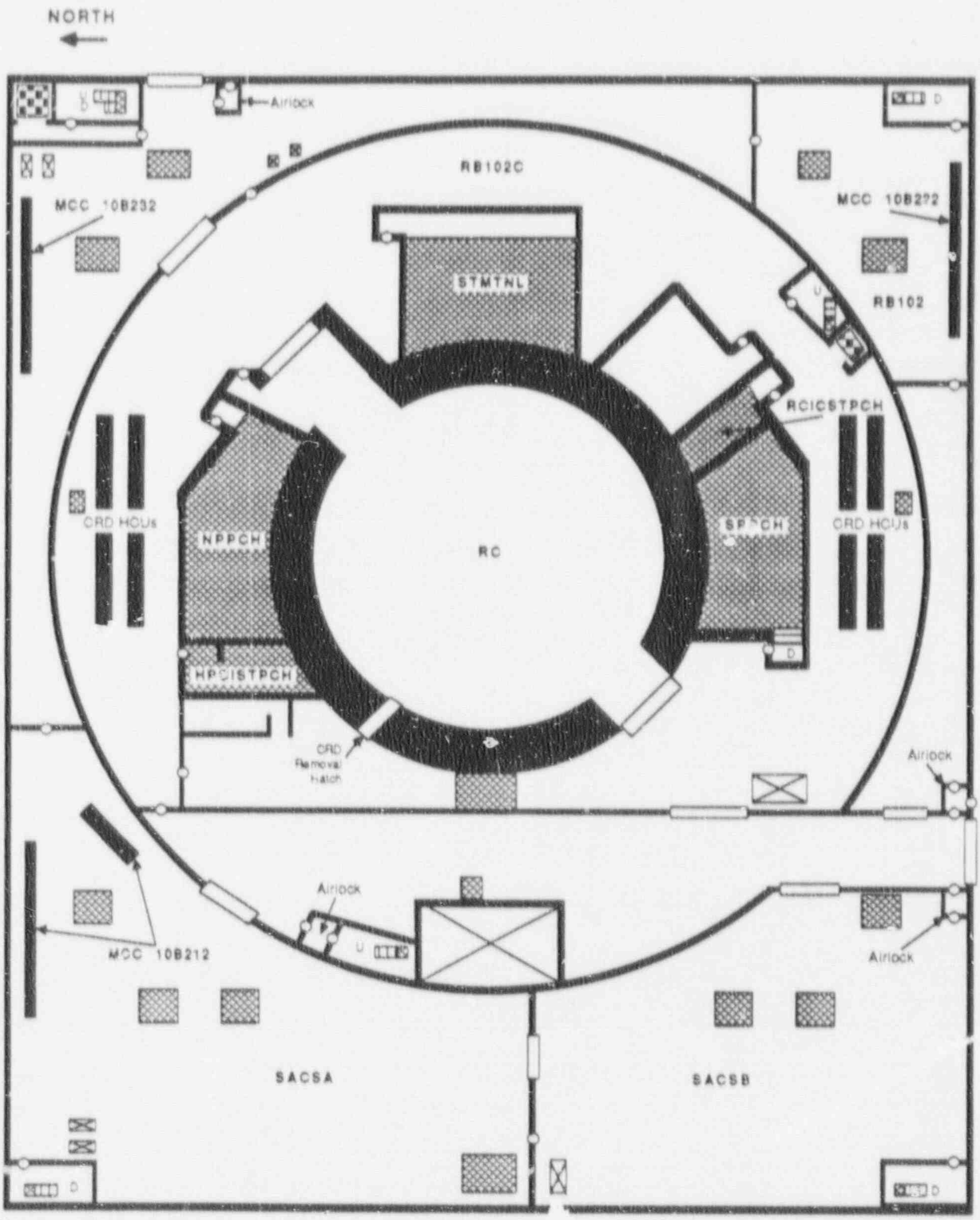


Figure 4-6. Hope Creek Reactor Building Elevation 102'-0"

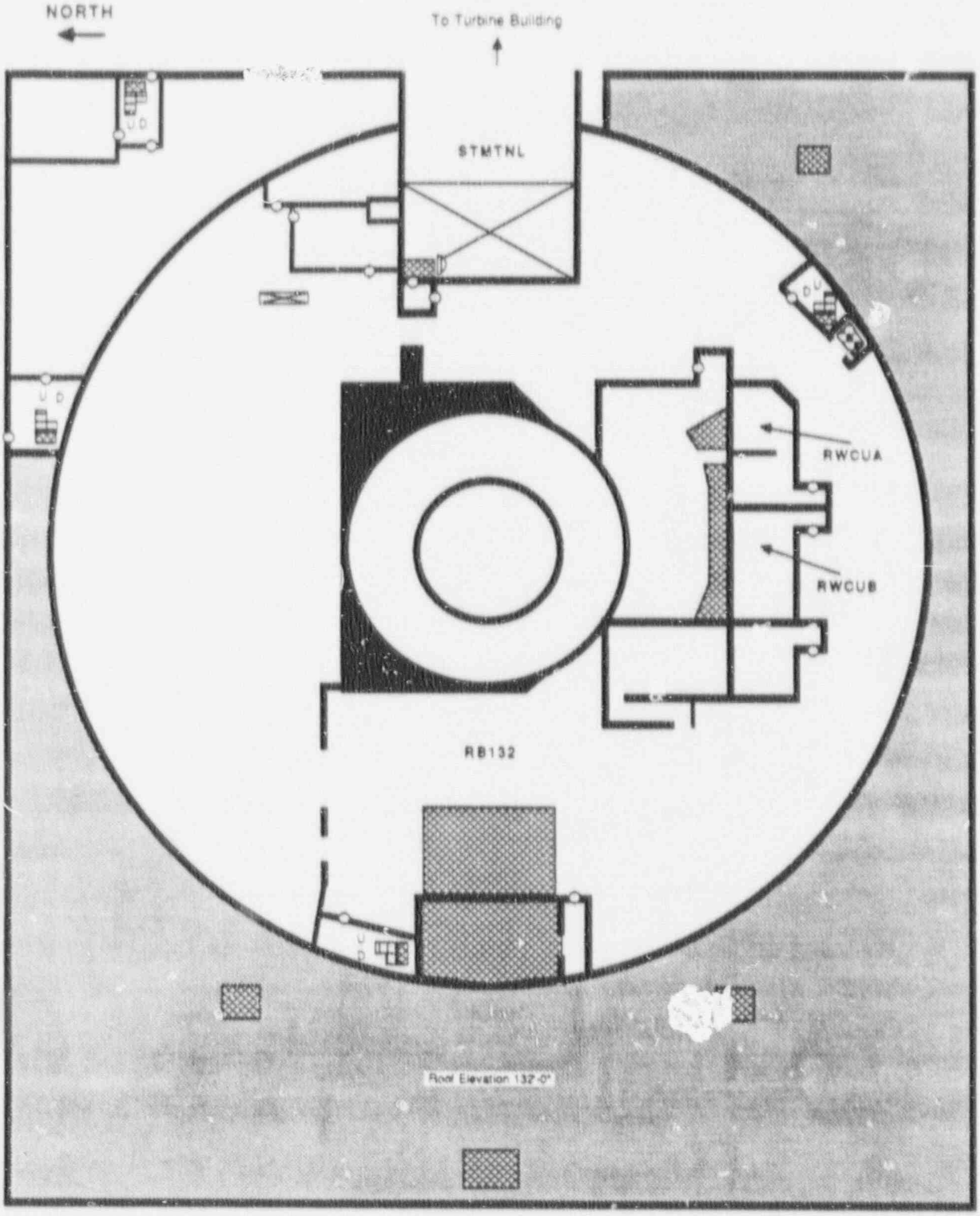


Figure 4-7. Hope Creek Reactor Building Elevation 132'-0"

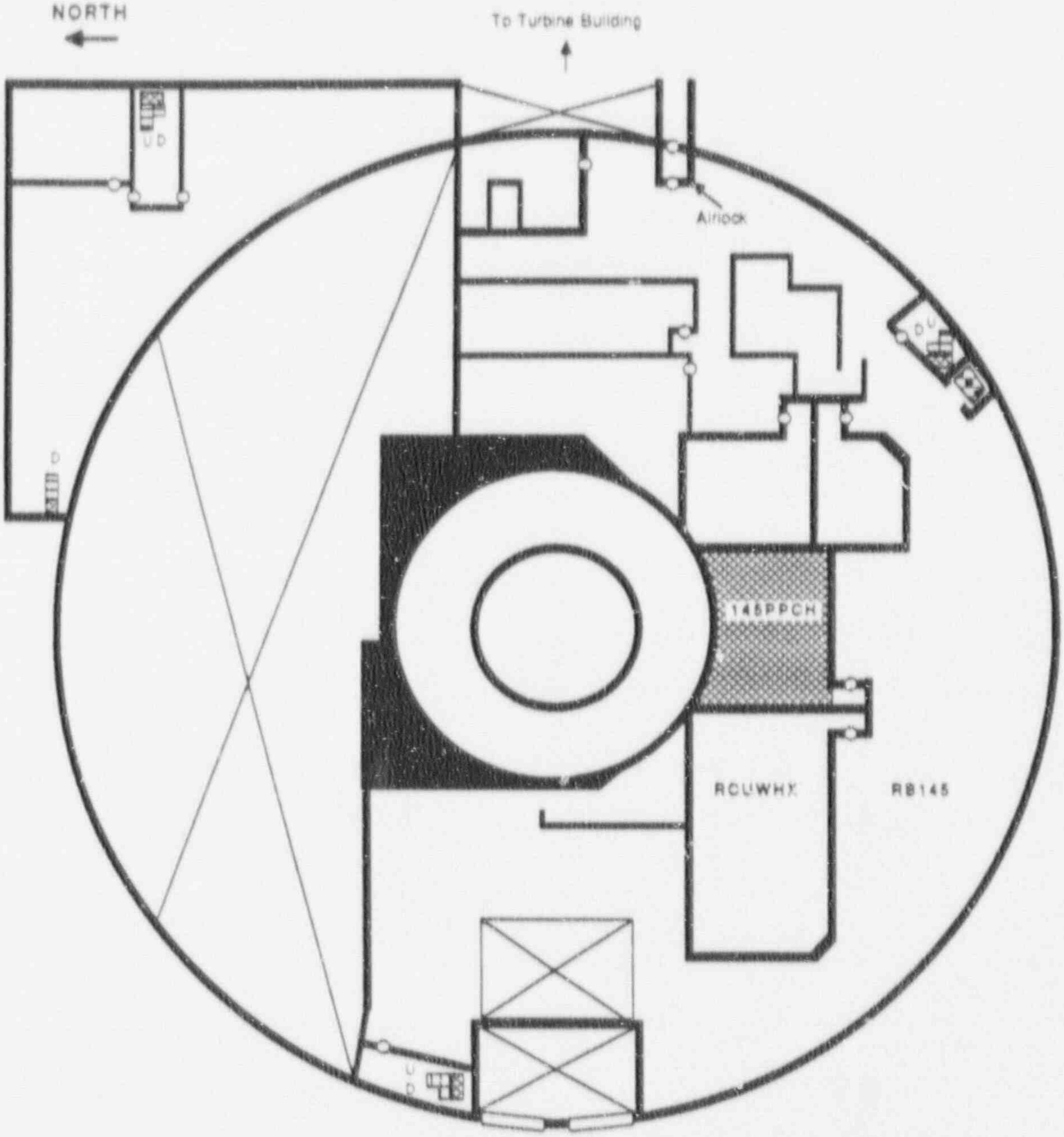


Figure 4-8. Hope Creek Reactor Building Elevation 145'-0"

