UNITED STATES NUCLEAR REGULATORY COMMISSION

NUCLEAR POWER PLANT SYSTEM SOURCEBOOK

WASHINGTON NUCLEAR PROJECT NO. 2 (WNP-2)

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NUCLEAR POWER PLANT
SYSTEM SOURCEBOOK

WASHINGTON NUCLEAR PROJECT NO. 2 (WNP-2)

50-397

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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.

WNP-2
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	1/89	Original report

WNP-2 SYSTEM SOURCEBOOK

This sourcebook contains summary information on WNP-2. 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 WNP-2 nuclear power plant is listed below:

- Docket number	50-397
- Operator	Washington Public Power Supply System
- Location	Washington State, 12 miles north of Richland
- Commercial operation date	December 1984
- Reactor type	BWR/5
- NSSS vendor	General Electric
- Power (MWt/MWe)	3323/1145
- Architect-engineer	Burns and Roe
- Containment type	Steel and reinforced concrete cylinder (Mark II)

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The WNP-2 plant contains a General Electric BWR/5 nuclear steam supply system with a Mark II containment incorporating the drywell/pressure suppression concept. The plant also has a secondary containment structure of reinforced concrete. Other BWR/5 plants in the United States are as follows:

- Nine Mile Point 2
- La Salle

WNP-2 uses a high pressure core spray system, a reactor core isolation cooling system, a low pressure core spray system, and a multi-mode RHR system. The reactor core isolation cooling and RHR systems include the capability for steam condensing.

WNP-2 differs from other earlier BWR vintages in that it has a single 100% capacity LPCS pump. BWR/4 and earlier plants typically have two 100% capacity LPCS trains.

3. SYSTEM INFORMATION

This section contains descriptions of selected systems at WNP-2 in terms of general function, operation, system success criteria, major components, and support system requirements. A summary of major systems at WNP-2 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 WNP-2 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	-	-
- High-Pressure Injection & Recirculation	High-Pressure Core Spray (HPCS) System	3.3	5.4.15, 6.3.1.2.1, 6.3.2.2.1
- Low-pressure Injection & Recirculation	Low-Pressure Core Spray (LPCS) System,	3.3	5.4.16, 6.3.1.2.2, 6.3.2.2.3
	Low-Pressure Coolant Injection (LPCI) Mode (an operating mode of the RHR system)	3.3	5.4.7.1.1.2, 6.3.1.2.3, 6.3.2.2.4
- Automatic Depressurization System (ADS)	Same	3.3	6.3.1.2.4, 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	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	5.6.2.5.3, 5.4.7.1.1.5

Table 3-1. Summary of WNP-2 Systems Covered in this Report (Continued)

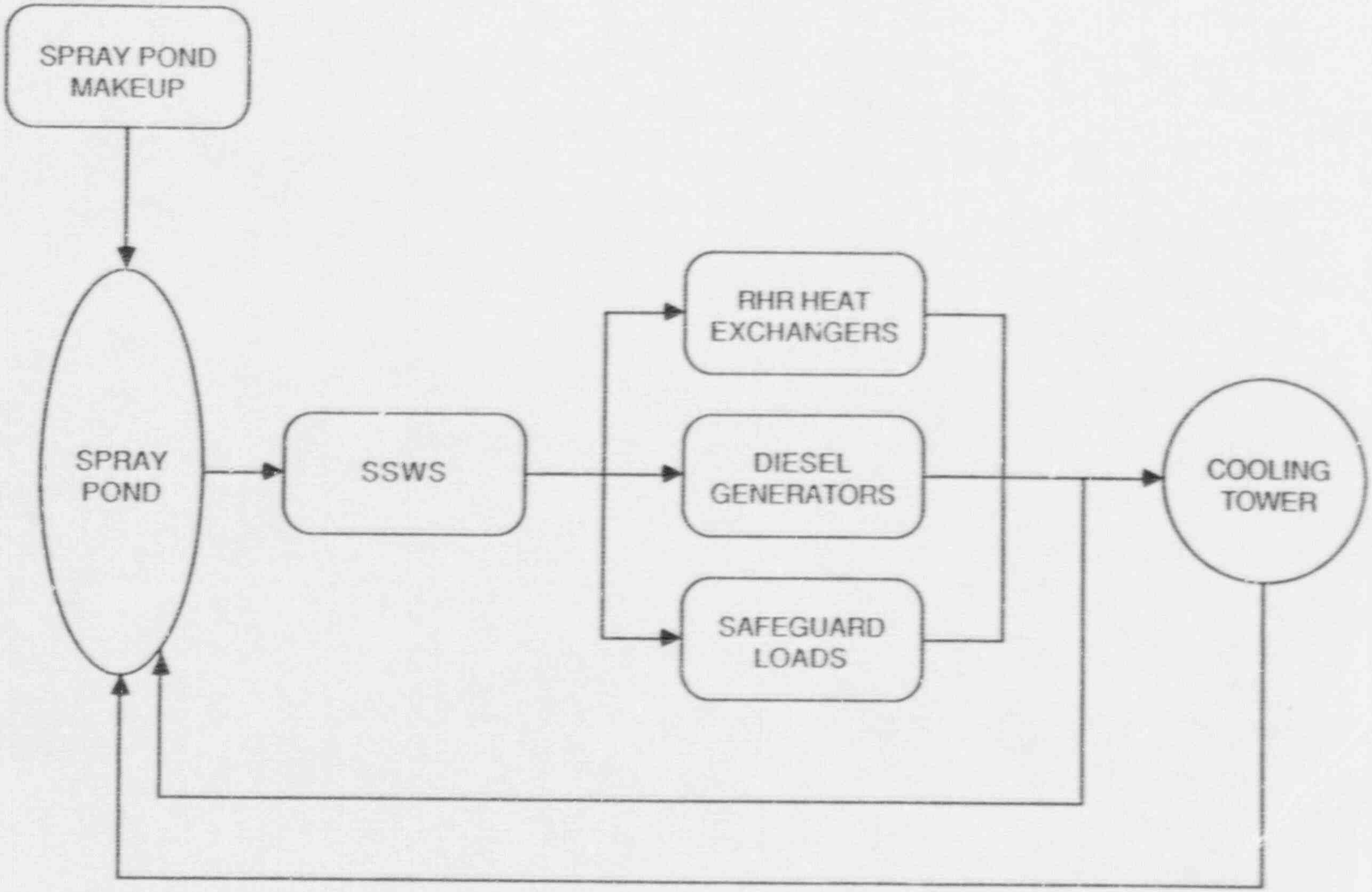
Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Coolant Inventory Control Systems			
- Reactor Water Cleanup (RWCU) System	Same	X	5.4.8
- ECCS	See above	-	-
- Control Rod Drive Hydraulic System (CRDHS)	Same	3.6	4.6.1.1.2.4
Containment Systems			
- Primary Containment	Containment	X	6.2.1
- Secondary Containment	Same	X	6.2.3
- Standby Gas Treatment System (SGTS)	Same	X	6.5.1
- Containment Heat Removal Systems			
- Suppression Pool Cooling System	Same (an operating mode of the RHR system)	3.3	5.4.7.1.1.3, 6.2.2
- Containment Spray System	Same (an operating mode of the RHR system)	3.3	5.4.7.1.1.4, 6.2.2
- Containment Fan Cooler System	Primary Containment Cooling System	X	9.4.11
- Containment Normal Ventilation Systems	Primary Containment Cooling System,	X	9.4.11
	Reactor Building Ventilation System	X	9.4.2
- Combustible Gas Control Systems	Atmosphere Mixing System,	X	6.2.5.2.1
	Hydrogen Recombiner System,	X	6.2.5.2.3
	Hydrogen Concentration Monitoring System,	X	6.2.5.2.2
	Containment Purge	X	6.2.5.2.4

Table 3-1. Summary of WNP-2 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
- Control Rod System	Control Rod Drive System	X	4.6
- Chemical Poison System	Standby Liquid Control System (SLCS)	X	5.4.17, 9.3.5
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Reactor Trip System	3.4	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safety Feature Systems	X	7.3
- Remote Shutdown System	Same	3.4	7.4.1.4
- Other I&C Systems	Various other systems	X	7.4 to 7.7
Support Systems			
- Class 1E Electric Power System	Same	3.5	8.3
- Non-Class 1E Electric Power System	Same	3.5	8
- Diesel Generator Auxiliary Systems	Same	3.5	8.3.1.1.8.1.3 to 8.3.1.1.8.1.7, 9.4.7, 9.4.8, 9.5.4 to 9.5.8
- Component Cooling Water (CCW) System	Reactor Building Closed Cooling Water (RBCCW) System	X	9.2.2
- Service Water System (SWS)	Plant Service Water System, Standby Service Water System	X 3.7	9.2.1 9.2.7

Table 3-1. Summary of WNP-2 Systems Covered in this Report (Continued)

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Support Systems (continued)			
- Residual Heat Removal Service Water (RHRSW) System	None	-	-
- Other Cooling Water Systems	None noted	-	-
- Fire Protection Systems	Same	X	9.5.1
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Same	X	9.4
- Emergency Ventilation Systems	Reactor Buiding Emergency Cooling and Critical Electrical Equipment Area Cooling Systems	X	9.4.9
- Instrument and Service Air Systems	Compressed Air Systems	X	9.3.1
- Refueling and Fuel Storage Systems	Fuel Storage and Handling Systems	X	9.1
- Radioactive Waste Systems	Radioactive Waste Management Systems	X	11
- Radiation Protection Systems	Same	X	12



SSWS = Standby Service Water System

Figure 3-1. Cooling Water Systems Functional Diagram for WNP-2

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

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

3.1.2 System Definition

The RCS includes: (a) the reactor vessel, (b) two recirculation loops, (c) recirculation pumps, (d) 18 safety/relief valves, and (e) connected piping out to a suitable isolation valve boundary. Simplified diagrams of the RCS and important system interfaces are shown in Figures 3.1-1 and 3.1-2. A summary of data on selected RCS components is presented in Table 3.1-1.

3.1.3 System Operation

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

Some 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 four main steam lines. There are two main steam isolation valves (MSIVs) in each main steam line. Condensate from the turbine is returned to the RCS as feedwater.

Following a transient that involves the loss of the main condenser or loss of feedwater, heat from the RCS is dumped to the suppression chamber via PORVs on the main steam lines. A LOCA inside containment or operation of the Automatic Depressurization System (ADS) also dumps heat to the suppression chamber.

The main steam line isolation valves automatically isolate the reactor coolant pressure boundary in the event a pipe break occurs downstream from the isolation valves. Main steam line flow restrictions limit the loss of coolant resulting from a main steam line break outside the primary containment.

The pressure relief system protects the reactor coolant pressure boundary from damage due to overpressure. Following a transient that involves a loss of heat sink, heat from the RCS is dumped to the suppression pool via safety/relief valves in the main steam lines. A LOCA inside containment or operation of the Automatic Depressurization system (ADS) also dumps heat to the suppression chamber. Post-accident 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 to the ultimate heat sink by the Residual Heat Removal (RHR) system operating in the suppression pool cooling mode. Actuation systems provide for automatic closure of the MSIVs and isolation of other lines connected to the RCS.

3.1.4 System Success Criteria

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

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

3.1.5 Component Information

A. RCS
  1. Total volume: 21,670 ft^3
  2. Water volume: 14,510 ft^3 (including recirculation loops).
  3. Steam volume: 7,160 ft^3
  4. Steam flow: 14.98 x 10^6 lb/hr.
  5. Normal operating pressure: 1056 psig @ core inlet, 1031 psig @ core outlet

B. Safety/Relief Valves (18)
  1. Set pressure: 1177 to 1217 psig
  2. Relief capacity: 863,900 to 906,200 lb/hr (each)

C. Recirculation Pumps (2)
  1. Rated flow: 47,200 gpm @ 805 ft. head (349 psid)
  2. Type: Centrifugal

D. Jet Pumps (20)
  1. Total flow: 108.5 x 10^6 lb/hr @ 88.2 ft. head (38 psid)

3.1.6 Support Systems and Interfaces

A. Motive Power

The recirculation pumps are supplied with non-Class 1E power from an AC motor generator set.

B. MSIV Operating Power

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

C. Recirculation Pump Cooling

The reactor plant component cooling water system provides cooling water to the recirculation pump coolers.

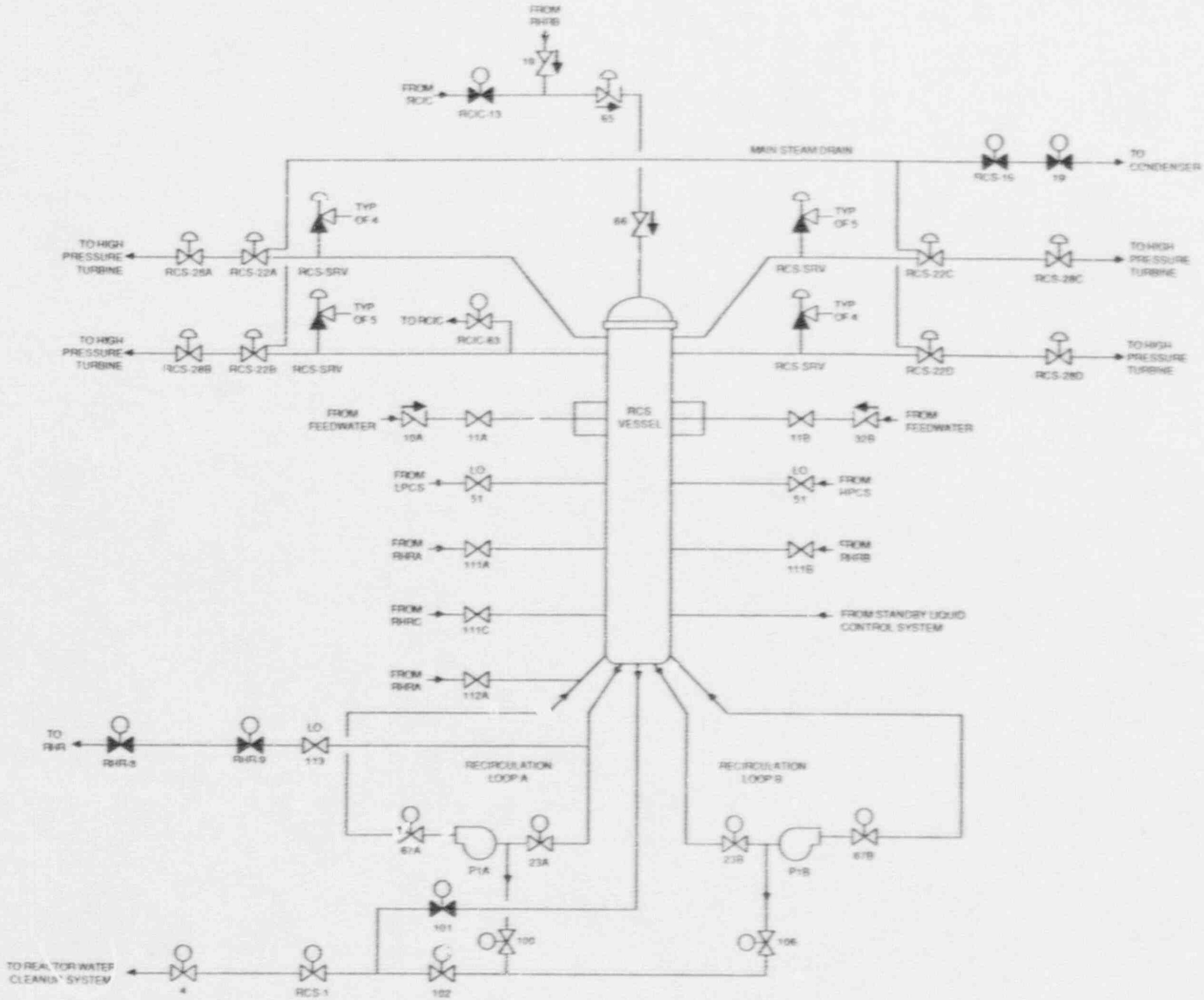


Figure 3.1-1. WNP-2 Reactor Coolant System

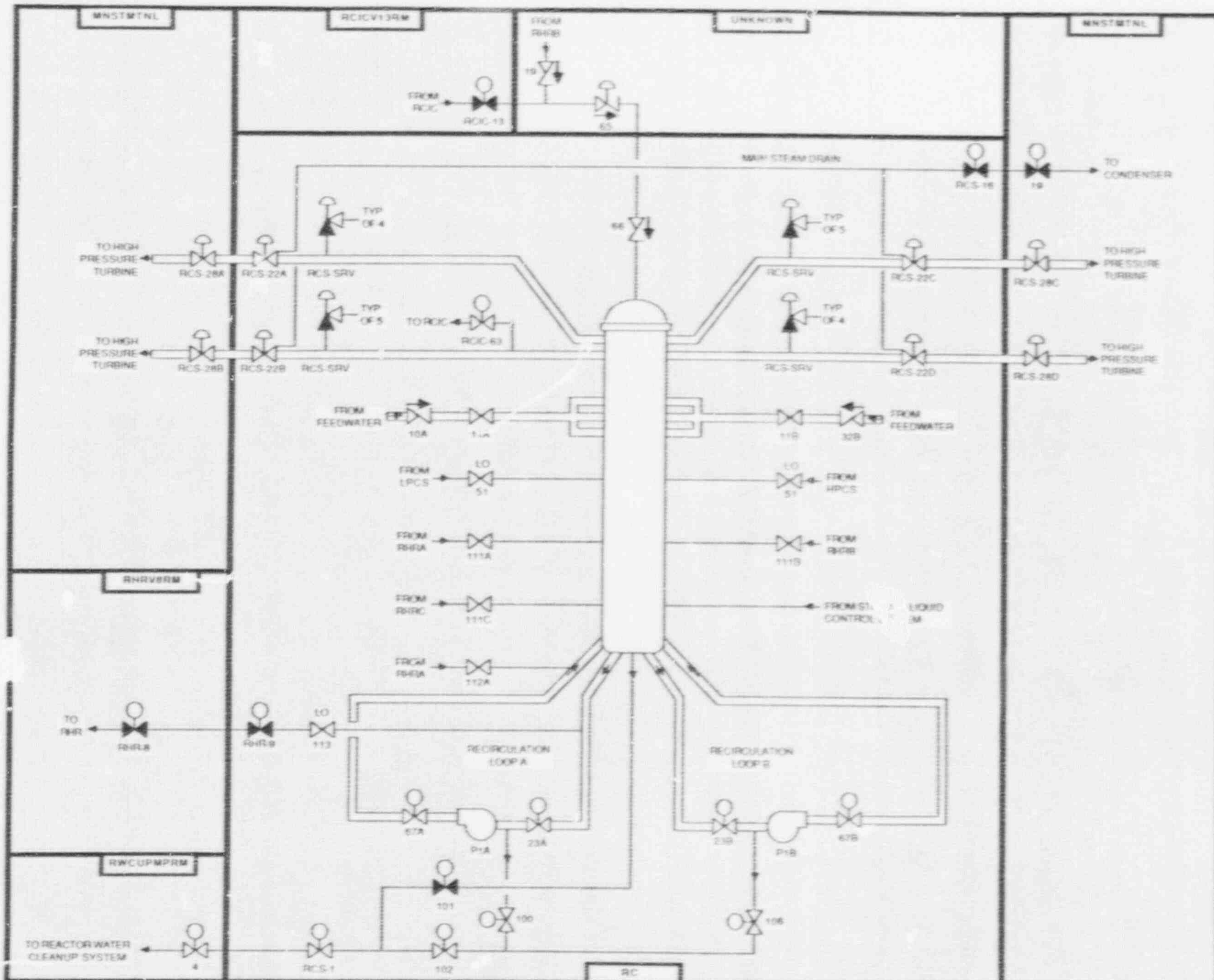


Figure 3.1-2. WNP-2 Reactor Coolant System Showing Component Locations

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Table 3.1-1. WNP-2 Reactor Coolant System Data Summary for Selected Components

SYSTEM	COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RCS	RCIC-63	MOV	RC	MCC8B-A	480	MCC8BRM	AC/B
RCS	RCIC-64	MOV	548RB	MCCS2-1A	480	MCCS2-1RM	DC/C
RCS	RCIC-8	MOV	RCICV8RM	MCCS1-1D	480	RPSRM1	DC/A
RCS	RCS-1	MOV	RC	MCC8B-A	480	MCC8BRM	AC/B
RCS	RCS-16	MOV	RC	MCC8B-A	480	MCC8BRM	AC/B
RCS	RCS-SRV	SRV	RC				
RCS	RHR-8	MOV	RHRV8RM	MCCS2-1A	480	MCCS2-1RM	DC/C
RCS	RHR-9	MOV	RC	MCC8B-A	480	MCC8BRM	AC/B

3.2 REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.2.1 System Function

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

3.2.2 System Definition

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

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

3.2.3 System Operation

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

Upon receipt of a reactor pressure vessel (RPV) low water level signal, the turbine-pump steam supply valves are opened and makeup water is supplied to the RPV. The primary water supply for the RCIC is the condensate storage water tank (CST). The suppression pool is used as a backup water supply with automatic switchover effected upon a low level 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 RCIC can also operate in conjunction with the RHR system in the steam condensing mode, in which condensed steam is delivered from the RHR heat exchanger outlets of the RHR "A" or "B" loops to the RCIC pump suction, for return to the RCS. In this mode of operation, reactor core heat is transferred to the RHR system rather than to the suppression pool. The RCIC turbine still exhausts to the suppression pool.