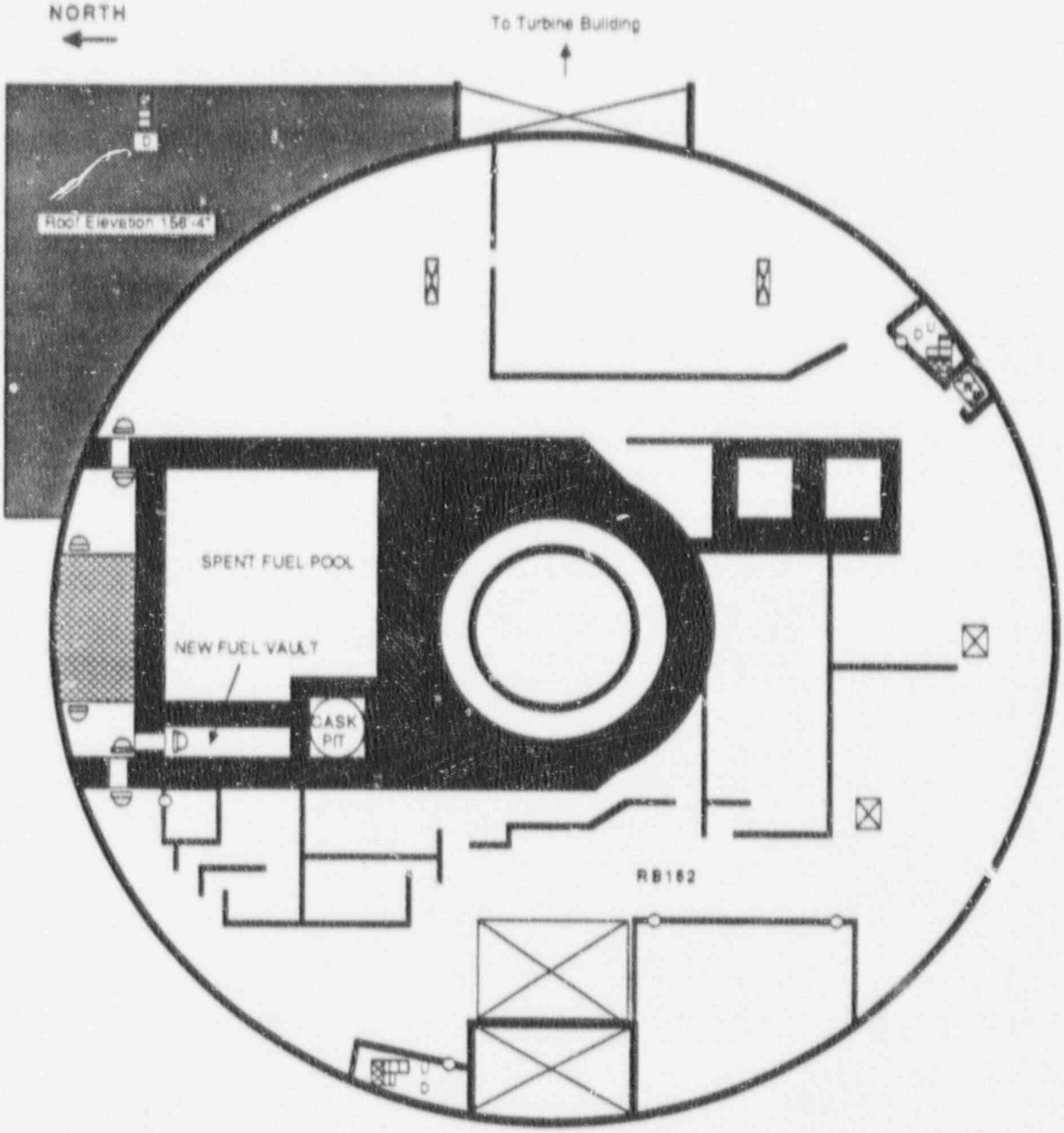


Figure 4-9. Hope Creek Reactor Building Elevation 162'-0"

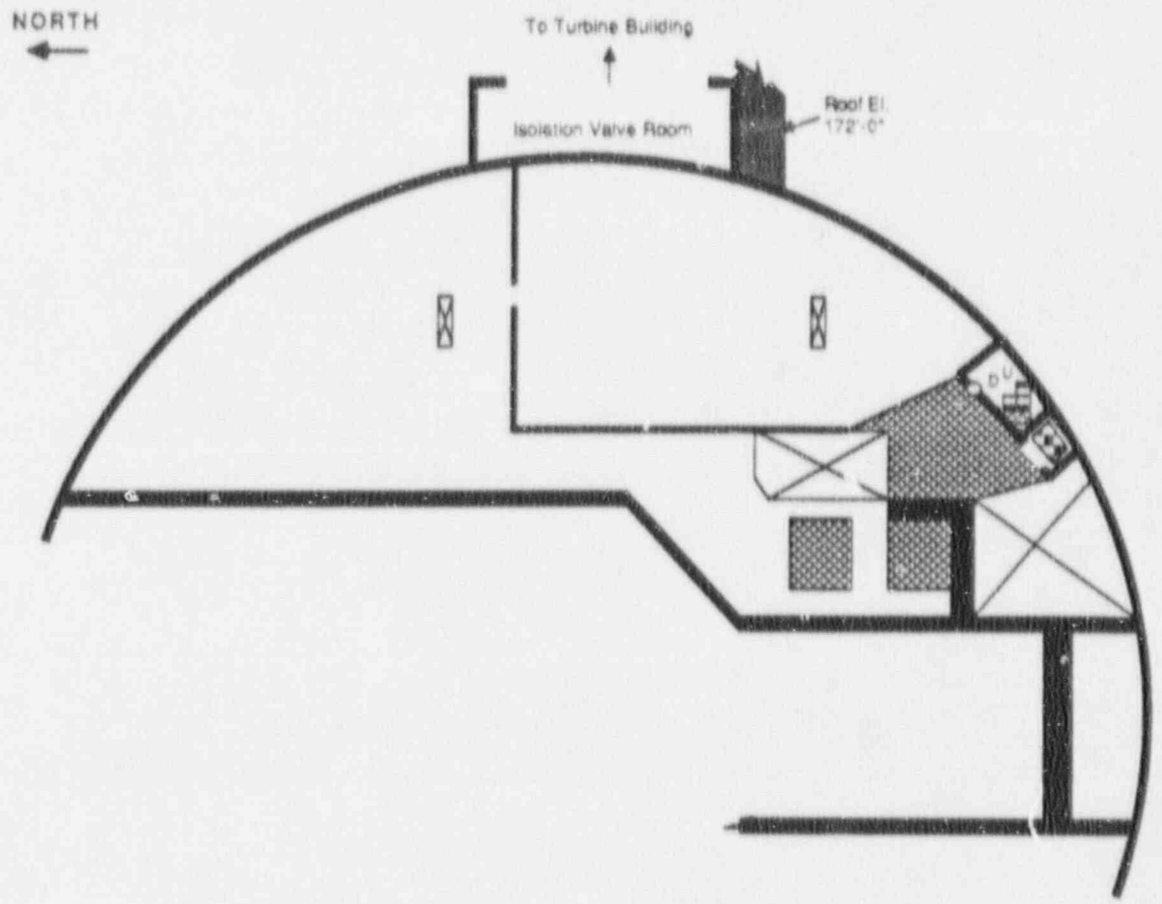


Figure 4-10. Hope Creek Reactor Building
Partial Plan Elevation 178'-6"

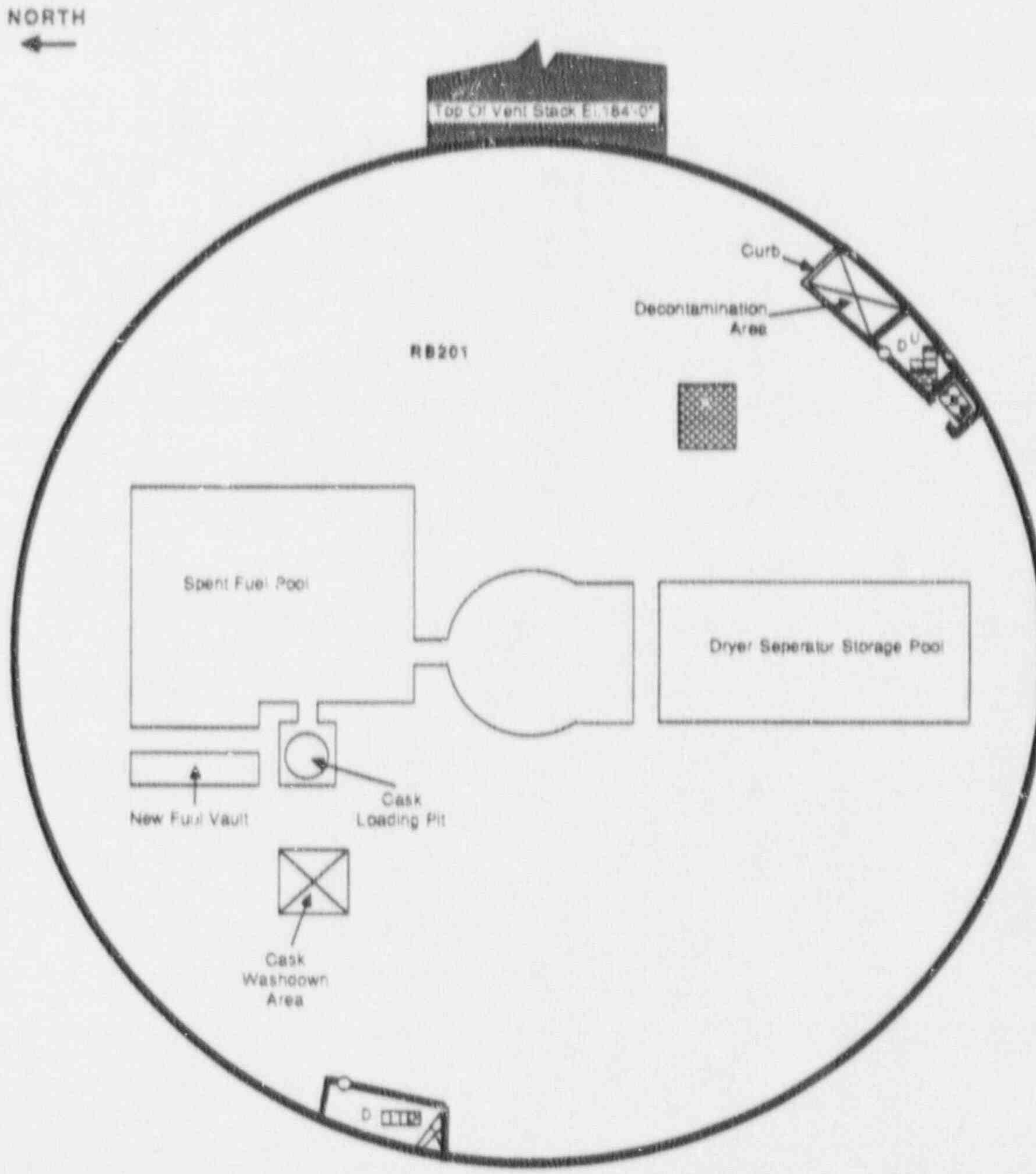


Figure 4-11. Hope Creek Reactor Building Elevation 201'-0"

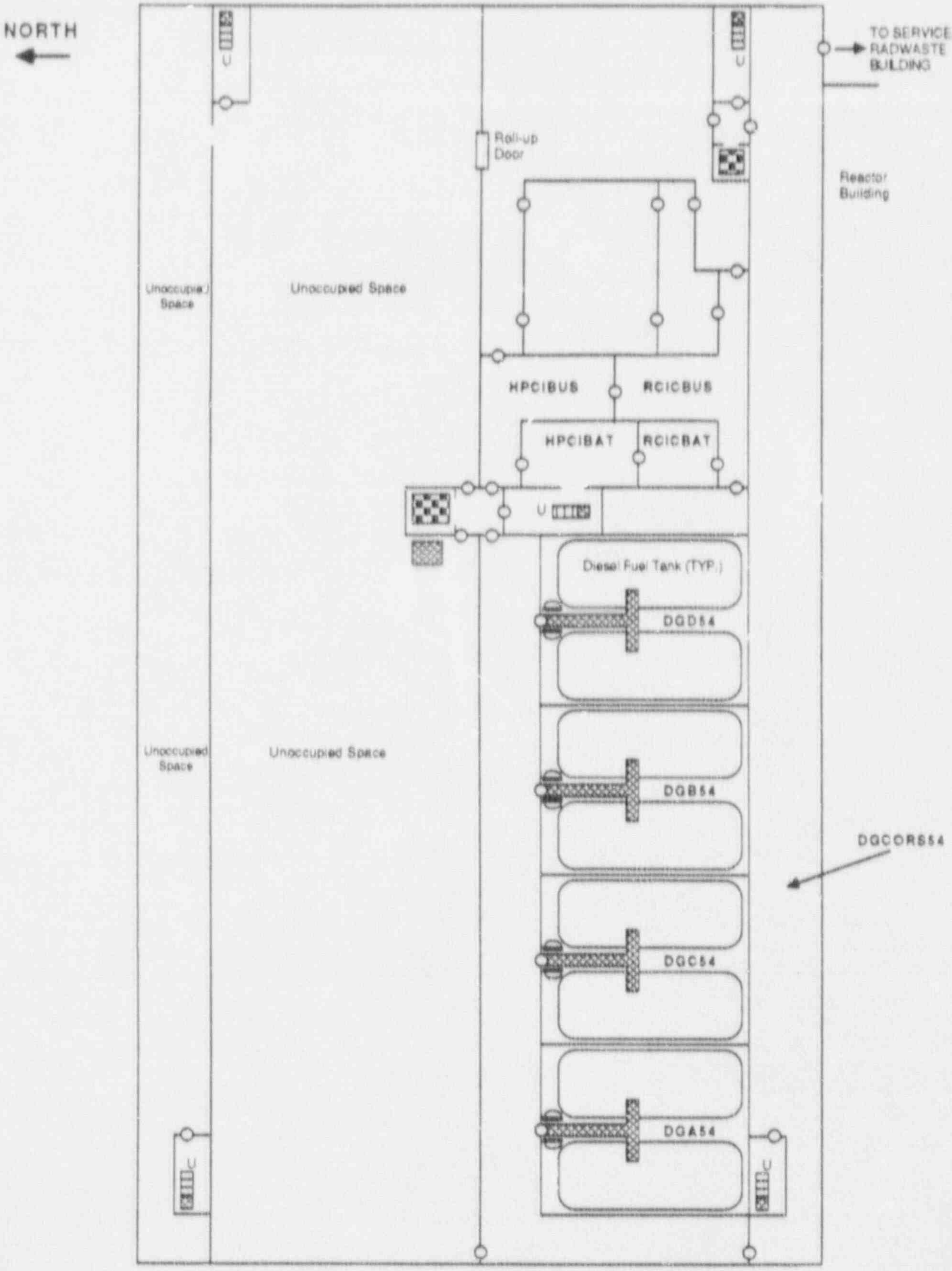


Figure 4-12. Hope Creek Control/Diesel Building Elevation 54'-0"

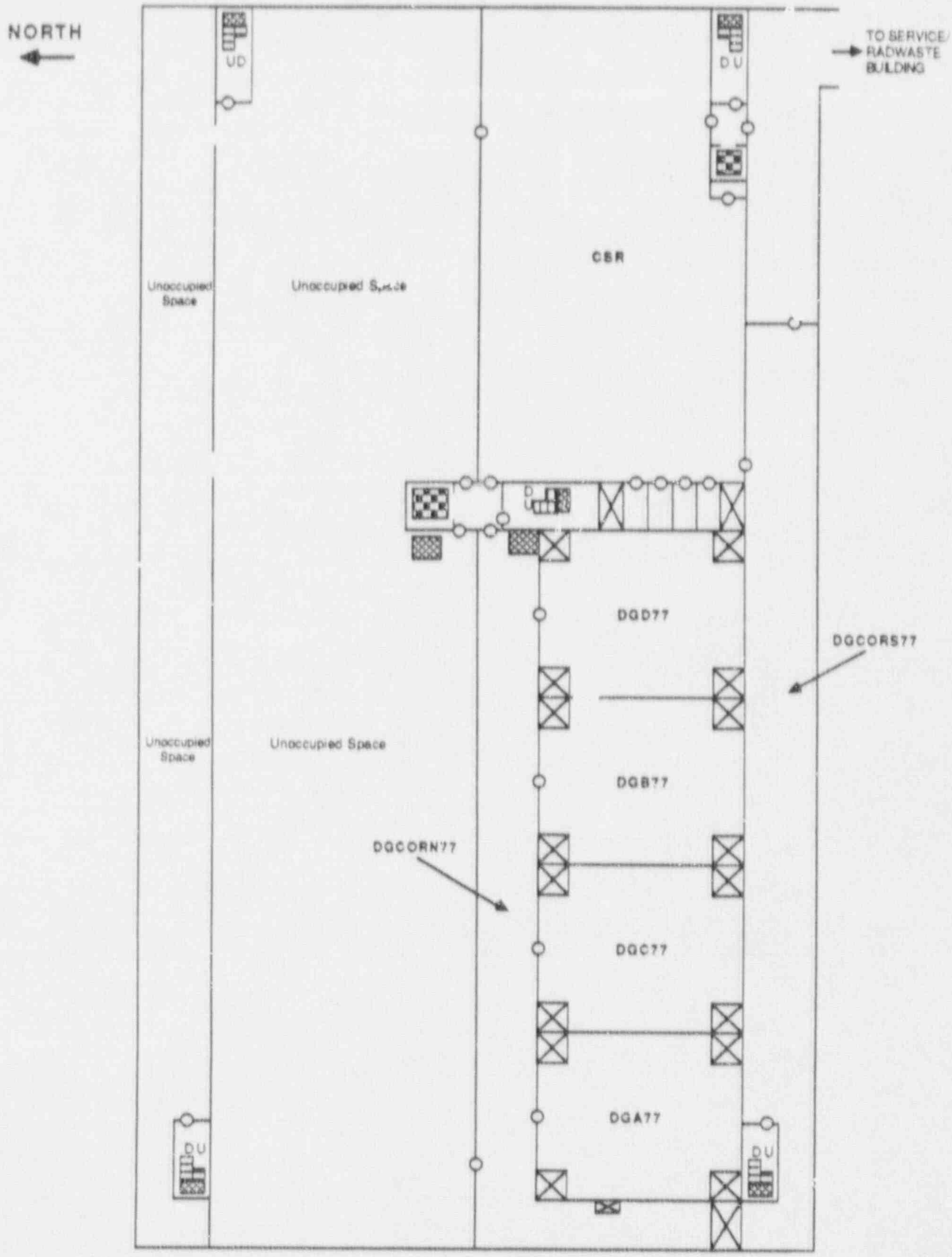


Figure 4-13. Hope Creek Control/Diesel Building Elevation 77'-0"