The HPCS system (as discussed in Section 3.3) serves as a backup to the RCIC system in the event the reactor becomes isolated from the main condenser during isolation and feedwater flow is lost.

3.2.4 System Success Criteria

For the RCIC system to be successful in the high pressure injection mode of operation, 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: 625 gpm @ 2890 ft. head (1253 psid)
   2. Rated Capacity: 100%
   3. Type: centrifugal

B. Condensate Storage Tank
   1. Capacity: 400,000 gal (135,000 gal reserved for RCIC and HPCS)

3.2.6 Support System and Interfaces

A. Control Signals
   1. Automatic
      a. The RCIC pump is automatically actuated on a reactor vessel low water level signal.
      b. Steam supply to the RCIC turbine is automatically isolated upon low reactor pressure, high pressure drop along steam supply line, high area temperature, or high pressure between turbine exhaust rupture diaphragms. It may then be necessary to restart the pump manually.
   2. Remote Manual
      The RCIC pump can be actuated by remote manual means from the Main Control Room. The RCIC system can also be operated from the Remote Shutdown Panel.

B. Motive Power
   1. The RCIC turbine driven pump is supplied with steam from main steam loop B, 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. The RCIC system is capable of operating on DC power alone for an unspecified period of time.

C. Other
   1. Lubrication and cooling for the turbine-driven pump are supplied locally.
   2. A room ventilation system cooled by the standby service water system (see Section 3.7) provides RCIC room cooling.

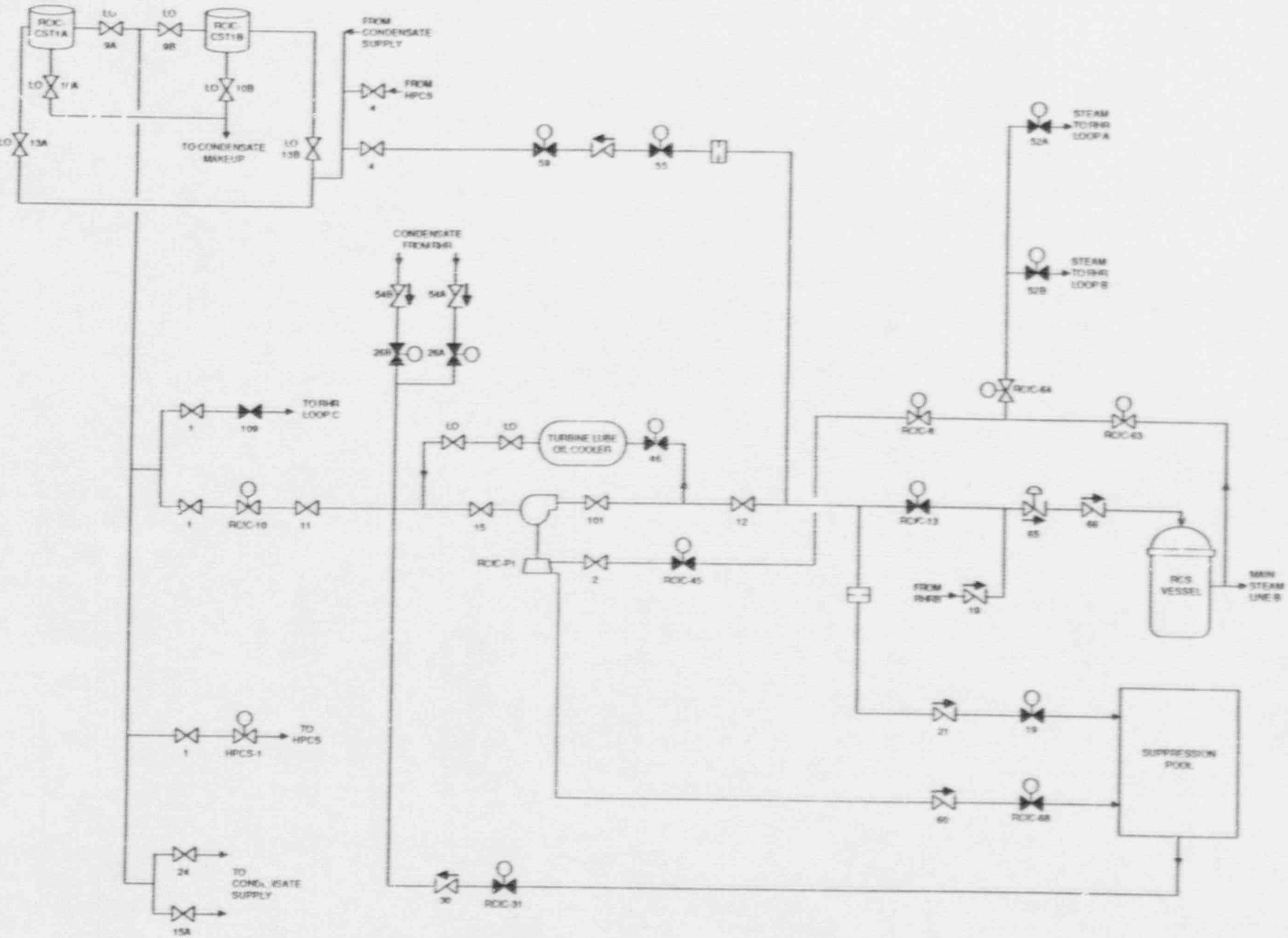

Figure 3.2-1. WNP-2 Reactor Core ... ion Cooling System

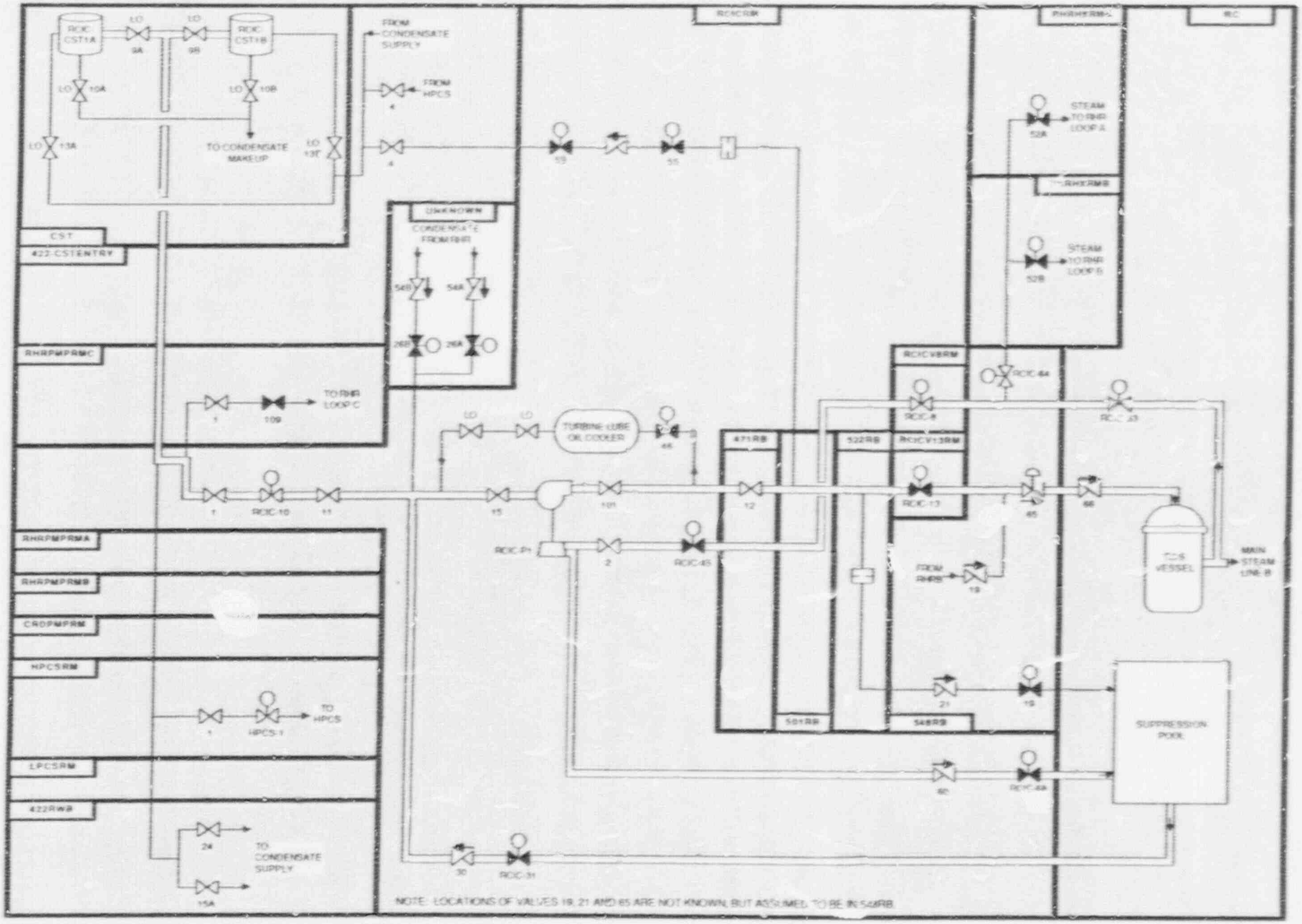

Figure 3.2-2. WNP-2 Reactor Core Isolation Cooling System Showing Component Locations

Table 3.2-1. WNP-2 Reactor Core Isolation Cooling System Data Summary for Selected Components

SYSTEM	COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RCIC	RCIC-10	MOV	RCICRM	MCCS1-1D	125	RPSRM1	DC/A
RCIC	RCIC-13	MOV	RCICV13RM	MCCS2-1A	250	MCCS2-1RM	DC/C
RCIC	RCIC-31	MOV	RCICRM	MCCS1-1D	125	RPSRM1	DC/A
RCIC	RCIC-45	MOV	RCICRM	MCCS2-1A	250	MCCS2-1RM	DC/C
RCIC	RCIC-63	MOV	RC	MCC8B-A	125	MCC8BRM	AC/B
RCIC	RCIC-68	MOV	RCICRM	MCCS1-1D	125	RPSRM1	DC/A
RCIC	RCIC-8	MOV	RCICV8RM	MCCS1-1D	125	RPSRM1	DC/A
RCIC	RCIC-CST	TANK	CST				
RCIC	RCIC-CST	TANK	CST				
RCIC	RCIC-P1	TDP	RCICRM				

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 Core Spray (HPCS) System
- Automatic Depressurization System (ADS)
- Low Pressure Core Spray System (LPCS)
- Low Pressure Coolant Injection (LPCI) System

The HPCS 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 HPCS system consists of a motor-driven pump, system piping, valves and controls. A dedicated diesel generator supplies electric power to HPCS components.

The Automatic Depressurization System (ADS) provides automatic RPV depressurization for small breaks so that the low pressure systems (LPCI and LPCS) can provide makeup to the RCS. The ADS utilizes 7 of the 18 safety/relief valves that discharge the high pressure steam to the suppression pool.

The LPCS system supplies make-up water to the reactor vessel at low pressure. The system consists of a motor-driven pump to supply water from the suppression pool to a spray sparger in the reactor vessel above the core.

The low pressure coolant injection system is an operating mode of the RHR system, and provides make-up water to the reactor vessel at low pressure. The LPCI system consists of three loops, designated RHRA, RHRB, and RHRC. Each loop consists of a motor-driven pump which supplies water from the suppression pool into the reactor vessel. The RHR system can be manually realigned as needed to perform suppression pool cooling or containment spray as part of the basic emergency core cooling function. Also, containment flooding can be accomplished with Standby Service Water injected through RHR Loop B.

Simplified drawings of the HPCS system are shown in Figures 3.3-1 and 3.3-2. The LPCS system is shown in Figures 3.3-3 and 3.3-4. The RHR system loops are shown in Figures 3.3-5 through 3.3-10. Interfaces between these systems and the RCS are shown in Section 3.1. A summary of data on selected ECCS components is presented in Table 3.3-1.

3.3.3 System Operation

All ECCS systems normally are in standby. The manner in which the ECCS operates to protect the reactor core is a function of the rate at which coolant is being lost from the RCS. The HPCS system is normally aligned to take a suction on the Condensate Storage Tank (CST). The HPCS system is automatically started in response to decreasing RPV water level, and will serve as the primary source of makeup if RCS pressure remains high. Reactor core heat is dumped to the suppression pool via the safety/relief valves which cycle as needed to limit RCS pressure. A dedicated diesel generator supplies electric power to HPCS components.

If the break is of such a size that the coolant loss exceeds the HPCS system capacity, then the LPCS and LPCI systems can provide higher capacity makeup to the reactor vessel. The ADS will automatically reduce RCS pressure if a break has occurred and RPV water level is not maintained by the HPCS system. Rapid depressurization permits flow from the LPCS or LPCI systems to enter the vessel. Water can be taken from the suppression pool by each of these system for injection into the core. The three LPCI pumps deliver water through three separate reactor vessel penetrations.

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 WNP-2 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:

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

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

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

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

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

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

For the suppression pool cooling function to be successful, either RHR train A or B must be aligned for containment heat removal and the associated standby 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. Motor-driven HPCS pump P1
   1. Rated flow: 1650 gpm @ 1110 psid, 6250 gpm @ 200 psid (vessel to pump suction)
   2. Rated capacity: 100%
   3. Type: centrifugal

B. Motor-driven LPCS pump P1
   1. Rated flow: 6250 gpm @ 122 psid (vessel to drywell)
   2. Rated capacity: 100%
   3. Type: centrifugal

C. Motor-driven LPCI pumps P1A, P1B, P1C
   1. Rated flow: 7,029 gpm each @ 20 psid (vessel to drywell)
   2. Type: centrifugal

D. RHR Heat Exchangers 1A and 1B
   1. Heat transfer capacity: unknown
   2. Rated capacity: 100%
   3. Type: shell and tube

E. Automatic-depressurization valves (7)
   1. Rated flow: 5.6 x 10^6 lb/hr @ 1125 psig (each)

F. Pressure Suppression Chamber
   1. Design temperature: 275°F
   2. Maximum operating temperature: 90°F
   3. Minimum water volume: 112,197 ft^3

3.3.6 Support Systems and Interfaces

A. Control signals
   1. Automatic
      a. The HPCS pump, LPCS pump, and the LPCI pumps are started, and all their associated valves are aligned, upon receipt of low water level in the reactor vessel or high pressure in the drywell.
      b. The HPCS pump is automatically tripped on a reactor vessel high water level signal. It may then be necessary to restart the pump manually.
      c. The ADS system is actuated upon coincident signals of the reactor vessel low water level, drywell high pressure, and discharge pressure indication on any LPCI or LPCS pump, but with a 2-minute delay. The control switches (one for each trip system solenoid) are located in the control room for each safety/relief valve associated with ADS. Each switch controls one of the two solenoid pilot valves.
      d. HPCS pump suction is automatically switched to the suppression pool on high suppression pool or low CST water level.
      e. LPCI initiation automatically causes all RHR components to perform their function under the LPCI mode.
   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 ECCS motor-driven pumps and motor-operated valves are Class 1E AC loads that can be supplied from the emergency diesel generator, as described in Section 3.5.
2. Load group assignments of ECCS subsystems are as follows:
   - RHR Loop A and the LPCS are supplied from AC Division 1.
   - RHR Loops B and C are supplied from AC Division 2.
   - HPCS is supplied from AC Division 3.
   - ADS valves are powered by Trains A and B of the 125 VDC systems.

C. Other

1. Lubrication for the ECCS pumps is assumed to be supplied locally.
2. RHR Loop A and LPCS pumps are cooled by SSW Loop A. RHR Loops B and C are cooled by SSW Loop B (see Section 3.7).