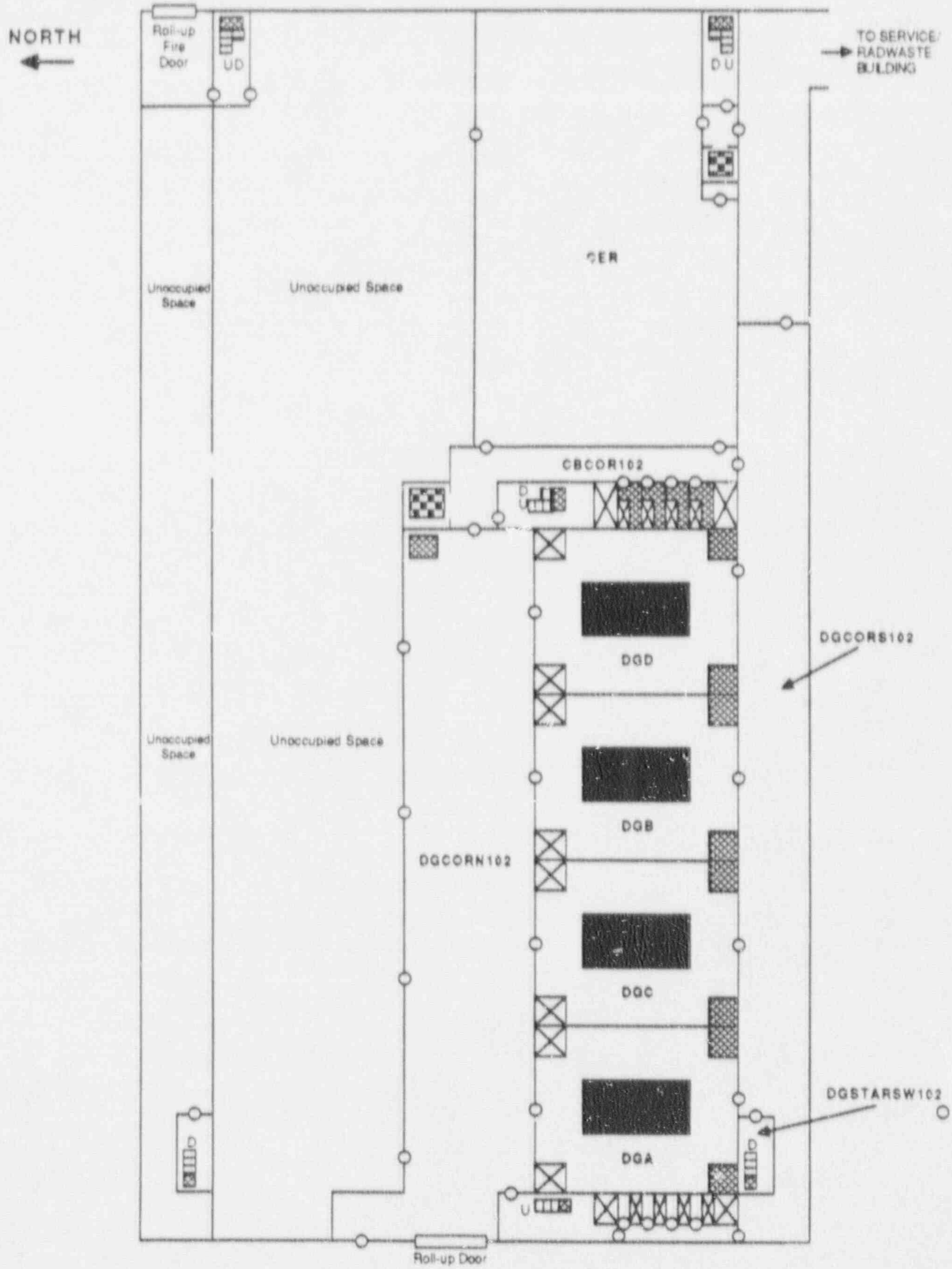


Figure 4-14. Hope Creek Control/Diesel Building Elevation 102'-0"

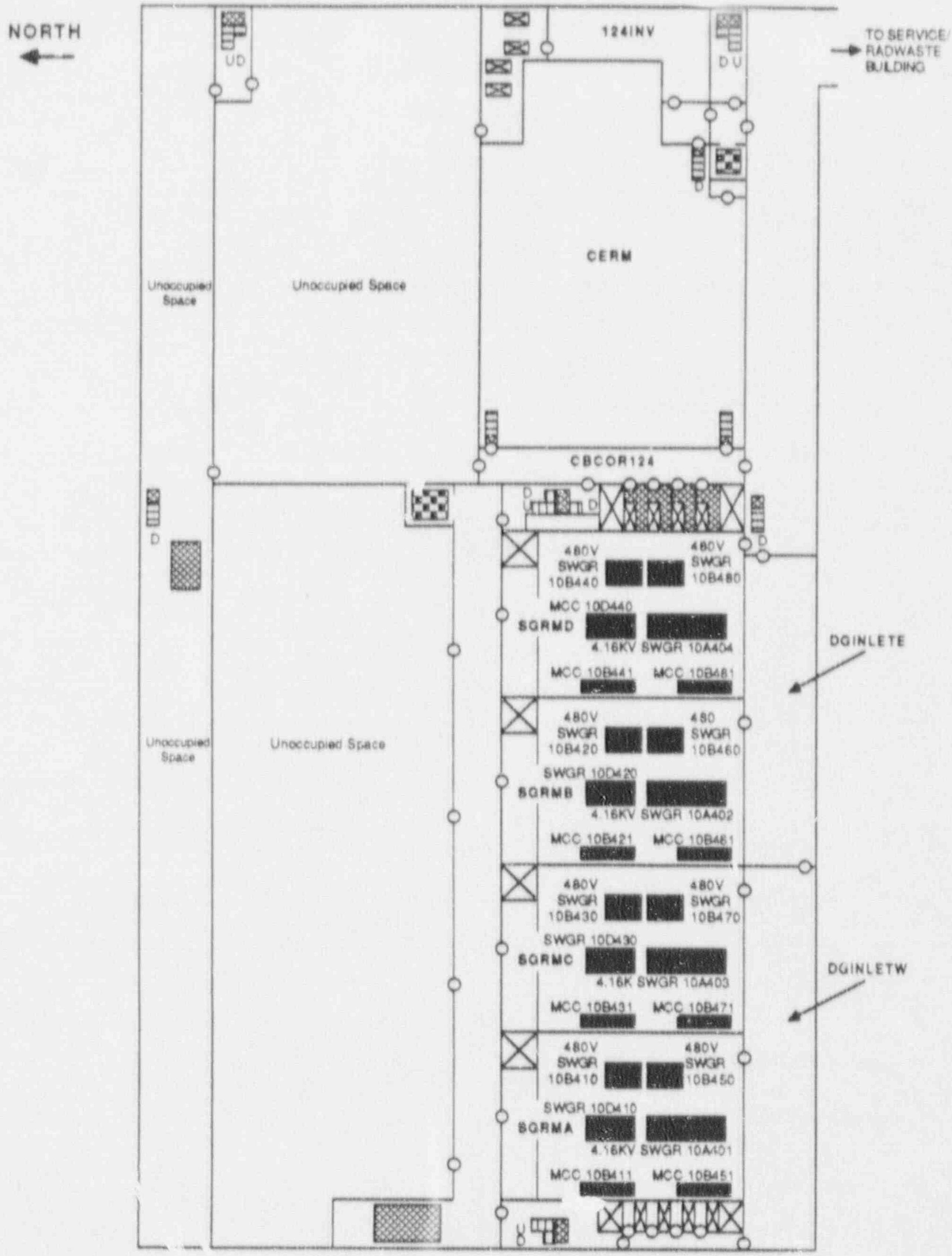


Figure 4-15. Hope Creek Control/Diesel Building Elevation 124'-0" and 130'-0"

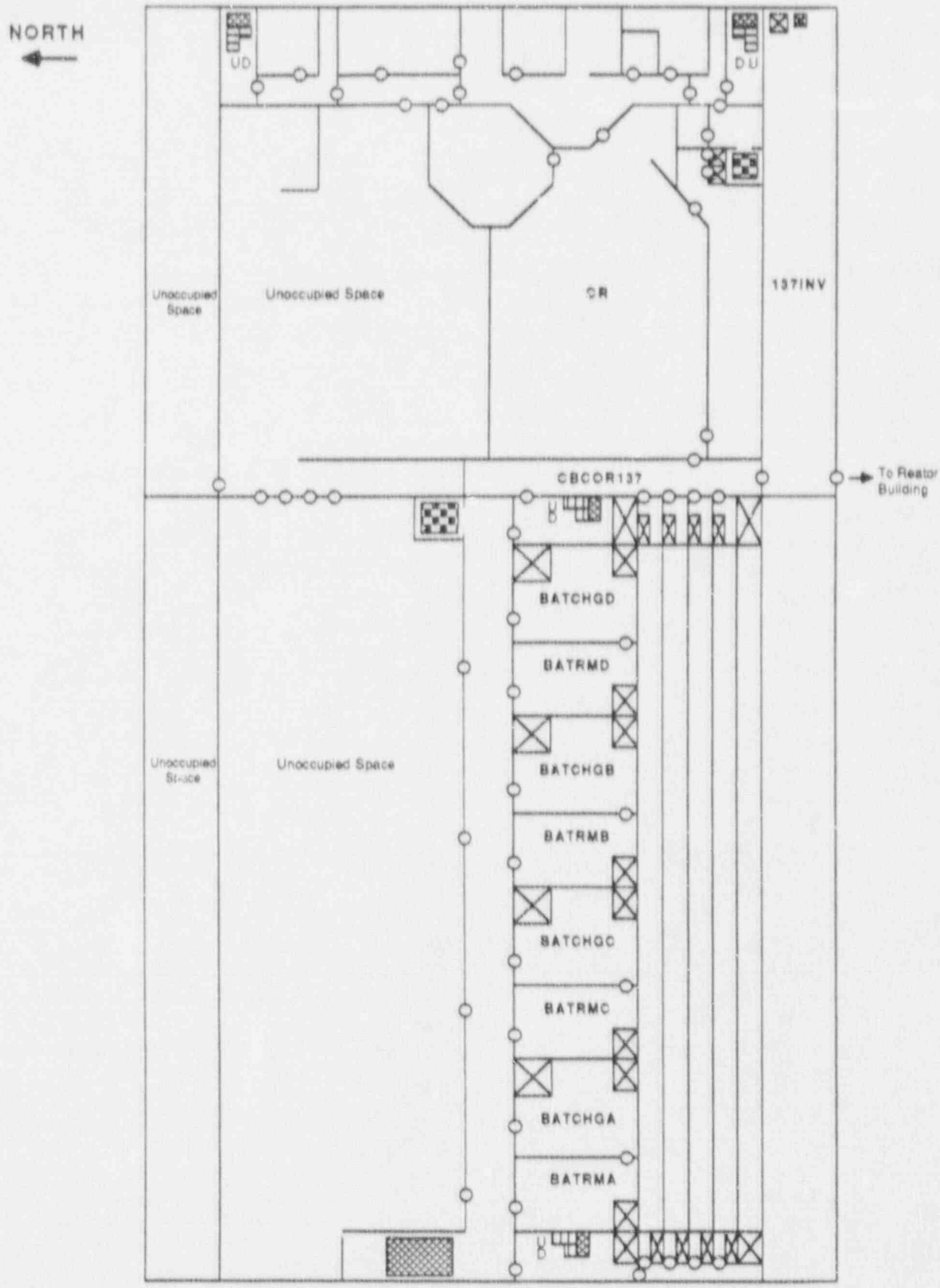


Figure 4-16. Hope Creek Control/Diesel Building Elevation 146'-0" and 137'-0'