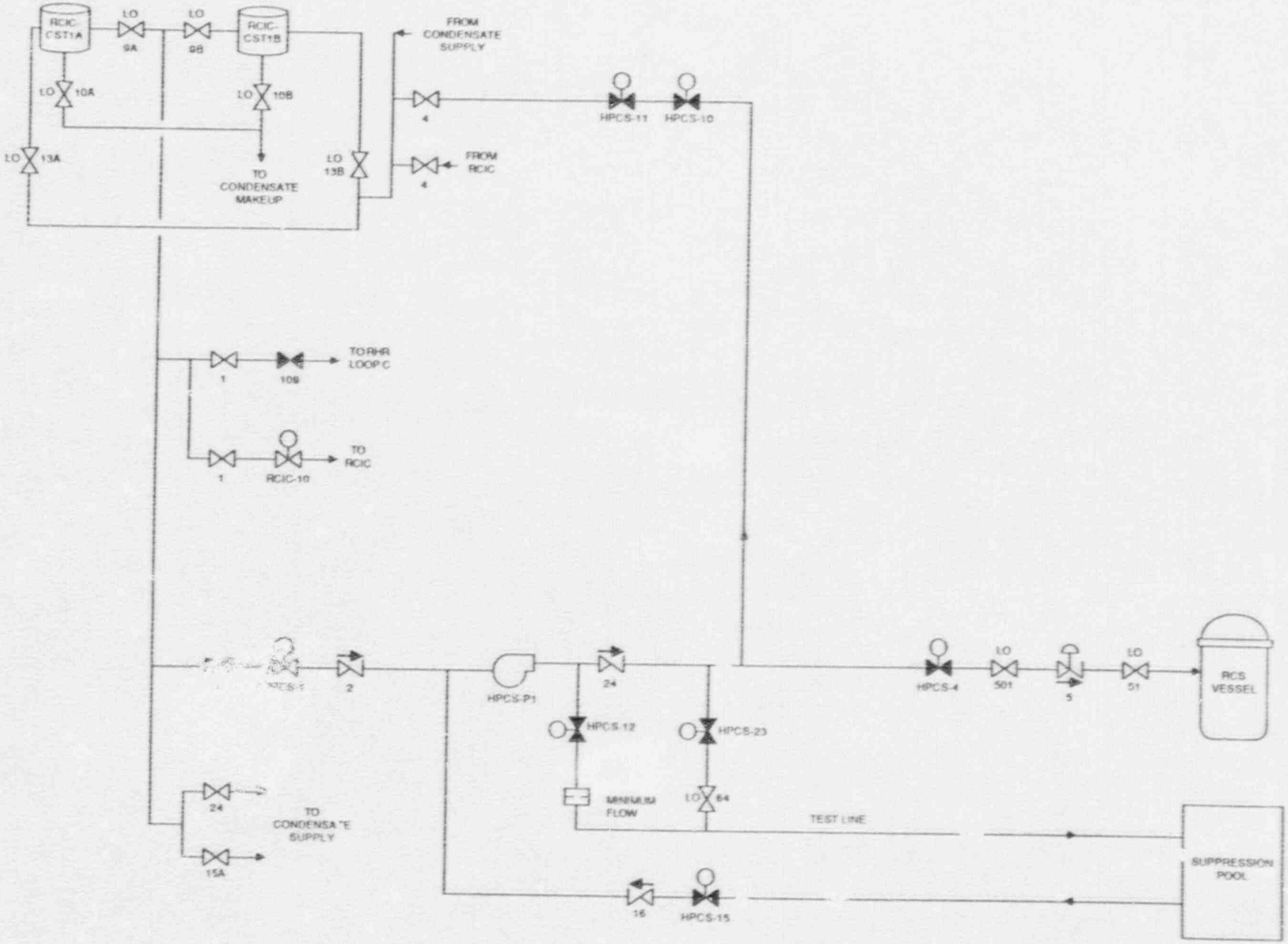

Figure 3.3-1. WNP-2 High Pressure Core Spray System

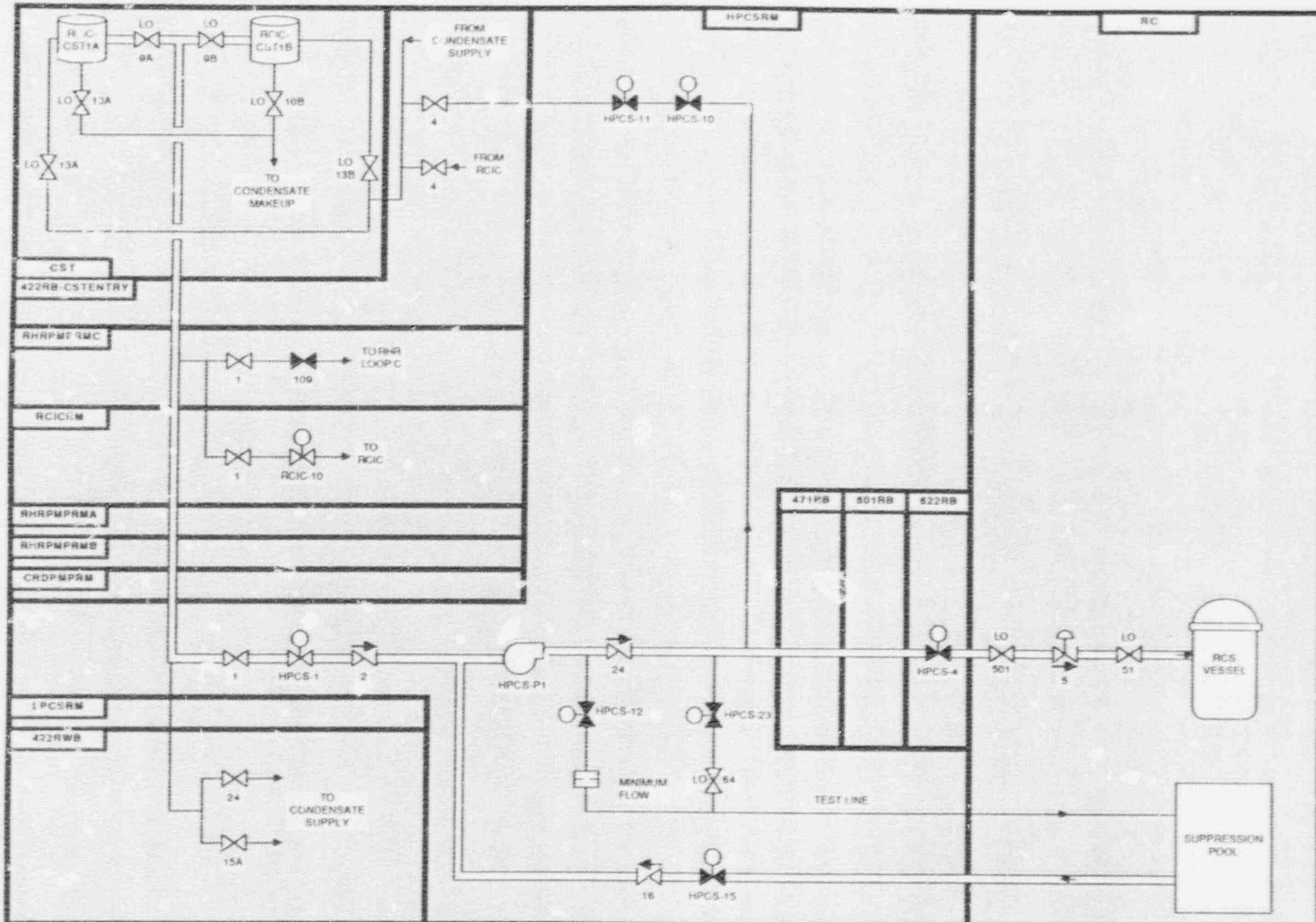

Figure 3.3-2. WNP-2 High Pressure Core Spray System Showing Component Locations

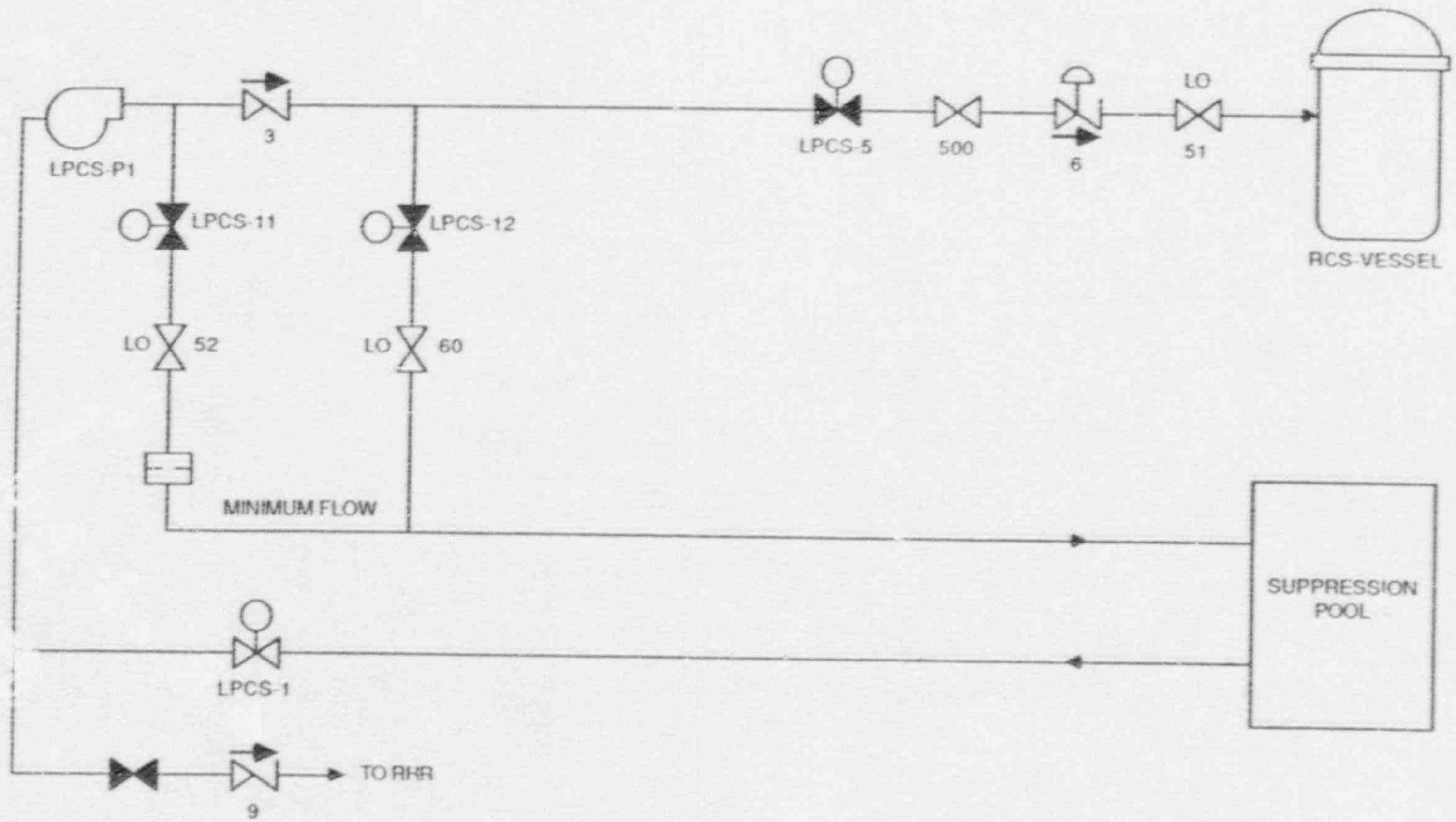

Figure 3.3-3. WNP-2 Low Pressure Core Spray System

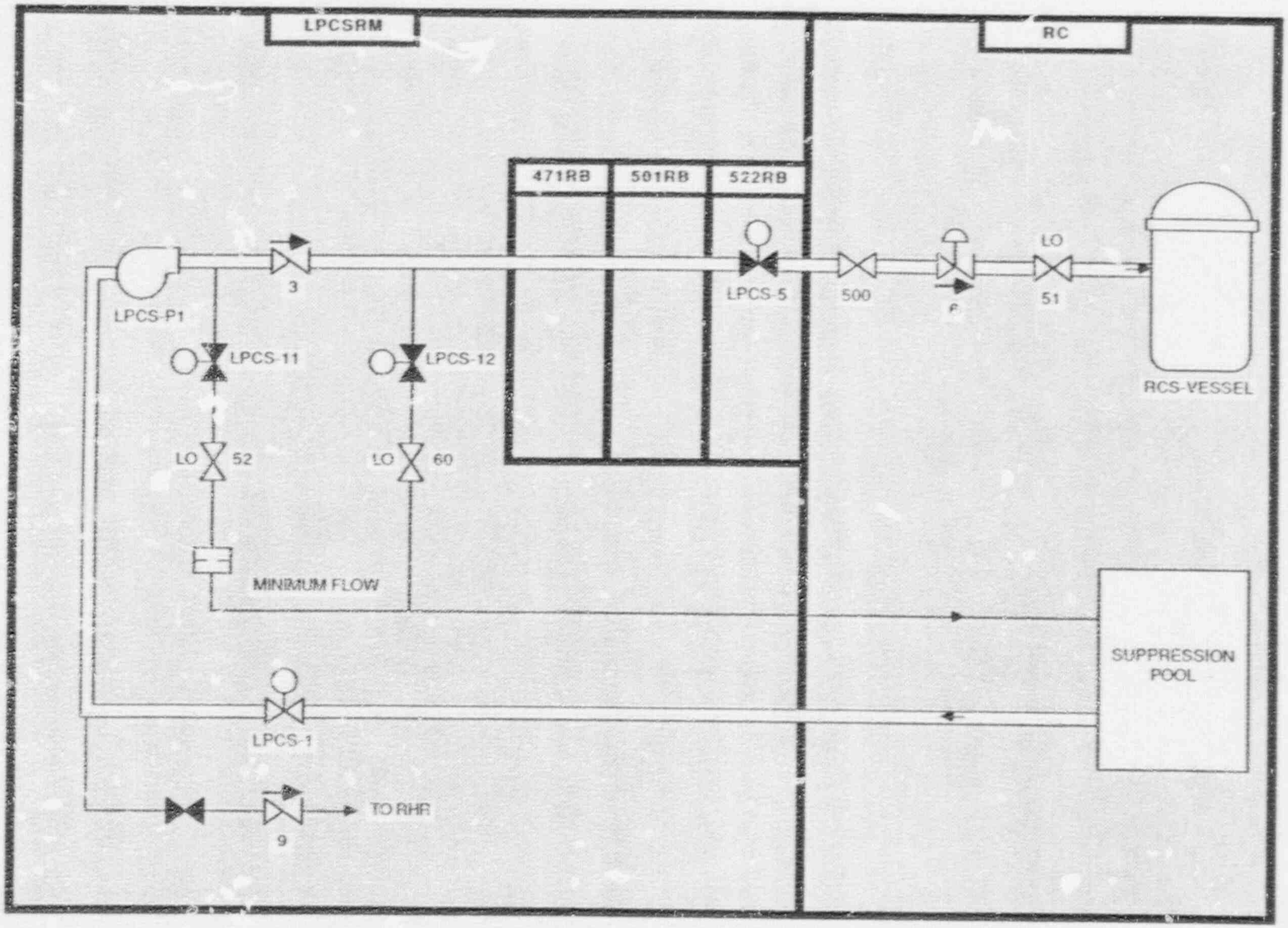

Figure 3.3-4. WNP-2 Low Pressure Core Spray System Showing Component Locations

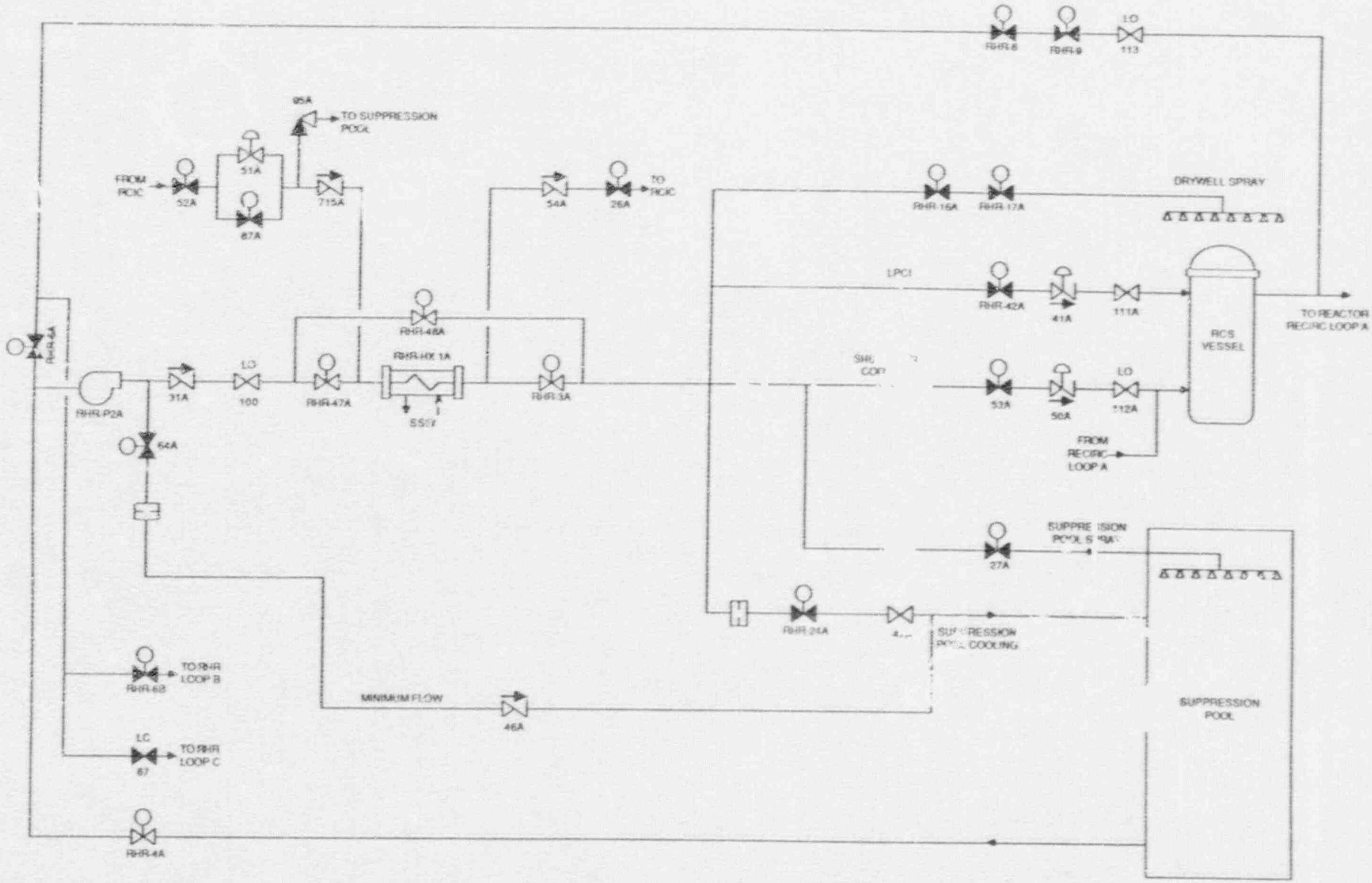

Figure 3.3-5. WNP-2 Residual Heat Removal System Loop A

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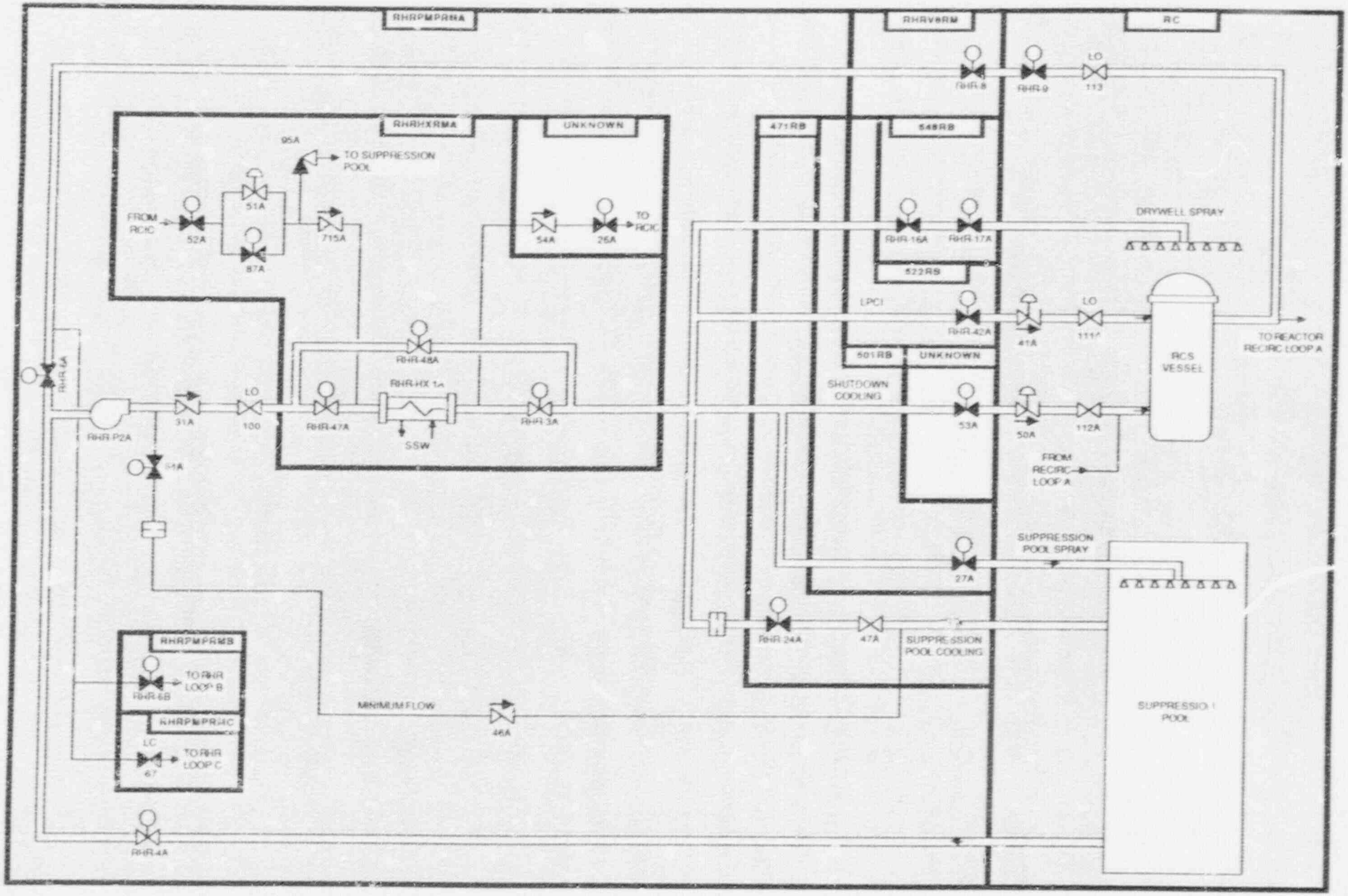