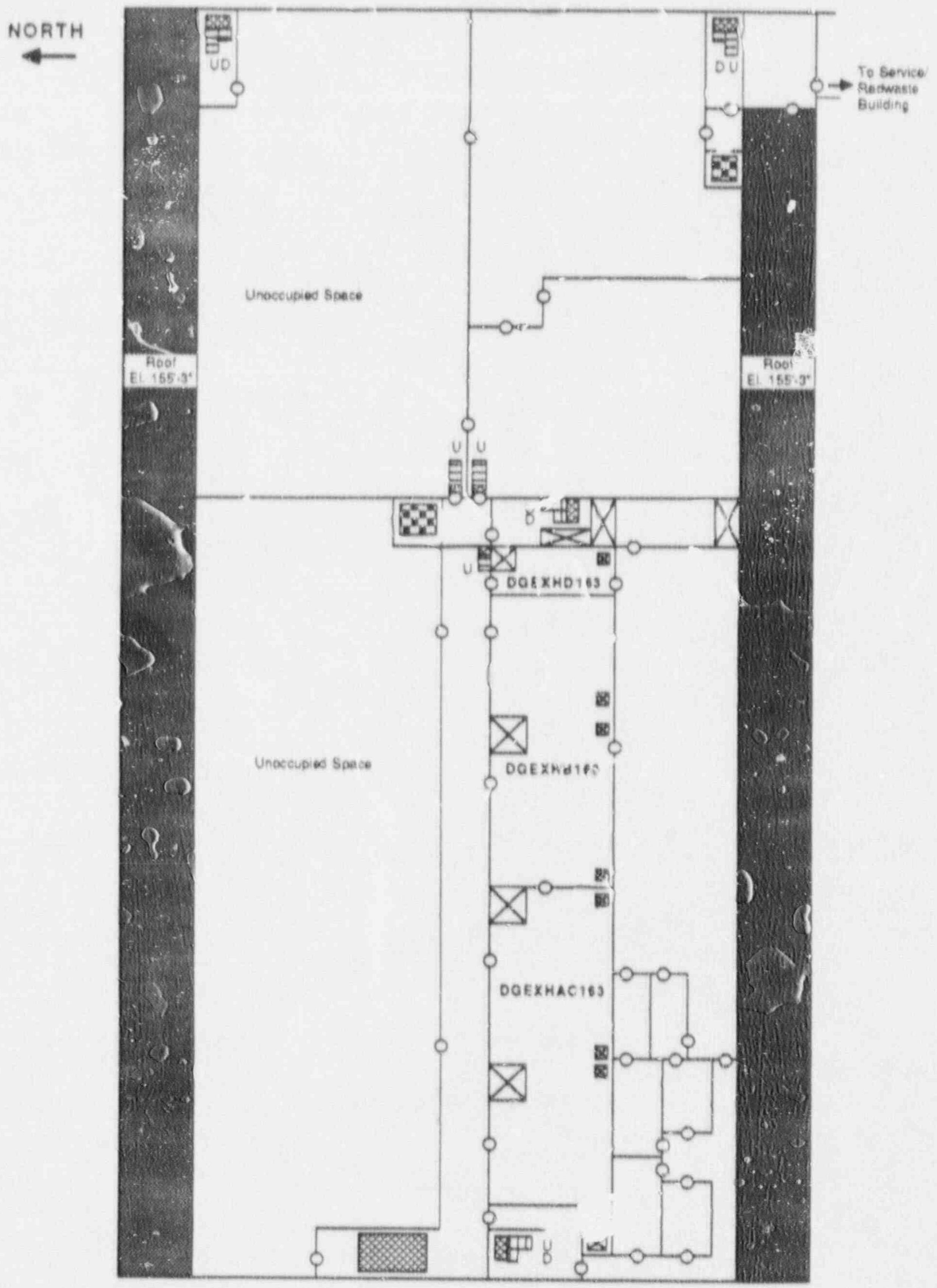


Figure 4-17. Hope Creek Control/Diesel Building Elevation 155'-3" and 163'-6"

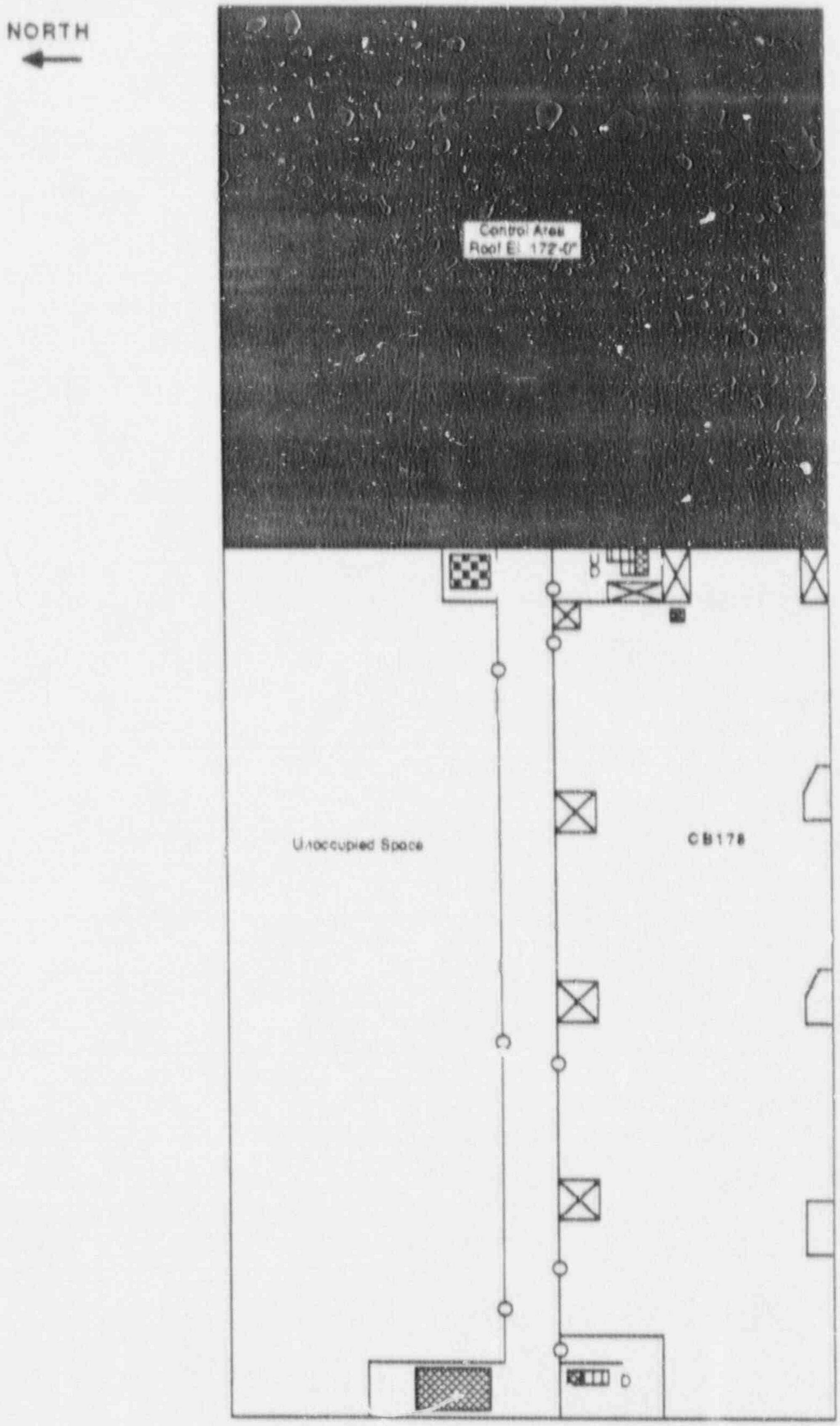


Figure 4-18. Hope Creek Control/Diesel Building Elevation 178'-0"

Table 4-1. Definition of Hope Creek Building and Location Codes

Abbreviation		Description
1.	124INV	Inverter Room, located on 124' elevation of the control area
2.	137INV	Inverter Room, located on 137' elevation of the control area
3.	145PCH	Pipe Chase, located between 132' and 162' elevations of the Reactor Building
4.	BATCHGA	Battery Charging Room A, located on 146' elevation of diesel generator area of control and diesel generator building
5.	BATCHGB	Battery Charging Room B, located on 146' elevation of diesel generator area
6.	BATCHGC	Battery Charging Room C, located on 146' elevation of diesel generator area
7.	BATCHGD	Battery Charging Room D, located on 146' elevation of diesel generator area
8.	BATRMA	Battery Room A, located on 146' elevation of diesel generator area
9.	BATRMB	Battery Room B, located on 146' elevation of diesel generator area
10.	BATRMC	Battery Room C, located on 146' elevation of diesel generator area
11.	BATRMD	Battery Room D, located on 146' elevation of diesel generator area
12.	CB155	155' elevation of the control area
13.	CB163	163' elevation of the control area
14.	CB178	178' elevation of the control area
15.	CBCOR77	Corridor located on 77' elevation of the control area
16.	CBCOR102	Corridor located on 102' elevation of the control area
17.	CBCOR124	Corridor located on 124' elevation of the control area
18.	CBCOR137	Corridor located on 137' elevation of the control area
19.	CER	Control Equipment Room, located on 102' elevation of the control area

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

Abbreviation	Description
20. CERM	Control Equipment Room Mezzanine, located on 117' elevation of the control area
21. CR	Control Room, located on 137' elevation of the control area
22. CSA	Core Spray Pump Room A, located on 54' elevation of the Reactor Building
23. CSB	Core Spray Pump Room B, located on 54' elevation of the Reactor Building
24. CSC	Core Spray Pump Room C, located on 54' elevation of the Reactor Building
25. CSD	Core Spray Pump Room C, located on 54' elevation of the Reactor Building
26. CSR	Cable Spreading Room, located on 77' elevation of the control area
27. CST	Condensate Storage Tank
28. DGA	Diesel Generator Room A, located on 102' elevation of the diesel generator area
29. DGA54	Room containing fuel tanks for DG A, located on 54' elevation of the diesel generator area
30. DGA77	Located on 77' elevation of the diesel generator area
31. DGB	Diesel Generator Room B, located on 102' elevation of the diesel generator area
32. DGB54	Room containing fuel tanks for DG B, located on 54' elevation of the diesel generator area
33. DGB77	Located on 77' elevation of the diesel generator area
34. DGC	Diesel Generator Room C, located on 102' elevation of the diesel generator area
35. DGC54	Room containing fuel tanks for DG C, located on 54' elevation of the diesel generator area

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

Abbreviation	Description
36. DGC77	Located on 77' elevation of the diesel generator area
37. DGCORN77	Diesel Generator Area North Corridor, located on 77' elevation
38. DGCORN102	Diesel Generator Area North Corridor, located on 102' elevation
39. DGCORS54	Diesel Generator Area South Corridor, located on 54' elevation
40. DGCORS77	Diesel Generator Area South Corridor, located on 77' elevation
41. DGD	Diesel Generator Room D, located on 102' elevation of the diesel generator area
42. DGD54	Room containing fuel tanks for DG D, located on 54' elevation of the diesel generator area
43. DGC77	Located on 77' elevation of the diesel generator area
44. DGEXHAC163	Room through which diesel generators A and C exhaust piping passes, located on 163' elevation of the diesel generator area
45. DGEXHB163	Room through which diesel generators B exhaust piping passes, located on 163' elevation of the diesel generator area
46. DGEXHD163	Room through which diesel generators D exhaust piping passes, located on 163' elevation of the diesel generator area
47. DGINLETE	Room containing diesel air inlet piping, located in the southeast corner of the diesel generator area at the 130' elevation
48. DGINLETW	Room containing diesel air inlet piping, located in the southwest corner of the diesel generator area at the 130' elevation
49. DGSTARSW102	Stairway at southwest corner of the 102' elevation of the diesel generator area
50. E77HALL	Eastern room located on the 77' elevation of the Reactor Building