Figure 3.3-6. WNP-2 Residual Heat Removal System Loop A Showing Component Locations

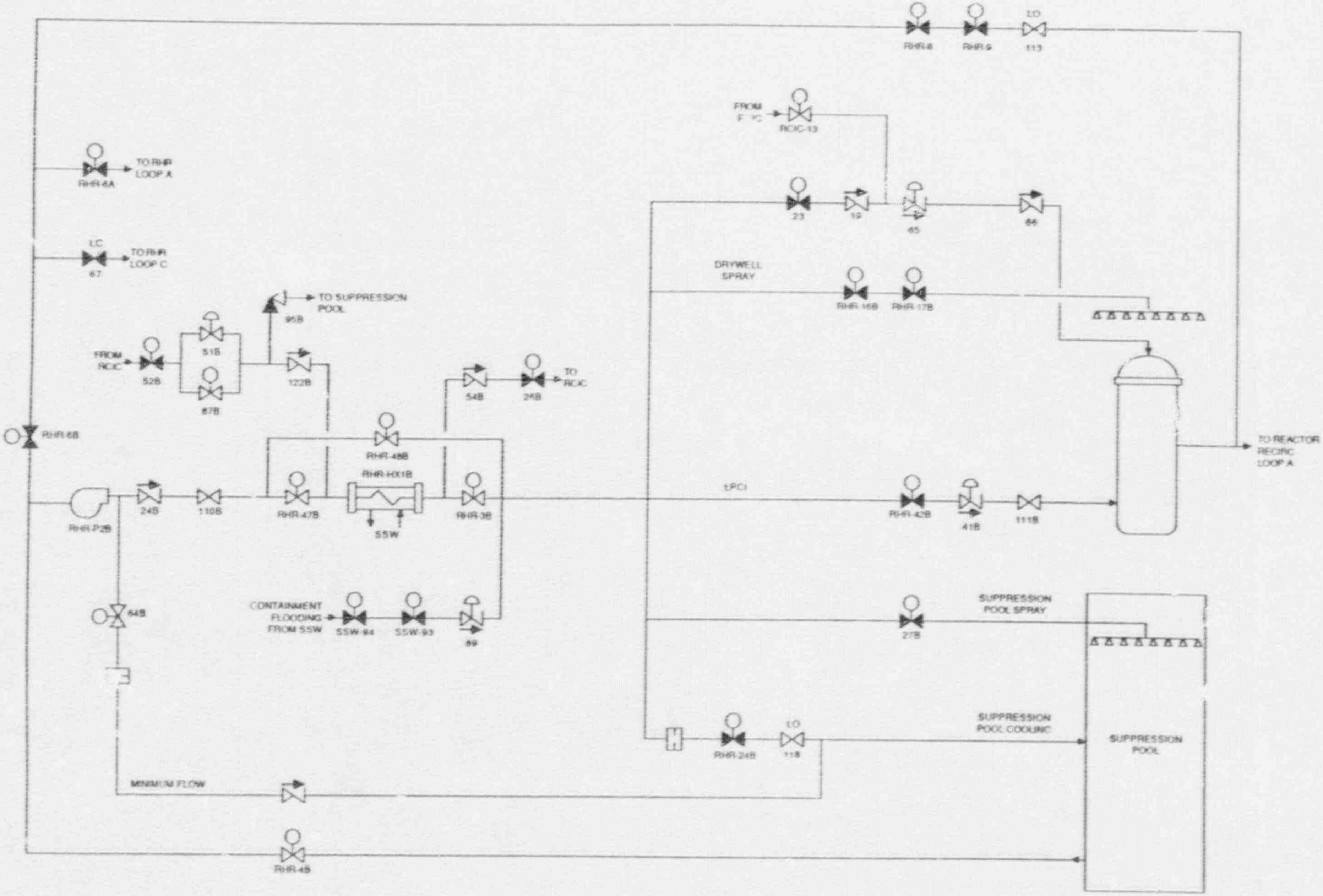


Figure 3.3-7. WNP-2 Residual Heat Removal Injection System Loop B

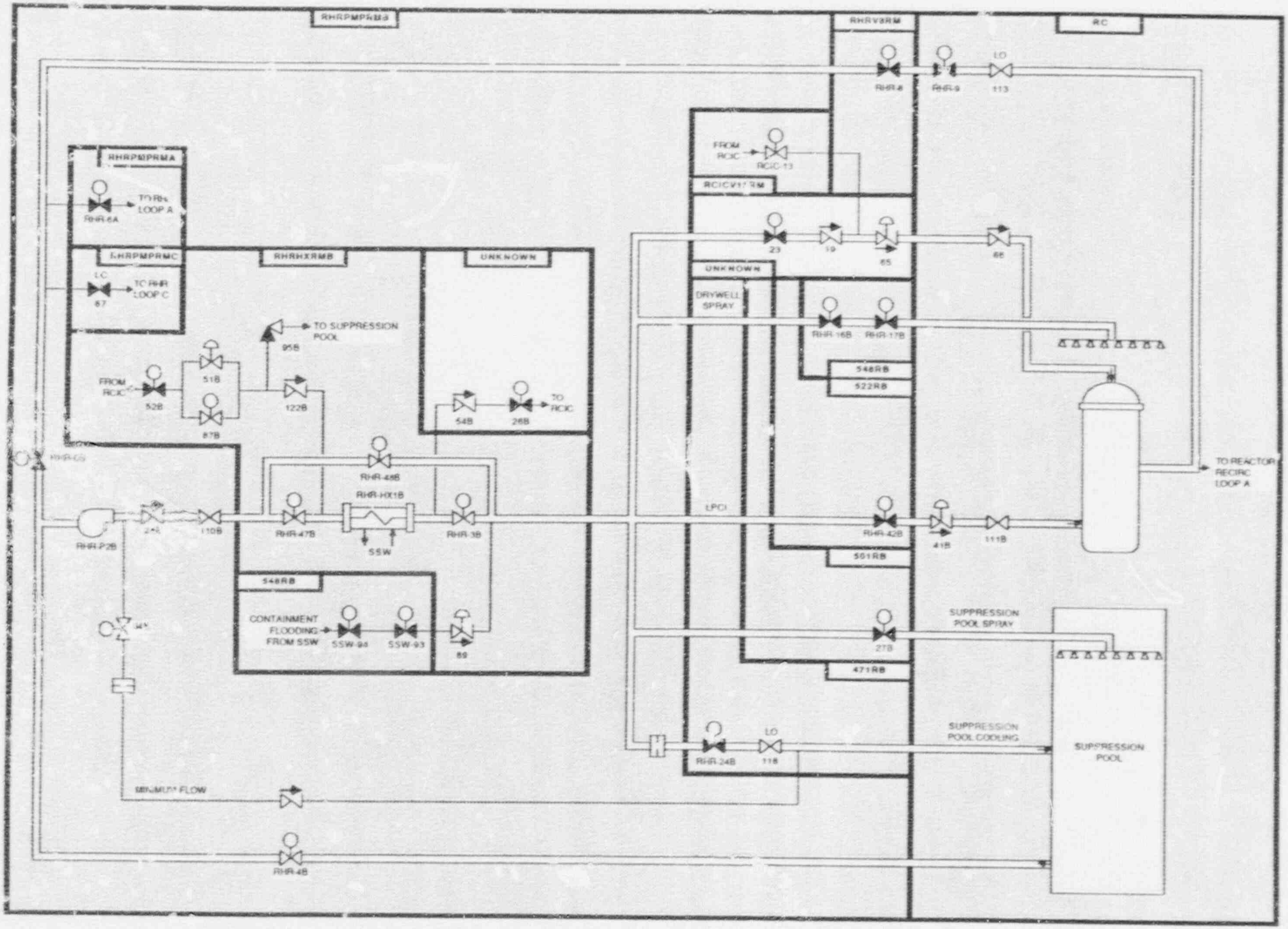


Figure 3.3-8. WNP-2 Residual Heat Removal Injection System Loop B Showing Component Locations

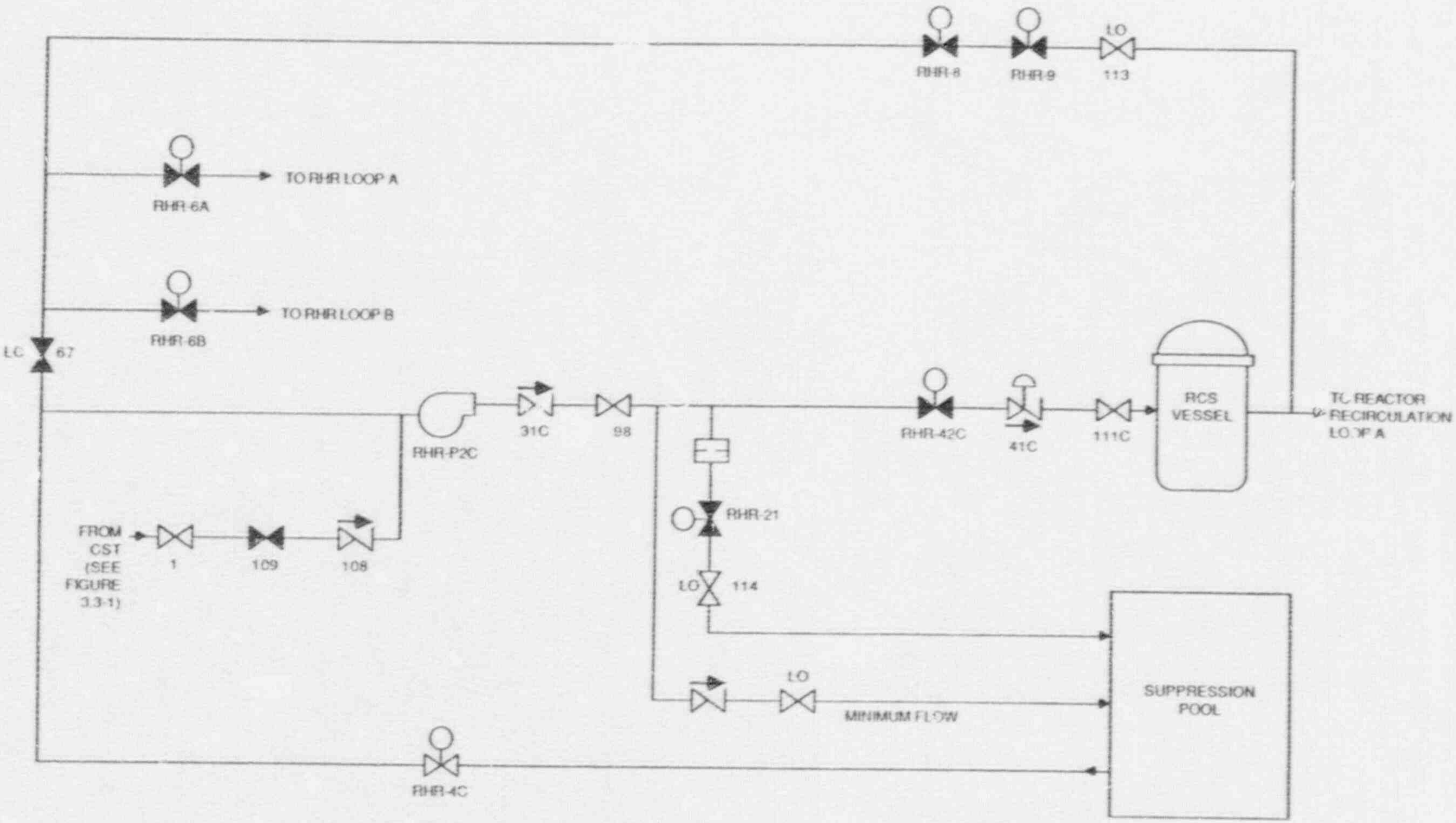


Figure 3.3-9. WNP-2 Residual Heat Removal System Loop C

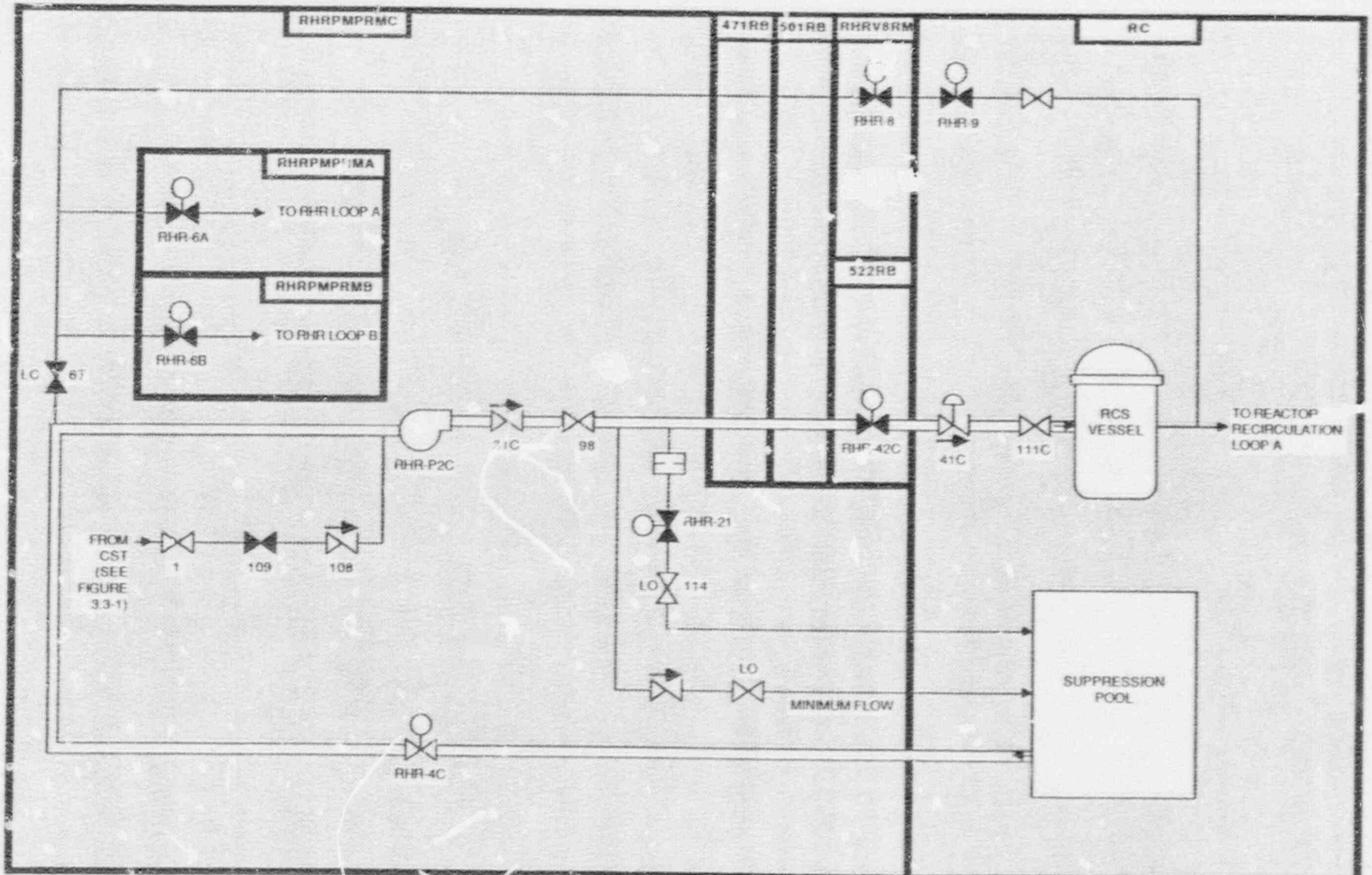


Figure 3.3-10. WNP-2 Residual Heat Removal System Loop C Showing Component Locations

Table [illegible].3-1. WNP-2 Emergency Core Cooling System Data Summary for Selected Components

SYSTEM	COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
ECCS	HPCS-12	MOV	HPCSRM	MCC4A	480	HPCSDGRM	AC/C
ECCS	LPCS-1[illegible]	MOV	LPCSRM	MCC7B-A	480	MCC7BRM	AC/A
ECCS	LPCS-12	MOV	LPCSRM	MCC7B-A	480	MCC7BRM	AC/A
ECCS	LPCS-44	MOV	LPCSRM	MCC7B	480	MCC7BRM	AC/A
ECCS	LPCS-5	MOV	522RB	MCC7B-A	480	MCC7BRM	AC/A
ECCS	LPCS-P1	MDP	LPCSRM	BUSSM7	4160	SWGRSM7RM	AC/A
ECCS	RC[illegible]V	SRV	RC				
ECCS	RHR-16[illegible]	MOV	548RB	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-16A	MOV	548RB	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-16B	MOV	548RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-16B	MOV	548RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-17A	MOV	548RB	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-17A	MOV	548RB	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-17B	MOV	548RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-17B	MOV	548RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-21	MOV	RHRPMPRMC	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-24A	MOV	471RB	MCC7B-A	480	MCC7BRM	AC/A
ECCS	RHR-24A	MOV	471RB	MCC7B-A	480	MCC7BRM	AC/A
ECCS	RHR-24B	MOV	471RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-24B	MOV	471RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-3A	MOV	RHRHXRMA	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-3B	MOV	RHRHXRMB	MCC8B-B	480	MCC8B-BRM	AC/B
ECCS	RHR-42A	MOV	522RB	MCC7B-A	480	MCC7BRM	AC/A
ECCS	RHR-42B	MOV	522RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-42C	MOV	522RB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-47A	MOV	RHRHXRMA	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-47B	MOV	RHRHXRMB	MCC8B-B	[illegible]	MCC8B-BRM	AC/B

Table 3.3-1. WNP-2 Emergency Core Cooling System Data Summary for Selected Components (Continued)

SYSTEM	COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
ECCS	RHR-48A	MOV	RHRHXRMA	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-48A	MOV	RHRHXRMA	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-48B	MOV	RHRHXRMB	MCC8B-B	480	MCC8B-BRM	AC/B
ECCS	RHR-48B	MOV	RHRHXRMB	MCC8B-B	480	MCC8B-BRM	AC/B
ECCS	RHR-4A	MOV	RHRPMPRMA	MCC7B-A	480	MCC7BRM	AC/A
ECCS	RHR-4B	MOV	RHRPMPRMB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-4C	MOV	RHRPMPRMC	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-68A	MOV	RHRHXRMA	MCC7B-B	480	MCC7B-BRM	AC/A
ECCS	RHR-68B	MOV	RHRHXRMB	MCC8B-B	480	MCC8B-BRM	AC/B
ECCS	RHR-6A	MOV	RHRPMPRMA	MCC7B-A	480	MCC7BRM	AC/A
ECCS	RHR-6B	MOV	RHRPMPRMB	MCC8B-A	480	MCC8BRM	AC/B
ECCS	RHR-HX1A	HX	RHRHXRMA				
ECCS	RHR-HX1B	HX	RHRHXRMB				
ECCS	RHR-P2A	MDP	RHRPMPRMA	BUSSM7	4160	SWGRSM7RM	AC/A
ECCS	RHR-P2B	MDP	RHRPMPRMB	BUSSM8	4160	SWGRSM8RM	AC/B
ECCS	RHR-P2C	MDP	RHRPMPRMC	BUSSM8	4160	SWGRSM8RM	AC/B
ECCS	SSW-24	MOV	RHRPMPRMC	MCC8B-A	480	MCC8BRM	AC/B
ECCS	SSW-24A	MOV	RHRPMPRMA	MCC7B	480	MCC7BRM	AC/A

3.4 INSTRUMENTATION AND CONTROL (I&C) SYSTEMS

3.4.1 System Function

The instrumentation and control systems consist of the Reactor Protection System (RPS), other actuation and control systems, the Remote Shutdown System (RSS), and systems for the display of plant information to the operators. The RPS and ESF 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 shutdown the reactor when plant conditions exceed one or more specified limits. Other actuation and control systems will automatically actuate selected safety systems based on the specific limits or combinations of limits that are exceeded. The RSS provides for establishing a safe shutdown condition from outside the main control room, in the event that this room is not accessible.

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). Other actuation and control systems include independent sensor and transmitter units, logic units, and relays that interface with the control circuits for the many different components in safety systems. Operator instrumentation display systems consist of display panels that are powered by 120 VAC power (see Section 3.5). Controls and indication for equipment available for remote shutdown are provided at the Remote Shutdown Control (RSC) Panel.

3.4.3 System Operation

A. RPS

The RPS has four input instrument channels and two output actuation trains. The variables monitored by the RPS are listed below:

- Neutron monitoring system
- Reactor vessel high pressure
- Reactor vessel low water level
- Reactor vessel high water level
- Turbine stop valve closure
- Turbine control valve fast closure
- Main steam line isolation valve closure
- Scram discharge instrument volume high water level
- Drywell high pressure
- Main steam line high radiation
- Manual

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

B. Other Actuation and Control Systems

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

C. Remote Shutdown
Some of the existing systems used for normal reactor shutdown operation are also utilized in the remote shutdown capability to shutdown the reactor from outside the main control room. The remote shutdown capability is designed to control the required shutdown systems irrespective of shorts, opens, or grounds in the control circuit in the main control room that may have resulted from an event causing an evacuation. The functions needed for remote shutdown control are provided with manual transfer switches which override controls from the main control room and transfer the controls to the remote shutdown control. Remote shutdown control is not possible without actuation of the transfer devices. All necessary power supplies and control logic are also transferred. Operation of the transfer devices causes an alarm in the main control room. Access to the remote shutdown panel is administratively and procedurally controlled. All system equipment (i.e., valves and pumps) necessary for proper system lineup and complete system control are located on the remote shutdown panel. Controls that are critical to the safe shutdown of the plant that are available on the RSC Panel are listed in Table 3.4-1 (Ref. 1).

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 WNP-2 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 WNP-2 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 two 120 VAC RPS buses.
2. Other Actuation and Control Systems
Control power interfaces with the various front-line safety systems are summarized in Table 3.4-2.
3. Operator Instrumentation
Operator instrumentation displays are powered from the 125 VDC sources as shown in Table 3.4-2. Also see Section 3.5.

3.4.6 Section 3.4 References

1. WNP-2 Final Safety Analysis Report, Section 7.4.1.4.

Table 3.4-1. Controls Available on the WNP-2 RSC Panel

Description	Equipment Number
RCIC System MOV's	8, 10, 13, 19, 22, 31, 45, 46, 59, 60, 63, 64 69, 76, 80, 86, and trip throttle
RCIC System Auxiliary Pumps	Condensate pump P1, Vacuum pump P2
RHR System MOV's	3B, 4B, 6A, 6B, 8, 9, 11B, 16B, 23, 24B, 26B, 27B, 42B, 47B, 48B, 49B, 52B, 53B, 64B, 68B, 87B
RHR System Pump	2B
Nuclear Boiler System Air Operated Relief Valves	
Recirculation System MOV	23A
Standby Service Water System Pump	1B
Standby Service Water Valves	2B, 12B, 24B, 69B, 70B

Table 3.4-2. Matrix of WNP-2 Control Power Sources

SYSTEM	DC POWER SOURCE		
	DC-125-B1	DC-125-B2	DC-125-HPCS
RCIC	■		
HPCS			■
LPCS	■		
RHRA	■		
RHRB		■	
RHRC		■	
DG1	■		
DG2		■	
DG3			■
SSWA	■		
SSWB		■	
SSWHPCS			■
Remote Shutdown	■	■	
I&C NSSS	■	■	
I&C CR	■	■	
I&C Other	■	■	
ADS A Logic	■		
ADS B Logic		■	
Backup Scram Valves	■	■	
MSIVs Inboard	■		
MSIVs Outboard		■	
Safety Related Display Inst	■	■	■
Cont Inst Air	■	■	

NOTE: DC Division were assumed based on actual AC power divisions

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 WNP-2 onsite Class 1E electric power system consists of three independent trains, denoted A, B, and C, which serve Division 1, Division 2, and HPCS loads respectively. Trains A and B consist of a standby diesel generator, a 4160 VAC switchgear bus, two 480 VAC load center buses, a station battery, and a 125 VDC bus. The HPCS train is similar, except that there is one 480 VAC motor control center supplied from the 4160 VAC bus. Division 1 and 2 together provide functional redundancy to the HPCS (Division 3) system and are also redundant to each other.

The system also contains three 120 VAC power supplies which supply power to vital instrumentation panels. The 120 VAC MCCs are powered from 480 VAC and 125 VDC buses of electric power trains A and B via inverters. Power is also received from a separate 250 VDC system via an inverter.

Simplified one-line diagrams of the electric power system are shown in Figures 3.5-1 through 3.5-7. A summary of data on selected electric power system components is presented in Table 3.5-1. A partial listing of electrical sources and loads is presented in Table 3.5-2.

3.5.3 System Operation

During normal operation the Class 1E AC system is supplied by three normal 4160 VAC buses, SM4, SM7, and SM8. These normal buses are supplied by the main generator through the station transformer. Alternate sources of power are the backup and startup transformers which can supply power from the offsite grid.

The three standby diesel generators are started automatically upon either: (a) loss of voltage on the associated standby 4160 VAC bus and loss of startup sources; (b) a LOCA signal; or (c) a manual start signal. Each diesel generator and its auxiliaries is housed in a separate room, and each room is provided with its own ventilation and lighting systems. Diesel generator 1 is connected to 4160 VAC bus SM7, diesel generator 2 is connected to 4160 VAC bus SM8, and the HPCS diesel generator 3 is connected to 4160 VAC bus SM4. Bus SM7 feeds the 480 VAC load center buses 71 and 73, which in turn feed various Train A MCCs. Bus SM8 feeds 480 VAC buses 81 and 83, which in turn feed various Train B MCCs. Bus SM4 feeds 480 VAC MCC 4A directly through a transformer.

Upon loss of both normal and startup sources, non Class-1E switchgear buses are automatically deenergized, thereby shedding non-essential loads. The Division 1 and 2 buses are then automatically transferred to the 115/4.16 kV backup transformer. In the event that this source is unavailable, these buses are automatically transferred to the onsite standby sources (Division 1 and 2 diesel generators). The Division 3 (HPCS) 4.16 kV Class 1E bus SM4 cannot be connected to the backup source; loss of the normal sources causes automatic transfer of this load to the Division 3 onsite standby source (Division 3 diesel generator).

The 250 VDC subsystem consists of one station battery B2-1, battery charger S2-1 energized by Division A bus 73, and a 250 VDC distribution panel S2-1. The 125 VDC subsystem consists of two buses, each associated with a separate load group. DC bus S1-1 is normally supplied by bus 73 through battery charger 1, and DC bus S1-2 is normally supplied by bus 83 through battery charger 2. Station batteries B1-1 and B1-2 float on their respective DC buses and supply power for starting diesel generators 1 and 2. The HPCS system is served by a separate 125 VDC battery which floats on bus HPCS.

The 120 VAC subsystem consists of two uninterruptible power supplies that feed the plant vital instrumentation panels. Each UPS receives power from both the 480 VAC subsystem and either the 250 or 125 VDC subsystem. The 250 VDC system is designed to supply 120/240 VAC power on an uninterruptible basis to plant controls and instrumentation via a solid state inverter. Power is also supplied to critical plant instrumentation at 120/240 VAC via Division 1 and Division 2 distribution systems. AC power is normally fed to the system from 15 kV static inverter-static switch arrangements supplied from both the 125 VDC battery systems (primary sources) and the critical AC distribution panels (alternate sources). The 120 VAC subsystem also includes two RPS buses for powering Reactor Protection System instrumentation.

The RPS power system is designed to provide 120 VAC power to logic and/or system components of the reactor protection and containment isolation systems. The RPS power system consists of two high inertia AC motor generator sets, each equipped with a voltage regulator designed to respond to voltage changes. 120 VAC power is supplied from two sources. The motor generators (supplied from separate Division 1 and 2 motor control centers) provide the primary power source, with alternate power supplied from a non-Class 1E distribution panel. Since the RPS has fail safe logic circuits, power losses will not prevent the RPS from performing its safety function.

Two separate 24 VDC systems are provided to power the Division 1 and 2 main control room equipment. Each bank is provided with a battery charger which receives 120 VAC input power from its respective Division 1 or 2 120 VAC vital power panel.

Redundant safeguards equipment such as motor driven pumps and motor operated valves are supplied by different buses and 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 or indirectly from 4160 bus SM7. Load group "AC/B" contains components powered either directly or indirectly from 4160 bus SM8. Load group "AC/C" contains components powered either directly or indirectly from 4160 bus SM4. Components receiving DC power are assigned to load groups "DC/A" to "DC/D", based on the battery source. DC/A and DC/B correspond to 125 VDC batteries B1-1 and B1-2, respectively. DC/C corresponds to 250 VDC battery B2-1. Finally, DC/D corresponds to 125 VDC battery B1-HPCS.

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 1 and 2
   1. Continuous power rating: 4400 kW
   2. Short-term rating: 4900 kW
   3. Rated voltage: 4160 VAC
   4. Manufacturer: unknown

B. HPCS diesel generator 3
   1. Continuous power rating: 2600 kW
   2. Rated voltage: 4160 VAC
   3. Manufacturer: General Motors

C. 125 VDC station batteries 1-1, 1-2, and 1-HPCS
   1. Cells: 58 for 1-1 and 1-2, 60 for 1-HPCS
   2. Design capacity: about 2 hours with design loads

D. 250 VDC station battery 2-1
   1. Cells: 116
   2. Design capacity: about 2 hours with design loads

3.5.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      The standby diesel generators are automatically started on loss of voltage on their associated bus or on a LOCA signal. The starting circuitry and control power for DG 1 and 2 is supplied from separate 125 VDC station batteries 1-1 and 1-2. The HPCS diesel generator has a separate battery, B1-HPCS.
   2. Remote Manual
      The diesel generators can be started or stopped manually from the main control room or from local control panels.

B. Diesel Generator Auxiliary Systems
   The following auxiliaries are provided for each emergency diesel generator:
   - Cooling
     Diesels 1, 2, and the HPCS diesel each have a closed (jacket) cooling system consisting of a forced circulation cooling water system which cools the engine directly and a heat exchanger connected to the respective train of the standby service water system (see Section 3.7).
   - Fueling
     An independent day tank is provided for each diesel. A day tank will support almost 8.5 hours of diesel operation with design loads (Ref. 1, Section 9.5.4).
   - Lubrication
     Each diesel generator has a self-contained lubrication system.
   - Starting
     DG 1 and 2 have independent starting air starting systems. The HPCS diesel has two independent air starting systems.
   - Ventilation
     Fans are provided for diesel room ventilation.

C. Switchgear Room Ventilation
   The essential switchgear rooms have fan cooler units that are cooled by the Shutdown Service Water System (SSWS, see Section 3.7).

3.5.7 Section 3.5 References

1. Washington Public Power Supply System, Final Safety Analysis Report for WNP-2, June, 1982.

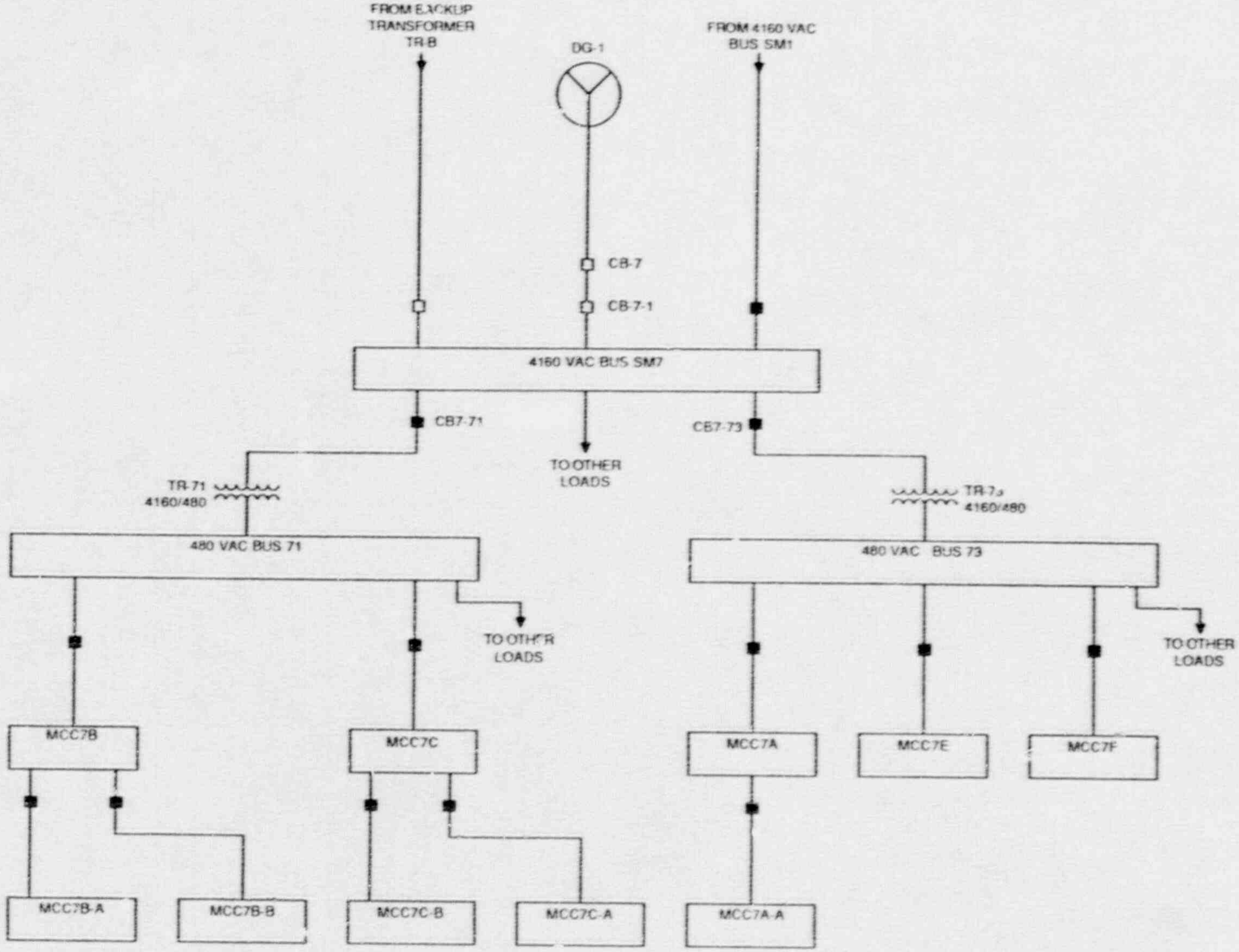


Figure 3.5-1. WNP-2 4160/480 VAC Electric Power System (Page 1 of 2, Train A)