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

Abbreviation	Description
51. HPCI	HPCI Pump Room, located on 54' elevation of the Reactor Building
52. HPCIBAT	HPCI Battery Room, located on 54' elevation of the control area
53. HPCIBUS	HPCI Bus Room, located on 54 elevation of the control area
54. HPCIMCC	HPCI MCC Room, located on 54' elevation of the Reactor Building
55. HPCISTPCH	HPCI Steam Pipe Chase, located on 102' elevation of the Reactor Building
56. INTSTA	Intake Structure Room A
57. INTSTB	Intake Structure Room B
58. INTSTR	Intake Structure area common to all SSWS pump suctions
59. MCC252	MCC B252 room, located on 77' elevation of the Reactor Building
60. NPPCH	North Pipe Chase located on 102' elevation of the Reactor Building
61. RACS	RACS Room, located on 77' elevation of the Reactor Building
62. RB54	Located on 54' elevation of the Reactor Building, precise location unknown
63. RB77NE	Northeast corner of 77' elevation of the Reactor Building
64. RB77SE	Southeast corner of 77' elevation of the Reactor Building
65. RB102	South side of 102' elevation of the Reactor Building
64. RB102C	Central area within secondary containment at 102' elevation of the Reactor Building
67. RB102NE	Northeast Room, located on 102' elevation of the Reactor Building

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

Abbreviation	Description
68. RB132	132' elevation of the Reactor Building
69. RB145	145' elevation of the Reactor Building
70. RB162	162' elevation of the Reactor Building
71. RBCOR77	Northwest Corridor, located on 77' elevation of the Reactor Building
72. RC	Reactor Containment
73. RCIC	RCIC Pump Room, located on 54' elevation of the Reactor Building
74. RCICBAT	RCIC Battery Room, located on 54' elevation of the Reactor Building
75. RCICBUS	RCIC Bus Room, located on 54' elevation of the control area
76. RHRA	RHRA Pump Room, located on 54' elevation of the Reactor Building
77. RHRB	RHRB Pump Room, located on 54' elevation of the Reactor Building
78. RHRC	RHRC Pump Room, located on 54' elevation of the Reactor Building
79. RHRD	RHRD Pump Room, located on 54' elevation of the Reactor Building
80. RPA	Area surrounding Removal Path A, located on 102' elevation of the Reactor Building
81. RSP	Remote Shutdown Panel Room, located on 137' elevation of the control area
82. RWCUA	RWCU Pump Room A, located on 132' elevation of the Reactor Building
83. RWCUB	RWCU Pump Room B, located on 132' elevation of the Reactor Building
84. RWCUHX	RWCU Heat Exchanger Room, located on 145' elevation of the Reactor Building

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

Abbreviation	Description
85. S77HALL	South Hall, located on 77' elevation of the Reactor Building
86. SACSA	SACS A Room, located on 102' elevation of the Reactor Building
87. SACSB	SACS B Room, located on 102' elevation of the Reactor Building
88. SGRMA	Switchgear Room A, located on 130' elevation of the diesel generator area
89. SGRMB	Switchgear Room B, located on 130' elevation of the diesel generator area
90. SGRMC	Switchgear Room C, located on 130' elevation of the diesel generator area
91. SGRMD	Switchgear Room D, located on 130' elevation of the diesel generator area
92. SP	Suppression Pool area
93. SPPCH	South Pipe Chase, located on 102' elevation of the Reactor Building
94. STMTNL	Steam Tunnel from the Reactor Building to the Turbine Building
95. TB54	Turbine Building, 54' elevation
96. TB77	Turbine Building, 77' elevation
97. TSFP	Spent fuel pool operating floor, located on 201' elevation of the Reactor Building

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
BATCHGA	EP	AD413	BC
BATCHGA	EP	AD414	BC
BATCHGB	EP	BD413	BC
BATCHGB	EP	BD414	BC
BATCHGC	EP	CD413	BC
BATCHGC	EP	CD414	BC
BATCHGD	EP	DD413	BC
BATCHGD	EP	DD414	BC
BATRMA	EP	BATTERY A	BAT
BATRMB	EP	BATTERY B	BAT
BATRMC	EP	BATTERY C	BAT
BATRMD	EP	BATTERY D	BAT
CSA	ECCS	CS PUMP A	MDP
CSB	ECCS	CS PUMP B	MDP
CSC	ECCS	CS PUMP C	MDP
CSD	ECCS	CS PUMP D	MDP
CST	ECCS	CST	TANK
CST	RCIC	CST	TANK
DGA	EP	DG A	DG
DGB	EP	DG B	DG
DGC	EP	DG C	DG
DGCORS54	SACS	SAC-1065	HOV
DGD	EP	DG D	DG
E77HALL	EP	MCC-B242	MCC
HPCI	ECCS	FD-3	MOV
HPCI	ECCS	HPCI-5	MOV
HPCI	ECCS	HPCI-[illegible]	MOV
HPCI	ECCS	HPCI-25	MOV
HPCI	ECCS	HPCI TURB. STOP, TURB. CONTROLS	HOV
HPCIBAT	EP	HPCI BATTERY	BAT

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
HPCIBUS	EP	D423	BC
HPCIBUS	EP	BUS D450	BUS
HPCISTPCH	ECCS	FD-2	MOV
HPCISTPCH	RCS	FD-2	MOV
INTSTA	SWS	SWS PUMP A	MDP
INTSTA	SWS	SW-473	MOV
INTSTA	SWS	SW-474	MOV
INTSTA	SWS	SWS PUMP C	MDP
INTSTB	SWS	SWS PUMP B	MDP
INTSTB	SWS	SWS PUMP D	MDP
INTSTB	SWS	SW-475	MOV
INTSTB	SWS	SW-476	MOV
MCC252	EP	MCC-B252	MCC
NPPCH	ECCS	CS-8	MOV
NPPCH	ECCS	CS-7	MOV
NPPCH	ECCS	HPCI-1	MOV
NPPCH	ECCS	RHR-110	MOV
NPPCH	ECCS	RHR-113	MOV
NPPCH	ECCS	RHR-101	MOV
NPPCH	ECCS	RHR-115	MOV
NPPCH	ECCS	RHR-116	MOV
NPPCH	ECCS	RHR-113	MOV
NPPCH	ECCS	RHR-110	MOV
NPPCH	ECCS	RHR-115	MOV
NPPCH	ECCS	RHR-116	MOV
NPPCH	ECCS	RHR-20	MOV
NPPCH	RCS	RHR-164	MOV
RB102	EP	MCC-B222	MCC
RB102NE	EP	MCC-B232	MCC
RB54	SACS	SAC-1064	HOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RC	ECCS	SRV	SRV
RC	ECCS		PP
RC	ECCS	FW-8	MOV
RC	ECCS	FD-[illegible]	MOV
RC	ECCS	RHR-21	MOV
RC	RCIC	FW-4	MOV
RC	RCIC	FC-1	MOV
RC	RCS	FD-1	MOV
RC	RCS	MS-28,29,30, 31	MSIV
RC	RCS	[illegible]	RPV
RC	RCS	FC-1	MOV
RC	RCS	RCUW-1	MOV
RC	RCS	RHR-71	MOV
RC	RCS	MS-39	MOV
RCIC	RCIC	RCIC TDP	TDP
RCIC	RCIC	RCIC-1	MOV
RCIC	RCIC	RCIC-11	MOV
RCIC	RCIC	RCIC-12	MOV
RCIC	RCIC	FC-22	MOV
RCIC	RCIC	SV-19	SOV
RCIC	RCIC	RCIC-22	MOV
RCIC	RCIC	FC-21	MOV
RCICBAT	EP	RCIC BATTERY	BAT
RCICBUS	EP	BUS D460	BUS
RCICBUS	EP	BC D433	BC
RCICSTPCH	RCIC	FC-2	MOV
RCICSTPCH	RCS	FC-2	MOV
RHRA	ECCS	RHR PUMP A	MDP
RHRA	ECCS	RHR-108	MOV
RHRA	ECCS	RHR-107	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RHRA	ECCS	RHR-538	MOV
RHRA	ECCS	RHR-104	MOV
RHRA	ECCS	RHR HXA	HX
RHRA	ECCS	RHR-538	MOV
RHRA	ECCS	SAC-23	MOV
RHRA	ECCS	RHR HX A	HX
RHRB	ECCS	RHR PUMP B	MDP
RHRB	ECCS	RHR-11	MOV
RHRB	ECCS	RHR-10	MOV
RHRB	ECCS	RHR-427	MOV
RHRB	ECCS	RHR-7	MOV
RHRB	ECCS	RHR HX B	HX
RHRB	ECCS	RHR-427	MOV
RHRB	ECCS	SAC-26	MOV
RHRB	ECCS	RHR HX B	HX
RHRC	ECCS	RHR PUMP C	MDP
RHRD	ECCS	RHR PUMP D	MDP
S77HALL	ECCS	HPCI-10	MOV
S77HALL	RCIC, ECCS	AP-4	MOV
SACSA	EP	MCC-B212	MCC
SACSA	SACS	PUMP C	MDP
SACSA	SACS	SAC-3	MOV
SACSA	SACS	SAC-4	MOV
SACSA	SACS	SW-346	MOV
SACSA	SACS	SW-349	MOV
SACSA	SACS	PUMP A	MDP
SACSA	SACS	SAC-21, SAC-532	HOV
SACSA	SWS	SW-357	MOV
SACSA	SWS	SACS HXA1,A2	HX
SACSA	SWS	SW-357	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
SACSA	SWS	SW-381	MO
SACSB	SACS	PUMP B	MDP
SACSB	SACS	PUMP D	MDP
SACSB	SACS	SAC-7	MOV
SACSB	SACS	SAC-8	MOV
SACSB	SACS	SW-352	MOV
SACSB	SACS	SW-355	MOV
SACSB	SACS	SAC-531, SAC-22	HOV
SACSB	SWS	SACS HXB1,B2	HX
SACSB	SWS	SW-358	MOV
SACSB	SWS	SW-358	MOV
SGRMA	ECCS	PNL AD417	DIST. PNL
SGRMA	EP	CB-C401	CB
SGRMA	EP	BUS A401	BUS
SGRMA	EP	BUS D410	BUS
SGRMA	EP	BUS B410	BUS
SGRMA	EP	BUS B450	BUS
SGRMA	EP	AX400	TRAN
SGRMA	EP	AX401	TRAN
SGRMA	EP	MCC-B411	MCC
SGRMA	EP	MCC-B451	MCC
SGRMB	EP	CB-C402	CB
SGRMB	EP	BUS A402	BUS
SGRMB	EP	BUS D420	BUS
SGRMB	EP	BUS B420	BUS
SGRMB	EP	BUS A460	BUS
SGRMB	EP	BX400	TRAN
SGRMB	EP	BX401	TRAN
SGRMB	EP	MCC-B421	MCC
SGRMB	EP	MCC-B461	MCC