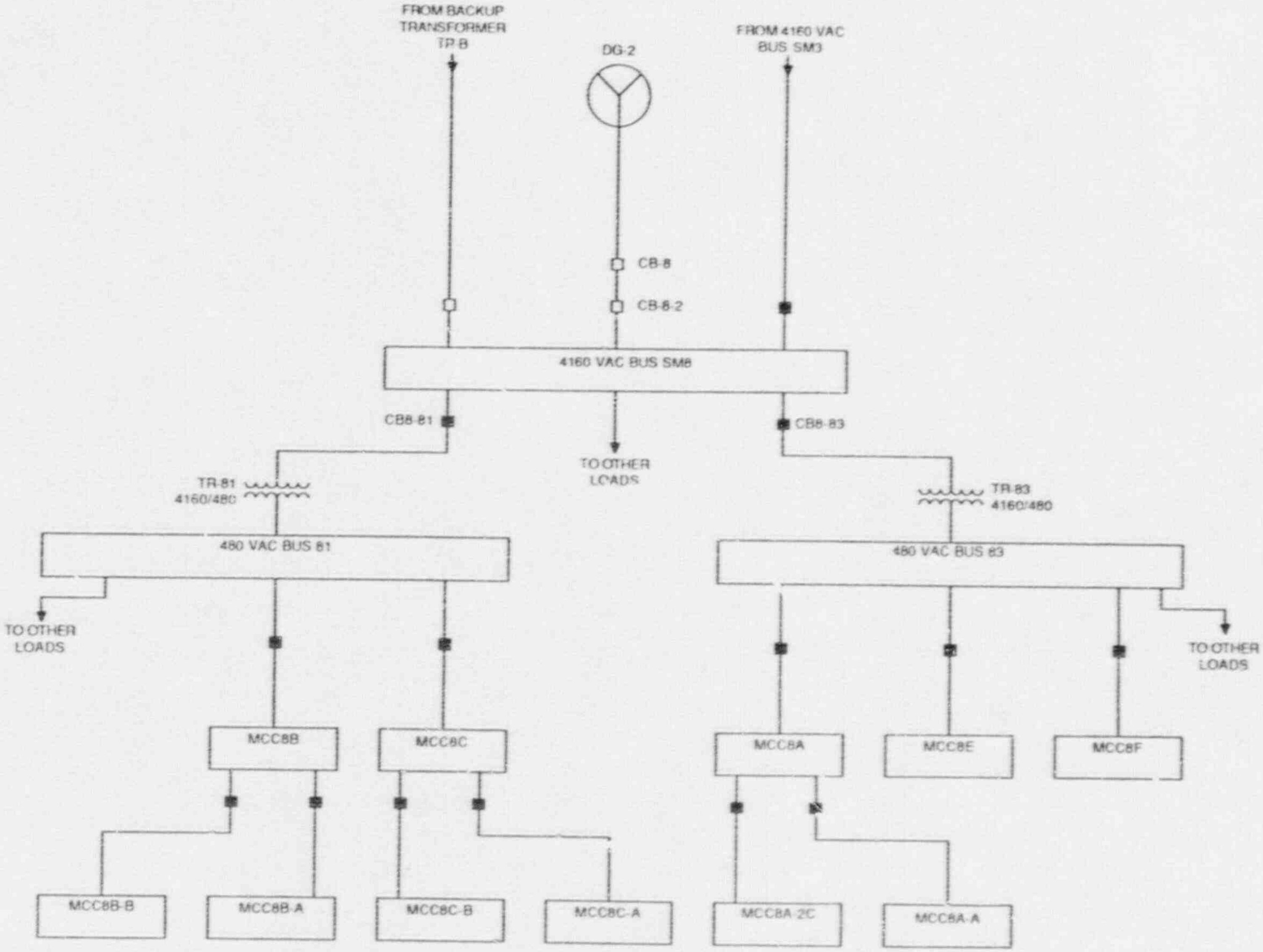
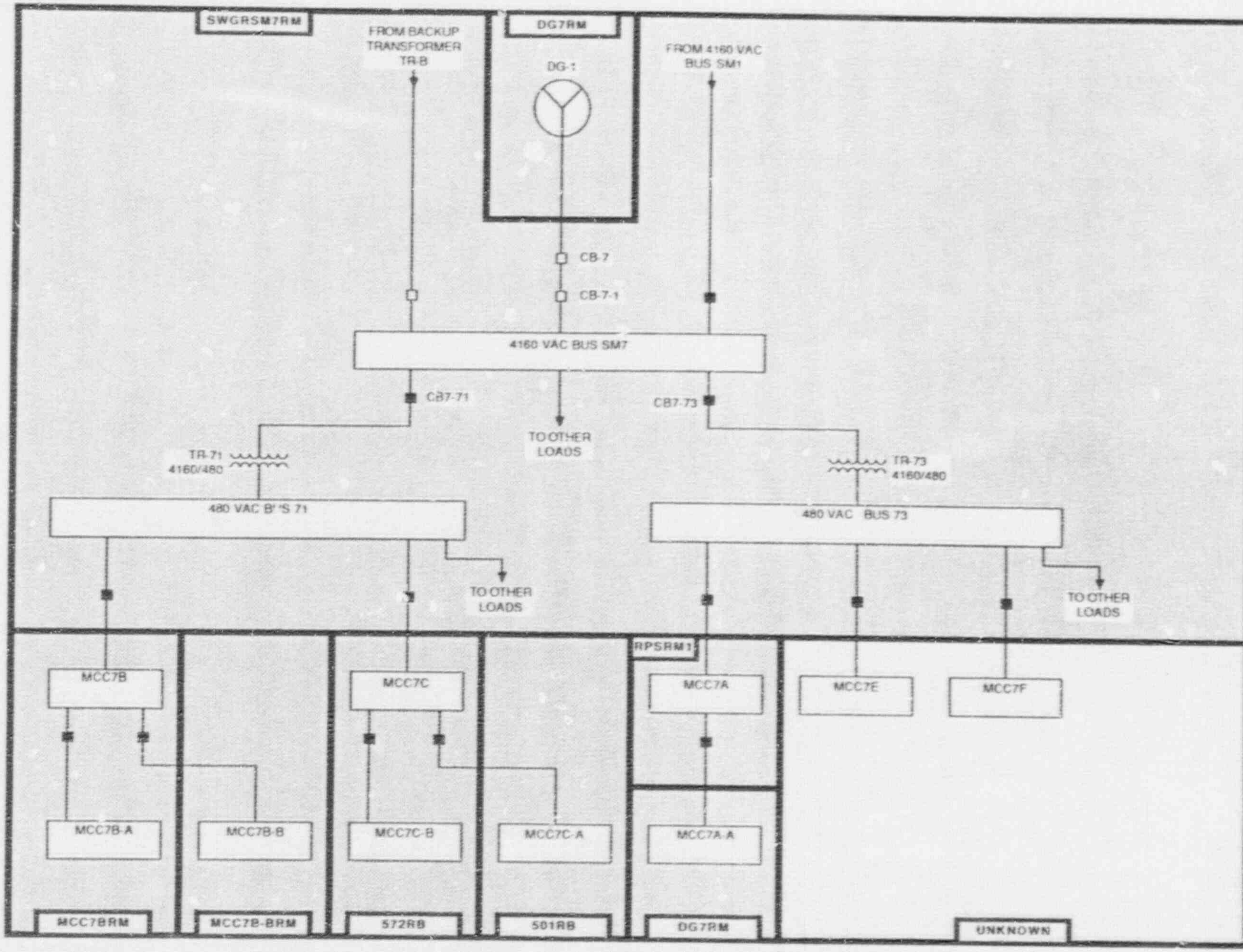
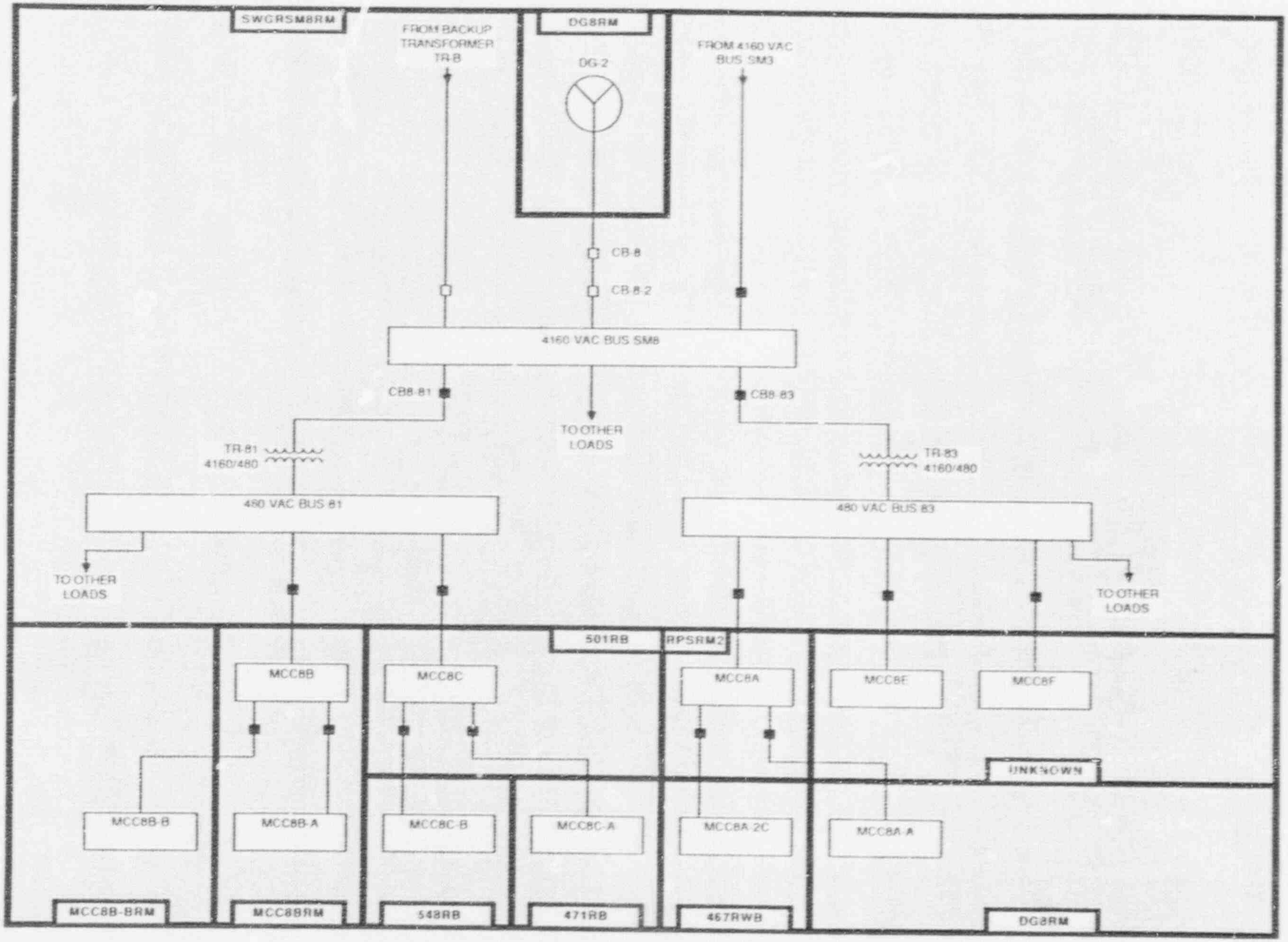


Figure 3.5-1. WNP-2 4160/480 VAC Electric Power System (Page 2 of 2, Train B)



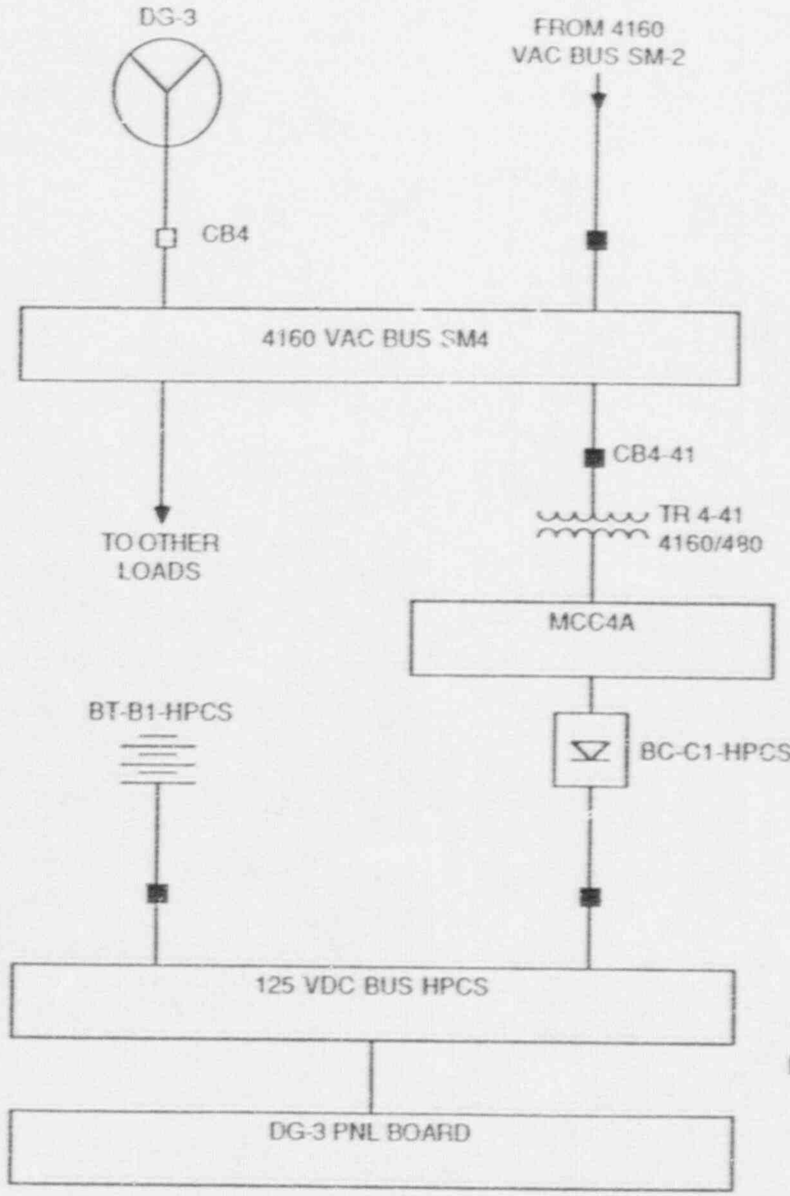
NOTE: LINES MAY NOT REPRESENT TRUE CABLE ROUTING BETWEEN ROOMS.

Figure 3.5-2. WNP-2 4160/480 VAC Electric Power System Showing Component Locations (Page 1 of 2, Train A)



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

Figure 3.5-2. WNP-2 4160/480 VAC Electric Power System Showing Component Locations (Page 2 of 2, Train B)



NOTE: (1) All components are located in the HPCSDGRM.

(2) Lines may not represent true cable routing between rooms.

Figure 3.5-3. WNP-2 HPCS AC and DC Power Systems (Train C)