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
SGRMB	RCIC	PNL BD417	DIST. PNL
SGRMC	EP	CB-C403	CB
SGRMC	EP	BUS A403	BUS
SGRMC	EP	BUS D430	BUS
SGRMC	EP	BUS B430	BUS
SGRMC	EP	BUS B470	BUS
SGRMC	EP	CX400	TRAN
SGRMC	EP	CX401	TRAN
SGRMC	EP	MCC-B431	MCC
SGRMC	EP	MCC-B471	MCC
SGRMD	EP	CB-C404	CB
SGRMD	EP	BUS A404	BUS
SGRMD	EP	BUS D440	BUS
SGRMD	EP	BUS B440	BUS
SGRMD	EP	BUS B480	BUS
SGRMD	EP	DX400	TRAN
SGRMD	EP	DX401	TRAN
SGRMD	EP	MCC-B441	MCC
SGRMD	EP	MCC-B481	MCC
SP	ECCS	CS-17	MOV
SP	ECCS	CS-19	MOV
SP	ECCS	CS-20	MOV
SP	ECCS	HPCI-54	MOV
SP	ECCS	RHR-103	MOV
SP	ECCS	RHR-6	MOV
SP	ECCS	RHR-98	MOV
SP	ECCS	RHR-1	MOV
SP	ECCS	HPCI-54	MOV
SP	ECCS	RHR-112	MOV
SP	ECCS	RHR-124	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
SP	ECCS	RHR-315	MOV
SP	ECCS	RHR-26	MOV
SP	ECCS	CS-18	MOV
SP	ECCS	RHR-124	MOV
SP	ECCS	RHR-112	MOV
SP	ECCS	RHR-26	MOV
SP	ECCS	RHR-315	MOV
SP	ECSS	HPCI-9	MOV
SP	RCIC	RCIC-2	MOV
SPPCH	ECCS	CS-4	MOV
SPPCH	ECCS	CS-3	MOV
SPPCH	ECCS	RHR-1[illegible]	MOV
SPPCH	ECCS	RHR-16	MOV
SPPCH	ECCS	RHR-[illegible]	MOV
SPPCH	ECCS	RHR-18	MOV
SPPCH	ECCS	RHR-19	MOV
SPPCH	ECCS	RHR-13	MOV
SPPCH	ECCS	RHR-16	MOV
SPPCH	ECCS	RHR-18	MOV
SPPCH	ECCS	RHR-19	MOV
SPPCH	RCS	RCUW-2	MOV
STMTNL	RCIC	RCIC-5	MOV
STMTNL	RCS	MS-32,33,34,35	MSIV
STMTNL	RCS	MS-40	MOV

5. BIBLIOGRAPHY FOR HOPE CREEK

1. NUREG-0671, "Assessment of the Impacts of the Salem and Hope Creek Stations on Shortnose Sturgeon", USNRC, April 1980.

2. NUREG-1048, "Safety Evaluation Report Related to the Operation of Hope Creek Generating Station", USNRC.

3. NUREG-1074, "Environmental Statement Related to the Operation of Hope Creek Generating Station", USNRC.

4. NUREG-1202, "Technical Specifications for Hope Creek Generating Station", USNRC.

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

A1. SYSTEM DRAWINGS

A1.1 Fluid System Drawings

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

- Flow generally is left to right.
  - Water sources are located on the left and water "users" (i.e., heat loads) or discharge paths are located on the right.
  - One exception is the return flow path in closed loop systems which is right to left.
  - Another exception is the Reactor Coolant System (RCS) drawing which is "vessel-centered", with the primary loops on both sides of the vessel.
  - Horizontal lines always dominate and break vertical lines.

- Component symbols used in the fluid system drawings are defined in Figure A-1.
  - Most valve and pump symbols are designed to allow the reader to distinguish among similar components based on their support system requirements (i.e., electric power for a motor or solenoid, steam to drive a turbine, pneumatic or hydraulic source for valve operation, etc.)
  - Valve symbols allow the reader to distinguish among valves that allow flow in either direction, check (non-return) valves, and valves that perform an overpressure protection function. No attempt has been made to define the specific type of valve (i.e., as a globe, gate, butterfly, or other specific type of valve).
  - Pump symbols distinguish between centrifugal and positive displacement pumps and between types of pump drives (i.e., motor, turbine, or engine).

- Locations are identified in terms of plant location codes defined in Section 4 of this Sourcebook.
  - Location is indicated by shaded "zones" that are not intended to represent the actual room geometry.
  - Locations of discrete components represent the actual physical location of the component.
  - Piping locations between discrete components represent the plant areas through which the piping passes (i.e. including pipe tunnels and underground pipe runs).
  - Component locations that are not known are indicated by placing the components in an unshaded (white) zone.
  - The primary flow path in the system is highlighted (i.e., bold white line) in the location version of the fluid system drawings.

A1.2 Electrical System Drawings

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

- Flow generally is top to bottom
  - In the AC power drawings, the interface with the switchyard and/or offsite grid is shown at the top of the drawing.
  - In the DC power drawings, the batteries and the interface with the AC power system are shown at the top of the drawing.
  - Vertical lines dominate and break horizontal lines.

- Component symbols used in the electrical system drawings are defined in Figure A-2.

- Locations are identified in terms of plant location codes defined in Section 4 of this Sourcebook.
  - Locations are indicated by shaded "zones" that are not intended to represent the actual room geometry.
  - Locations of discrete components represent the actual physical location of the component.
  - The electrical connections (i.e., cable runs) between discrete components, as shown on the electrical system drawings, DO NOT represent the actual cable routing in the plant.
  - Component locations that are not known are indicated by placing the discrete components in an unshaded (white) zone.

A2. SITE AND LAYOUT DRAWINGS

A2.1 Site Drawings

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

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

A2.2 Layout Drawings

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

Symbols used in the simplified layout drawings are defined in Figure A-3. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings however, many interior walls have been omitted for clarity. The building layout drawings, are approximately to scale, should not be used to estimate room size or distances. As-built scale drawings for should be consulted his purpose.