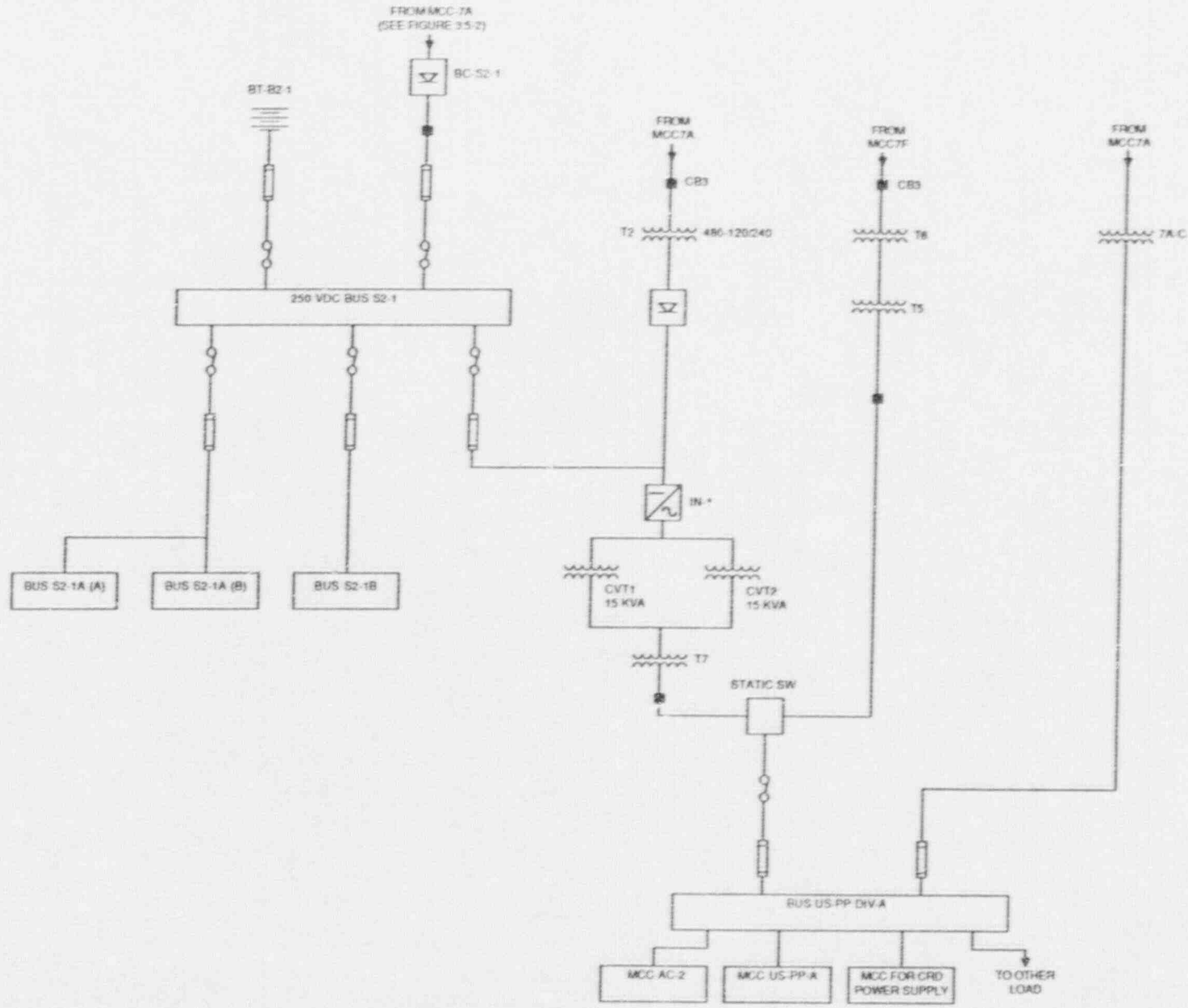


Figure 3.5-4. WNP-2 250 VDC and 120/240 VAC Electric Power System

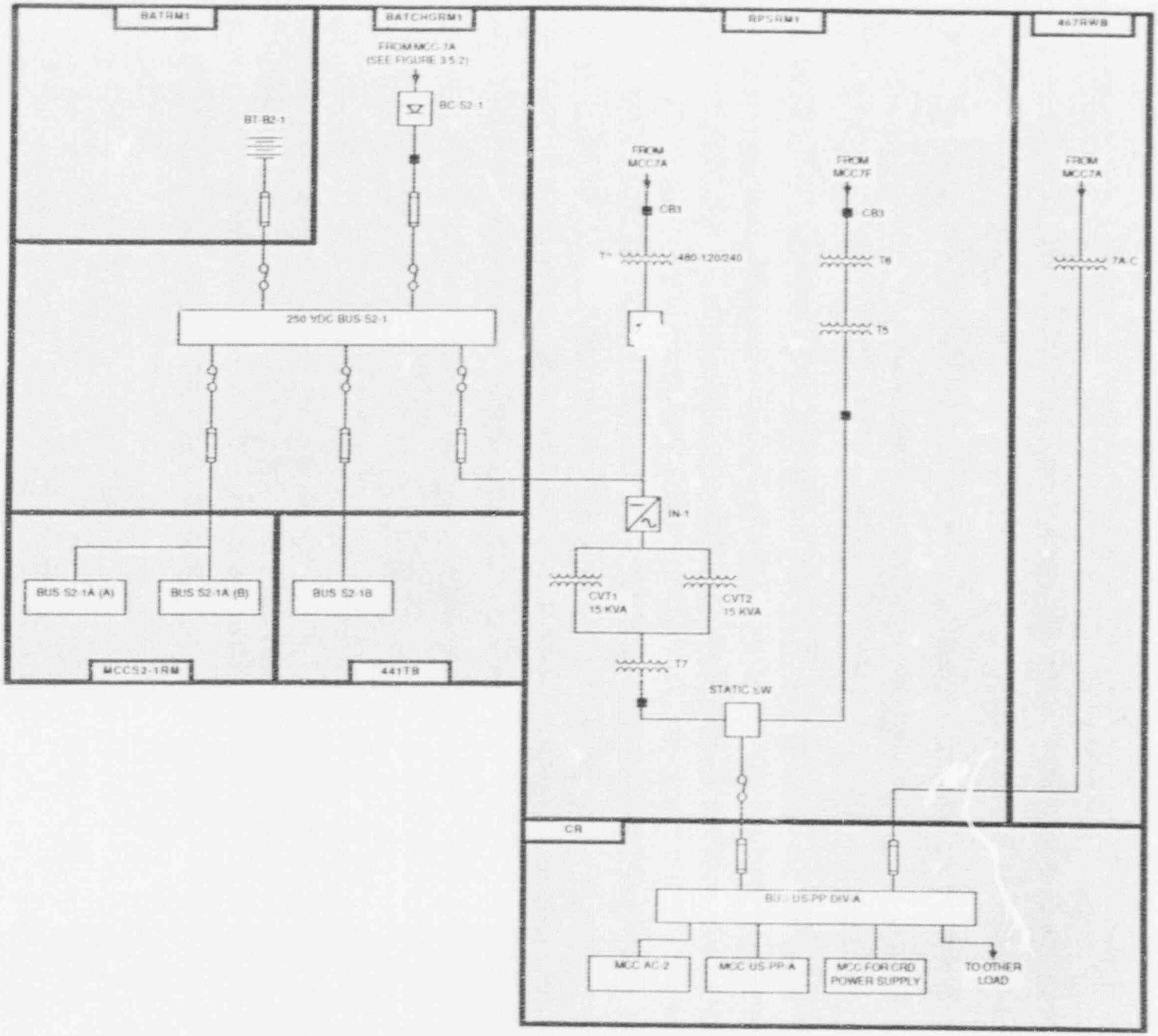


Figure 3.5-5. WNP-2 250 VDC and 120/240 VAC Electric Power System Showing Component Locations

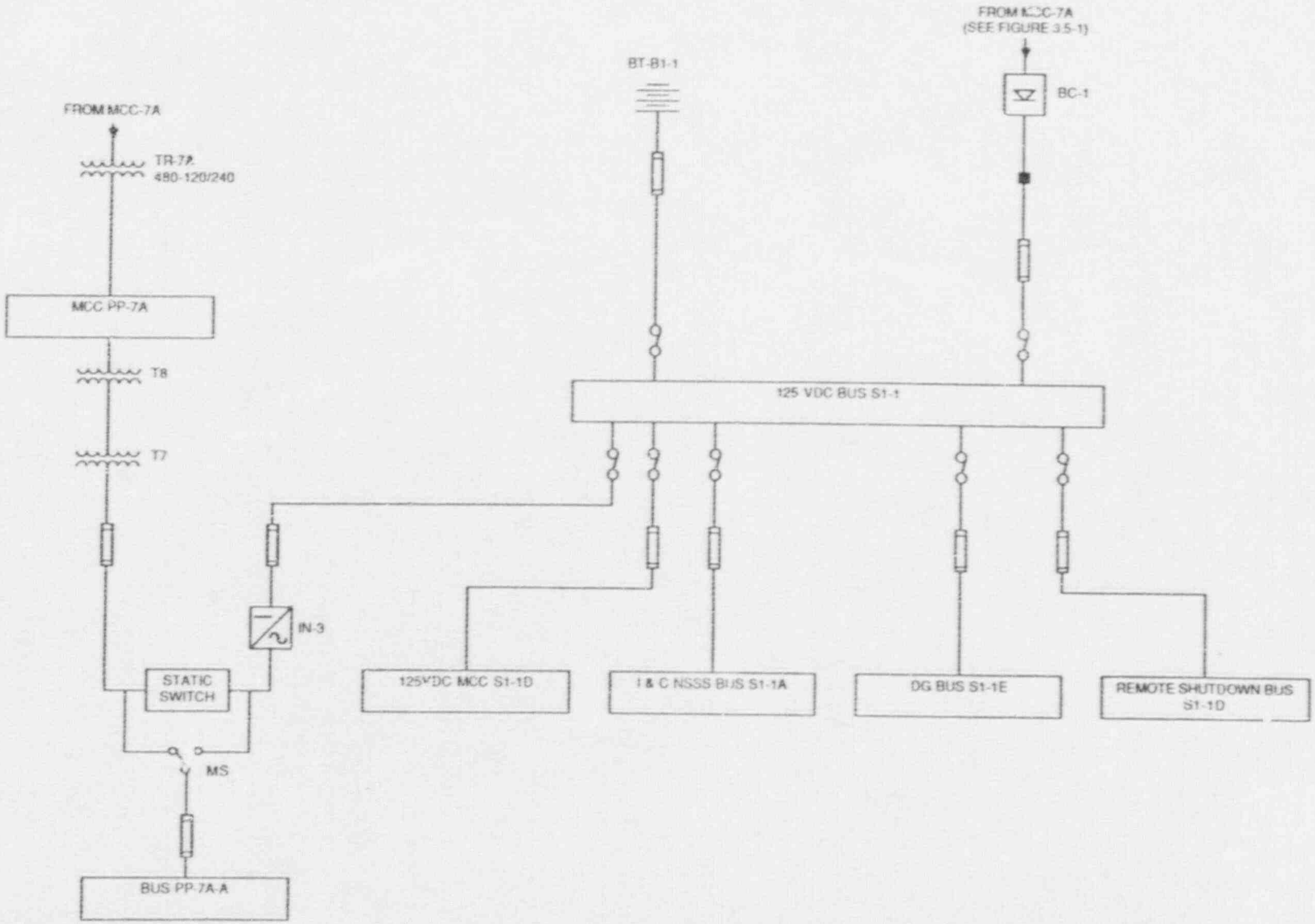


Figure 3.5-6. WNP-2 125 VDC and 120/240 VAC Electric Power System (Sheet 1 of 2, Train A)

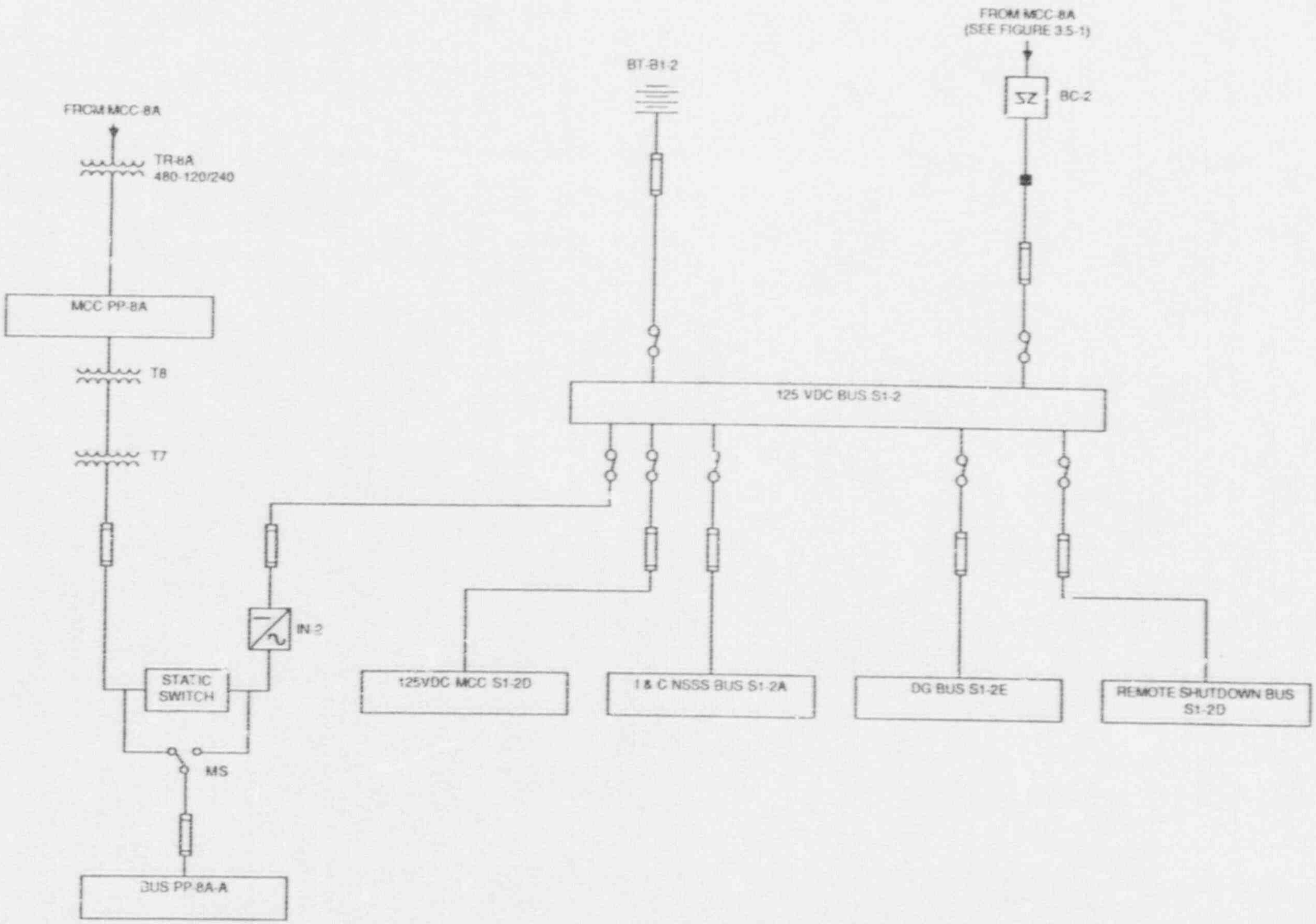


Figure 3.5-6. WNP-2 125 VDC and 120/240 VAC Electric Power System (Sheet 2 of 2, Train B)

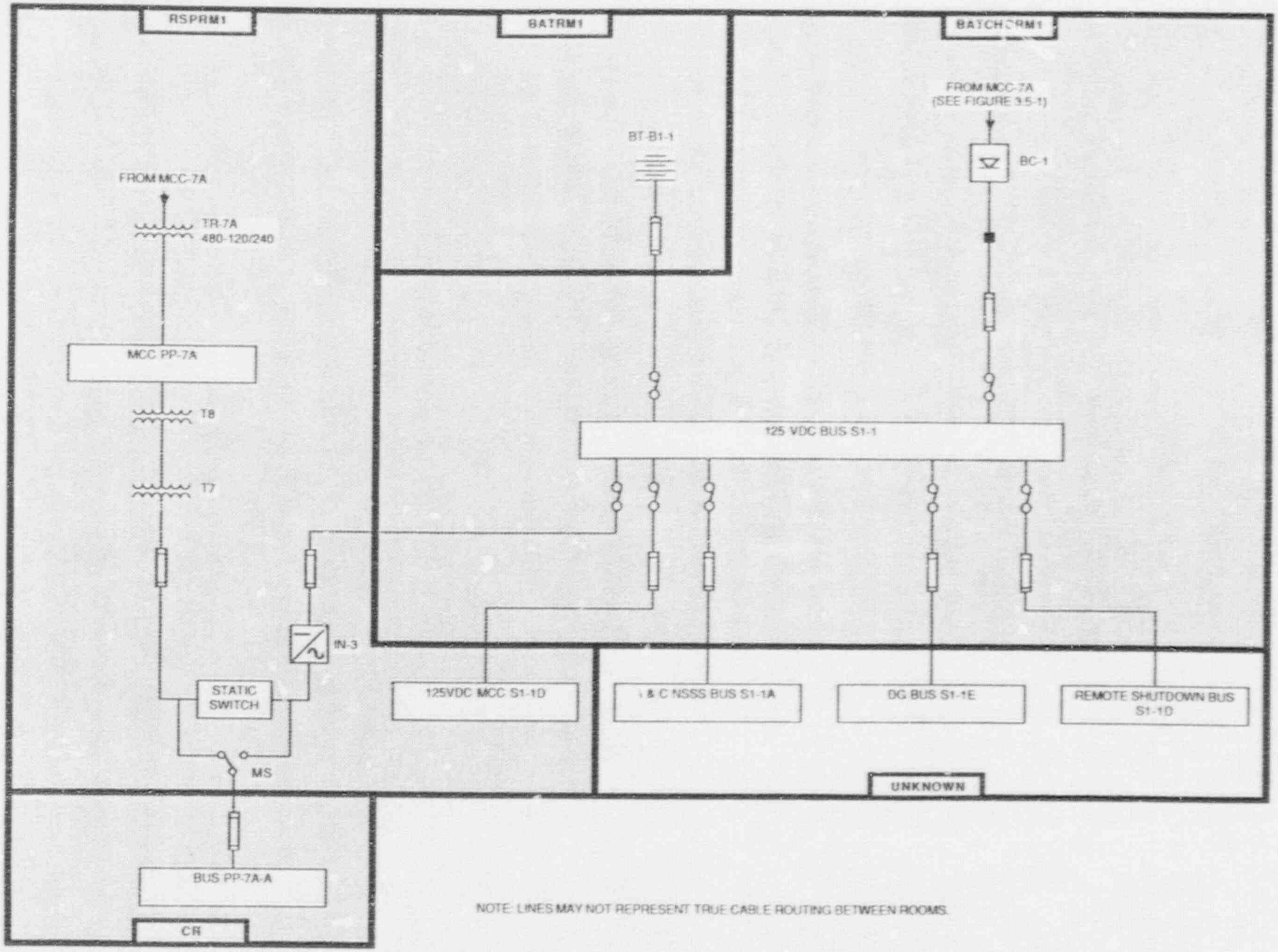


Figure 3.5-7. WNP-2 125 VDC and 120/240 VAC Electric Power System Showing Component Locations (Sheet 1 of 2, Train A)

Table 3.5-1. WNP-2 Electric Power System Data Summary for Selected Components

SYSTEM	COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
EP	BC-2	BC	BATCHGRM2	MCC8A	125	RPSRM2	DC/B
EP	BT-B1-2	BATT	BATRM2		125		DC/B
EP	BT-B1-HPCS	BATT	HPCSDGRM		125		DC/D
EP	BUS71	BUS	SWGRSM7RM	TR-71	480	SWGRSM7RM	AC/A
EP	BUS73	BUS	SWGRSM7RM	TR-73	480	SWGRSM7RM	AC/A
EP	BUSHPCS	BUS	HPCSDGRM	BTHPCS	125	HPCSDGRM	DC/D
EP	BUSS1-1E	PNL	DG1PNLRM	BUSS1-1	125	BATCHGRM1	DC/A
EP	BUSS1-2E	PNL	DG2PNLRM	BUSS1-2	125	BATCHGRM2	DC/B
EP	BUSS2-1	BUS	BATCHGRM1	BC-S2-1	250	BATCHGRM1	DC/C
EP	BUSSM7	BUS	SWGRSM7RM	DG-1	4160	DG7RM	AC/A
EP	BUSSM8	BUS	SWGRSM8RM	DG-2	4160	DG8RM	AC/B
EP	CB-7-1	CB	SWGRSM7RM	DG-1	4160	DG7RM	AC/A
EP	CB-8-1	CB	SWGRSM8RM	DG-2	4160	DG8RM	AC/B
EP	DG3PB	PNL	HPCSDGRM	BUSHPCS	125	HPCSDGRM	DC/D
EP	MCC4A	MCC	HPCSDGRM	TR4-41	480	HPCSDGRM	AC/C
EP	SSW-2A	MOV	PMPHSA	MCC7A	480	RPSRM1	AC/A
EP	SSW-2B	MOV	PMPHSB	MCC8A	480	RPSRM2	AC/B
EP	SWH-29	MOV	PMPHSA	MCC4A	480	HPSDGRM	AC/C
EP	TR4-41	TRAN	HPCSDGRM	BUSSM4	480	HPCSDGRM	AC/C