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

A3. APPENDIX A REFERENCES

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

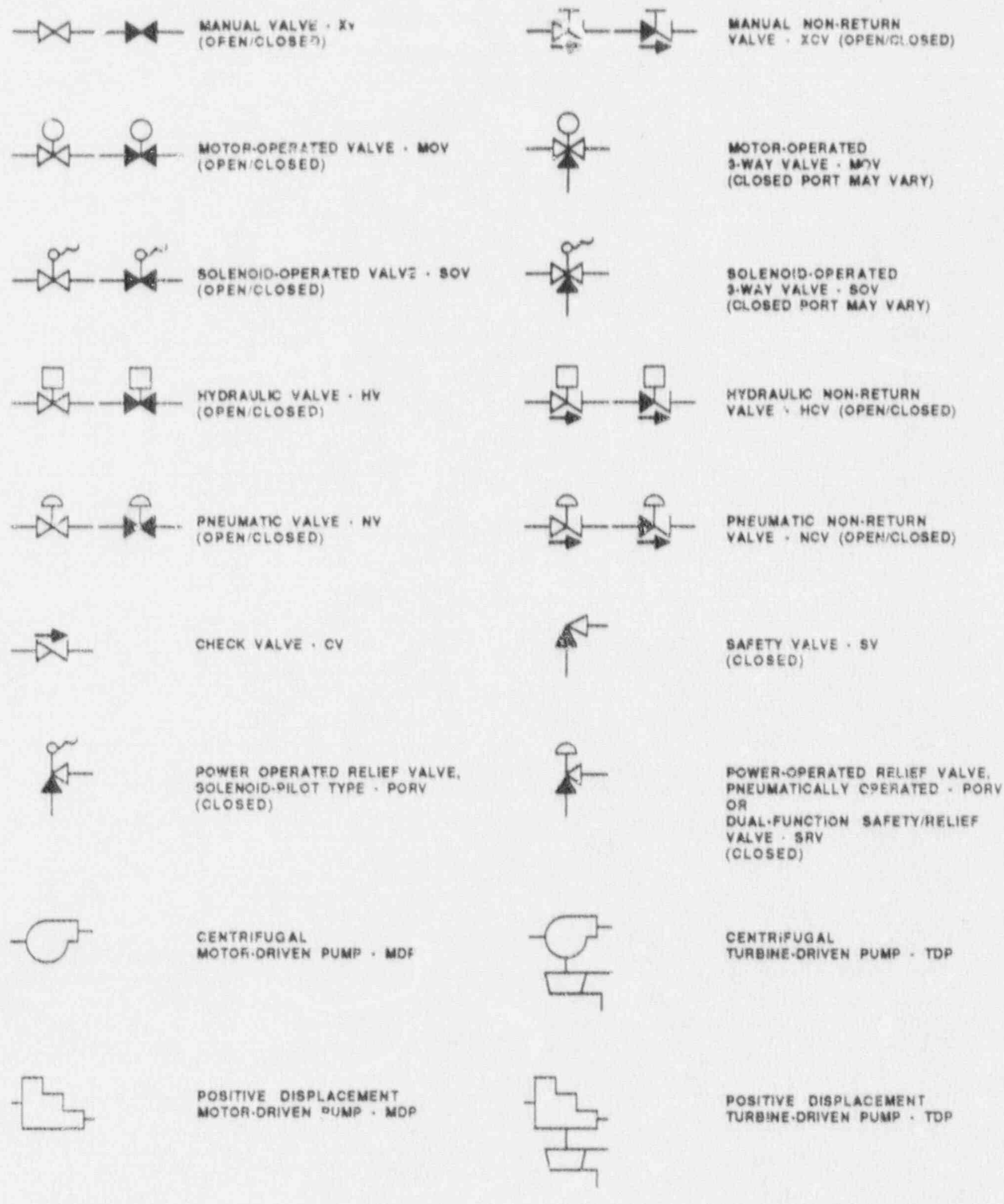


Figure A-1. Key To Symbols In Fluid System Drawings

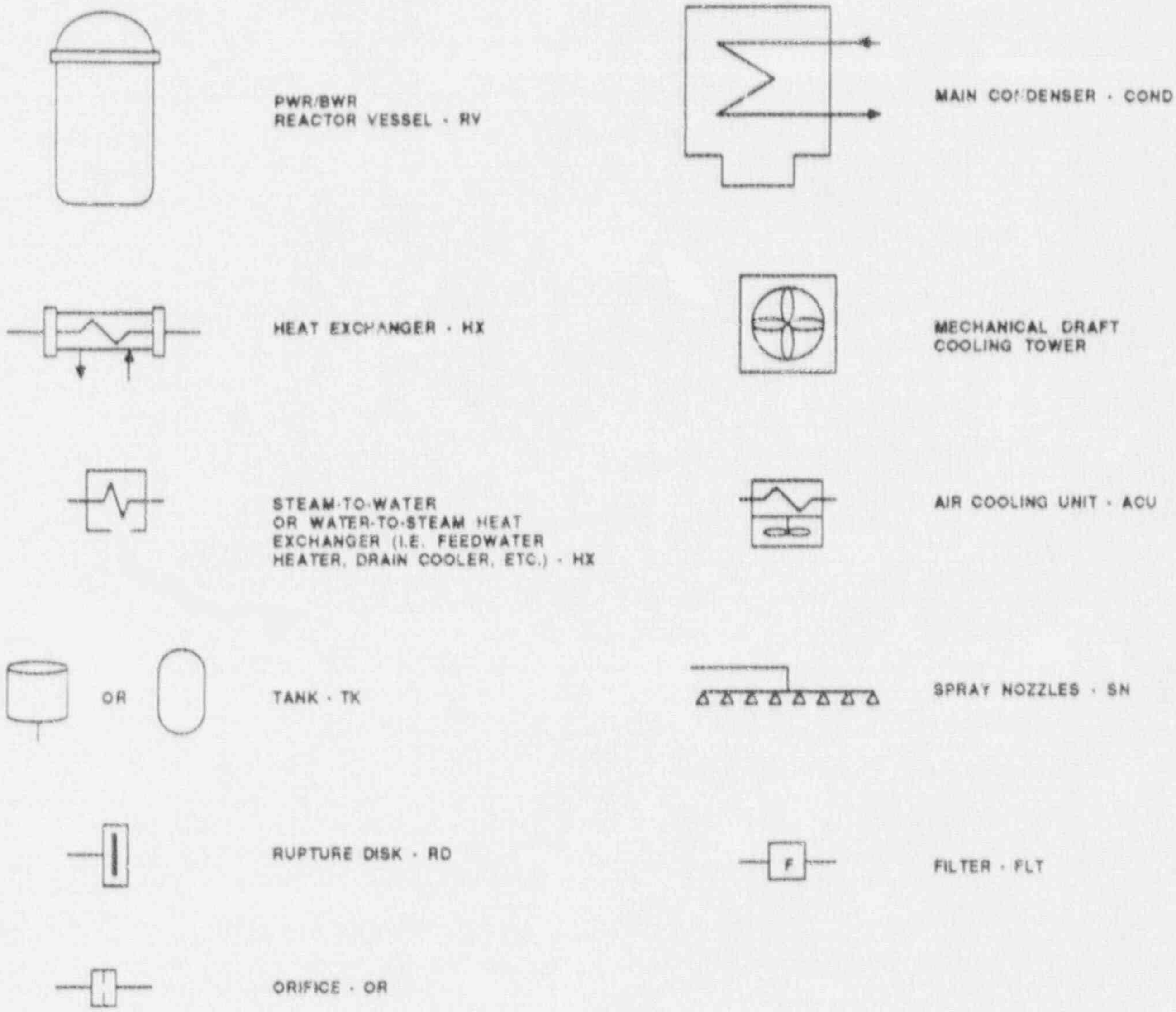


Figure A-1. Key To Symbols in Fluid System Drawings (Continued)

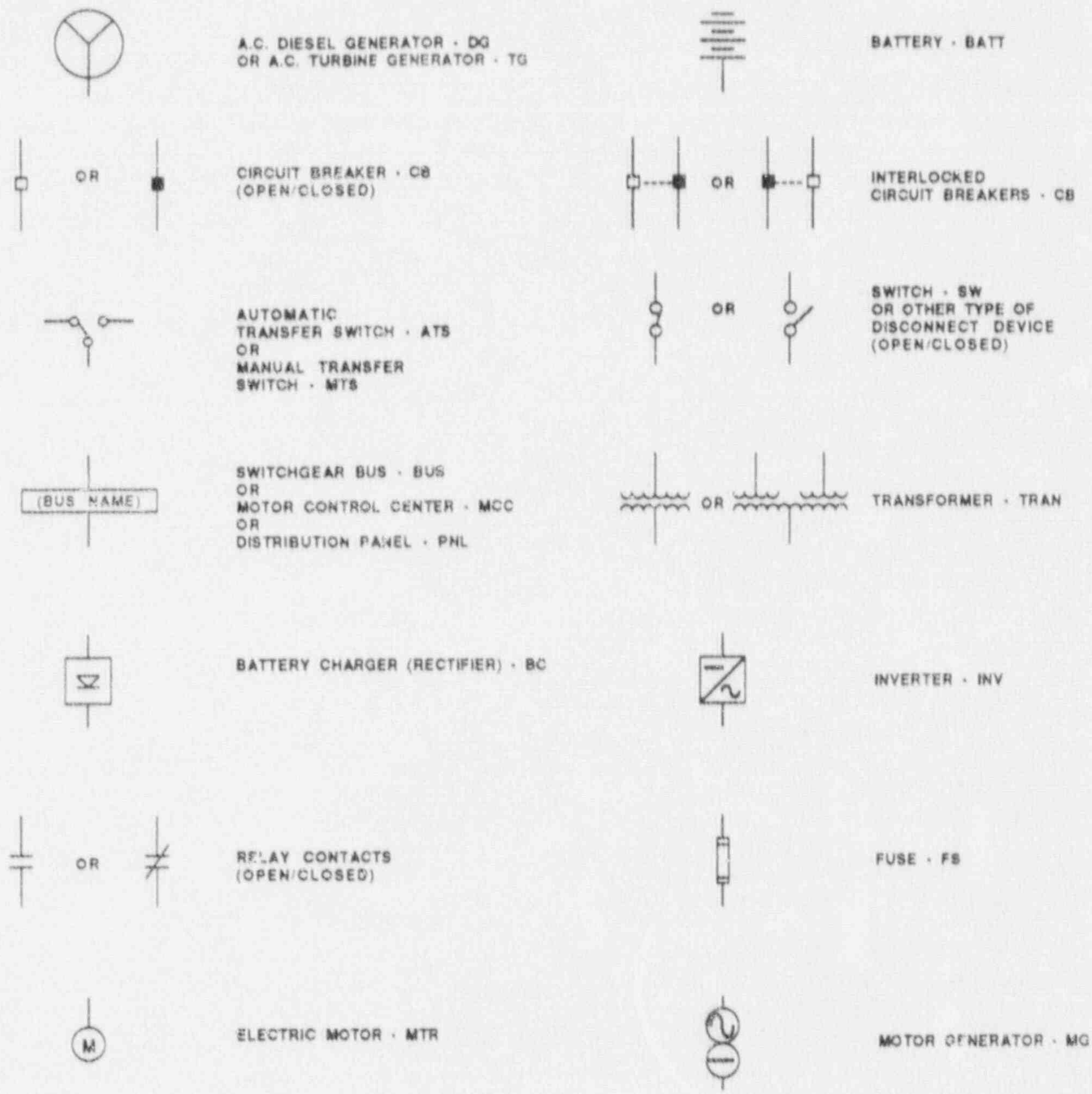


Figure A-2. Key To Symbols In Electrical System Drawings

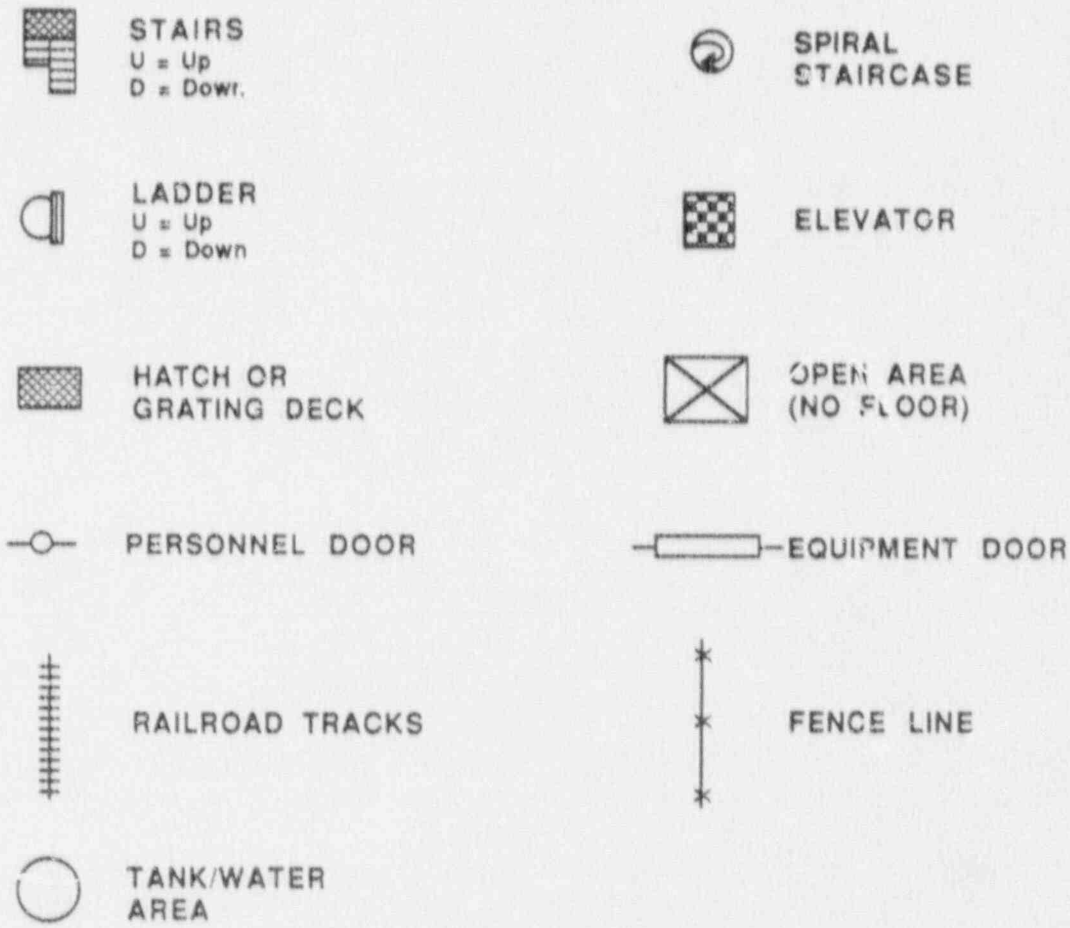


Figure A-3. Key To Symbols In Facility Layout Drawings

APPENDIX B
DEFINITION OF TERMS USED IN THE DATA TABLES

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

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

Code	Definition
RCS	Reactor Coolant System
RCIC	Reactor Core Isolation Cooling System
ECCS	Emergency Core Cooling Systems (including HPCI, LPCI, LPCS and ADS)
I&C	Instrumentation and Control Systems
EP	Electric Power System
SACS	Safety Auxiliaries Cooling System
SWS	Station 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