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
BC-1	125	DC/A	BATCHGRM1	EP	BUSS1-1	BUS	BATCHGRM1
BC-2	125	DC/B	BATCHGRM2	EP	BUSS1-2	BUS	BATCHGRM2
BC-S2-1	250	DC/C	BATCHGRM1	EP	BUSS2-1	BUS	BATCHGRM1
BTHPCS	125	DC/D	HPCSDGRM	EP	BUSHPCS	BUS	HPCSDGRM
BUSHPCS	125	DC/D	HPCSDGRM	EP	DG3PB	PNL	HPCSDGRM
BUSS1-1	125	DC/A	BATCHGRM1	EP	BUSS1-1E	PNL	DG1PNLRM
BUSS1-2	125	DC/B	BATCHGRM2	EP	BUSS1-2E	PNL	DG2PNLRM
BUSSM4	4160	AC/C	HPCSDGRM	ECCS	HPCS-P1	MDP	HPCSRM
BUSSM4	480	AC/C	HPCSDGRM	EP	TR4-41	TRAN	HPCSDGRM
BUSSM4	4160	AC/C	HPCSDGRM	SW	SWH-P2	MDP	PMPHSA
BUSSM7	4160	AC/A	SWGRSM7RM	ECCS	LPCS-P1	MDP	LPCSRM
BUSSM7	4160	AC/A	SWGRSM7RM	ECCS	RHR-P2A	MDP	RHRPMPRMA
BUSSM7	4160	AC/A	SWGRSM7RM	EP	TR-71	TRAN	SWGRSM7RM
BUSSM7	4160	AC/A	SWGRSM7RM	EP	TR-73	TRAN	SWGRSM7RM
BUSSM7	4160	AC/A	SWGRSM7RM	SW	SSW-P1A	MDP	PMPHSA
BUSSM8	4160	AC/B	SWGRSM8RM	ECCS	RHR-P2B	MDP	RHRPMPRMB
BUSSM8	4160	AC/B	SWGRSM8RM	ECCS	RHR-P2C	MDP	RHRPMPRMC
BUSSM8	4160	AC/B	SWGRSM8RM	EP	TR-81	TRAN	SWGRSM8RM
BUSSM8	4160	AC/B	SWGRSM8RM	EP	TR-83	TRAN	SWGRSM8RM
BUSSM8	4160	AC/B	SWGRSM8RM	SW	SSW-P1B	MDP	PMPHSB
DG-1	4160	AC/A	DG7RM	EP	BUSSM7	BUS	SWGRSM7RM
DG-1	4160	AC/A	DG7RM	EP	CB-7	CB	SWGRSM7RM
DG-1	4160	AC/A	DG7RM	EP	CB-7-1	CB	SWGRSM7RM
DG-2	4160	AC/B	DG8RM	EP	BUSSM8	BUS	SWGRSM8RM
DG-2	4160	AC/B	DG8RM	EP	CB-8	CB	SWGRSM8RM
DG-2	4160	AC/B	DG8RM	EP	CB-8-1	CB	SWGRSM8RM
DG-3	4160	AC/C	HPCSDGRM	EP	BUSSM4	BUS	HPCSDGRM
DG-3	4160	AC/C	HPCSDGRM	EP	CB4	CB	HPCSDGRM
EP-INST-D	120		UNKNOWN	I&C		PNL	CR
MCC4A	480	AC/C	HPCSDGRM	ECCS	HPCS-1	MOV	HPCSRM
MCC4A	480	AC/C	HPCSDGRM	ECCS	HPCS-10	MOV	HPCSRM

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC4A	480	AC/C	HPCSDGRM	ECCS	HPCS-11	MOV	HPCSRM
MCC4A	480	AC/C	HPCSDGRM	ECCS	HPCS-12	MOV	HPCSRM
MCC4A	480	AC/C	HPCSDGRM	ECCS	HPCS-15	MOV	HPCSRM
MCC4A	480	AC/C	HPCSDGRM	ECCS	HPCS-23	MOV	HPCSRM
MCC4A	480	AC/C	HPCSDGRM	ECCS	HPCS-4	MOV	522RB
MCC4A	480	AC/C	HPSDGRM	EP	SWH-29	MOV	PMPHSA
MCC4A	480	AC/C	HPCSDGRM	EP	SWH-4C	MOV	HPCSDGRM
MCC4A	480	AC/C	HPCSDGRM	SW	SWH-29	MOV	PMPHSA
MCC4A	480	AC/C	HPCSDGRM	SW	SWH-4C	MOV	PMPHSA
MCC7A	125	DC/A	RPSRM1	EP	BC-1	BC	BATCHGRM1
MCC7A	250	DC/C	RPSRM1	EP	BC-S2-1	BC	BATCHGRM1
MCC7A	480	AC/A	RPSRM1	EP	SSW-2A	MOV	PMPHSA
MCC7A	480	AC/A	RPSRM1	SW	SSW-12A	MOV	PMPHSA
MCC7A	480	AC/A	RPSRM1	SW	SSW-2A	MOV	PMPHSA
MCC7A	480	AC/A	RPSRM1	SW	SSW-69A	MOV	PMPHSA
MCC7A	480	AC/A	RPSRM1	SW	SSW-70B	MOV	PMPHSB
MCC7A-A	480	AC/C	DG7RM	EP	SSW-4A	MOV	DG7RM
MCC7B	480	AC/A	MCC7BRM	ECCS	LPCS-44	MOV	LPCSRM
MCC7B	480	AC/A	MCC7BRM	ECCS	SSW-24A	MOV	RHRPMPRMA
MCC7B-A	480	AC/A	MCC7BRM	ECCS	LPCS-1	MOV	LPCSRM
MCC7B-A	480	AC/A	MCC7BRM	ECCS	LPCS-11	MOV	LPCSRM
MCC7B-A	480	AC/A	MCC7BRM	ECCS	LPCS-12	MOV	LPCSRM
MCC7B-A	480	AC/A	MCC7BRM	ECCS	LPCS-5	MOV	522RB
MCC7B-A	480	AC/A	MCC7BRM	ECCS	RHR-24A	MOV	471RB
MCC7B-A	480	AC/A	MCC7BRM	ECCS	RHR-24A	MOV	471RB
MCC7B-A	480	AC/A	MCC7BRM	ECCS	RHR-42A	MOV	522RB
MCC7B-A	480	AC/A	MCC7BRM	ECCS	RHR-4A	MOV	RHRPMPRMA
MCC7B-A	480	AC/A	MCC7BRM	ECCS	RHR-6A	MOV	RHRPMPRMA
MCC7B-B	[illegible]	AC/A	MCC7B-BRM	ECCS	RHR-16A	MOV	548RB
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-16A	MOV	548RB
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-17A	MOV	548RB

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-17A	MOV	548RB
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-3A	MOV	RHRHXRMA
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-47A	MOV	RHRHXRMA
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-48A	MOV	RHRHXRMA
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-48A	MOV	RHRHXRMA
MCC7B-B	480	AC/A	MCC7B-BRM	ECCS	RHR-68A	MOV	RHRHXRMA
MCC8A	125	DC/B	RPSRM2	EP	BC-2	BC	BATCHGRM2
MCC8A	480	AC/B	RPSRM2	EP	SSW-2B	MOV	PMPHSB
MCC8A	480	AC/B	RPSRM2	SW	SSW-115	MOV	RHRHXRMB
MCC8A	480	AC/B	RPSRM2	SW	SSW-12B	MOV	PMPHSB
MCC8A	480	AC/B	RPSRM2	SW	SSW-2B	MOV	PMPHSB
MCC8A	480	AC/B	RPSRM2	SW	SSW-69B	MOV	PMPHSB
MCC8A	480	AC/B	RPSRM2	SW	SSW-70A	MOV	PMPHSA
MCC8A-A	480	AC/B	DG8RM	EP	SSW-4B	MOV	DG8RM
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-16B	MOV	548RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-16B	MOV	548RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-17B	MOV	548RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-17B	MOV	548RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-21	MOV	RHRPMPRMC
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-24B	MOV	471RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-24B	MOV	471RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-42B	MOV	522RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-42C	MOV	522RB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-4B	MOV	RHRPMPRMB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-4C	MOV	RHRPMPRMC
MCC8B-A	480	AC/B	MCC8BRM	ECCS	RHR-6B	MOV	RHRPMPRMB
MCC8B-A	480	AC/B	MCC8BRM	ECCS	SSW-24	MOV	RHRPMPRMC
MCC8B-A	480	AC/B	MCC8BRM	ECCS	SSW-24B	MOV	RHRPMPRMB
MCC8B-A	125	AC/B	MCC8BRM	RCIC	RCIC-63	MOV	RC
MCC8B-A	480	AC/B	MCC8BRM	RCS	RCIC-63	MOV	RC
MCC8B-A	480	AC/B	MCC8BRM	RCS	RCS-1	MOV	RC

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

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
MCC8B-A	480	AC/B	MCC8BRM	RCS	RCS-16	MOV	RC
MCC8B-A	480	AC/B	MCC8BRM	RCS	RHR-9	MOV	RC
MCC8B-B	480	AC/B	MCC8B-BRM	ECCS	RHR-3B	MOV	RHRHXRMB
MCC8B-B	480	AC/B	MCC8B-BRM	ECCS	RHR-47B	MOV	RHRHXRMB
MCC8B-B	480	AC/B	MCC8B-BRM	ECCS	RHR-48B	MOV	RHRHXRMB
MCC8B-B	480	AC/B	MCC8B-BRM	ECCS	RHR-48B	MOV	RHRHXRMB
MCC8B-B	480	AC/B	MCC8B-BRM	ECCS	RHR-68B	MOV	RHRHXRMB
MCCS1-1D	125	DC/A	RPSRM1	RCIC	RCIC-10	MOV	RCICRM
MCCS1-1D	125	DC/A	RPSRM1	RCIC	RCIC-31	MOV	RCICRM
MCCS1-1D	125	DC/A	RPSRM1	RCIC	RCIC-68	MOV	RCICRM
MCCS1-1D	125	DC/A	RPSRM1	RCIC	RCIC-8	MOV	RCICV8RM
MCCS1-1D	480	DC/A	RPSRM1	RCS	RCIC-8	MOV	RCICV8RM
MCCS2-1A	250	DC/C	MCCS2-1RM	RCIC	RCIC-13	MOV	RCICV13RM
MCCS2-1A	250	DC/C	MCCS2-1RM	RCIC	RCIC-45	MOV	RCICRM
MCCS2-1A	480	DC/C	MCCS2-1RM	RCS	RCIC-64	MOV	548RB
MCCS2-1A	480	DC/C	MCCS2-1RM	RCS	RHR-8	MOV	RHRV8RM
TR-71	480	AC/A	SWGRSM7RM	EP	BUS71	BUS	SWGRSM7RM
TR-73	480	AC/A	SWGRSM7RM	EP	BUS73	BUS	SWGRSM7RM
TR-81	480	AC/B	SWGRSM8RM	EP	BUS81	BUS	SWGRSM8RM
TR-83	480	AC/B	SWGRSM8RM	EP	BUS83	BUS	SWGRSM8RM
TR4-41	480	AC/C	HPCSDGRM	EP	MCC4A	MCC	HPCSDGRM

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, pumps, piping, filters, control valves, one hydraulic control unit for each control rod drive mechanism, and instrumentation. Water is supplied from the CST. The CRDHS also includes scram valves, scram accumulators, and a scram discharge volume (dump tank).

3.6.3 System Operation

During normal operation one CRDHS pump provides a constant flow for drive mechanism cooling and system pressure stabilization. One spare pump is provided for standby. A portion of the pump discharge flow is diverted through a minimum flow bypass line to the CST. 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.

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 dump tank. This coordinated action results in rapid insertion of control rods into the reactor.

Although not intended as a makeup system, the CRDHS can provide a source of cooling water to the RCS during vessel isolation. It is noted in NUREG-0626 (Ref 1), that this function is particularly important for some BWR/1 and BWR/2 plants for which the CRDHS is the primary source of makeup on vessel isolation. In later model BWR plants, RCS makeup at high pressure is performed by the RCIC (see Section 3.2) and HPCI or HPCS (see Section 3.3) systems. The maximum RCS makeup rate of the CRDHS is about 200 gpm with both pumps operating (Ref. 2).

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. Condensate Storage Tank
   1. Capacity: 400,000 gal

3.6.6 Support Systems and Interfaces

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

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

2. 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.

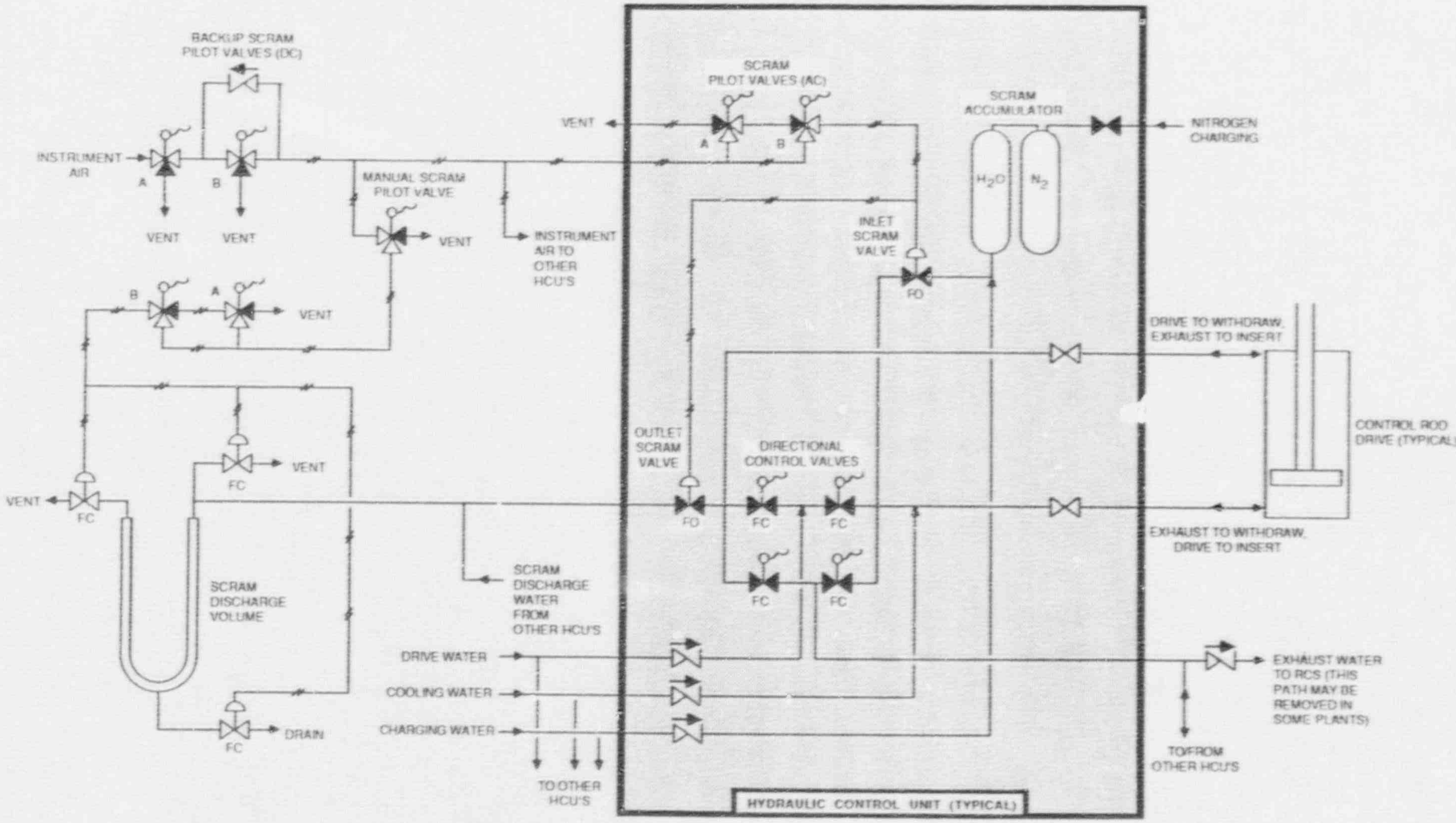


Figure 3.6-1. Simplified Diagram Of Portions Of The Control Rod Drive H.'draulic System That Are Related To The Scram Function

3.7 STANDBY SERVICE WATER (SSW) SYSTEM

3.7.1 System Function

The Standby Service Water System provides cooling water from the ultimate heat sink, the standby cooling tower, to various heat loads in the plant, including the Division 1 2, and HPCS diesel generators, RHR heat exchangers, RHR pump seal coolers, various room cooler units, and the control room air conditioners. The SSWS can also be used for containment flooding via injection through RHR Loop B.

3.7.2 System Definition

The SSW system contains three motor driven pumps which take suction from Spray Ponds A and B. The pumps supply three headers from which the heat loads are supplied. The two redundant systems A and B serve ECCS equipment, auxiliary plant equipment, and reactor shutdown cooling equipment. The third supply line serves the HPCS diesel generator and HPCS pump room cooler.

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

3.7.3 System Operation

The SSW system has the capability to provide cooling water to essential equipment through three separate supply lines. The A and B supply lines are capable of providing sufficient cooling water for all of the following minimum conditions which are essential to the safe shutdown of the reactor:

- One or two RHR pumps operating
- One standby diesel generator and one RHR heat exchanger operating
- One control room, cable room, and critical switchgear room air conditioning chillers operating
- One or two MCC rooms operating
- The RCIC room chiller or LPCS pump operating

The HPCS supply line serves the HPCS diesel generator and the HPCS pump room cooler.

During power operation, the SSW system is normally in standby. During the normal shutdown cooling mode of operation, water is circulated from the spray ponds through the RHR heat exchangers to the cooling towers for heat removal. The cooling water is returned from the cooling towers by gravity to the spray ponds for reuse. All SSW pumps are automatically started upon receipt of an ECCS actuation signal. Redundant spray pond low level switches in each spray pond pumphouse automatically close the redundant isolation valves on the SSW return line to the cooling towers and open the isolation valve to the spray pond. An ECCS signal also automatically performs this function. During the emergency shutdown mode of operation, service water is taken from the spray ponds, routed to the equipment requiring cooling, and returned to the spray ponds where it is cooled prior to recirculation.

The SSW pumps are provided with double-valved, normally closed bypass connections for transferring water from one spray pond to another. Should the service water pump be unavailable for transfer purposes, an atmospheric siphon is available for backup purposes. The two spray ponds are sized to have a combined equivalent storage for at least 30 days of SSW system operation.

An intertie with the RHR system is provided from the B loop of the SSW system supply header which contains two remote manually-operated isolation valves. These valves can be opened from the main control room in the event that primary containment flooding is necessary.

3.7.4 Success Criteria

The SSW system success criteria are described on a per train (header) basis. If the equipment in a particular header requires cooling, the SSW pump that serves the header must operate and there must be an intact flow path from the pump to the heat loads.

3.7.5 Component Information

A. Standby Service Water Pumps 1A, 1B, and 2
   1. Rated flow: 10,500 gpm @ 500 ft. head (217 psid) for P1A and P1B; 1200 gpm @123 ft. head (53 psid) for P2
   2. Rated capacity: 100%
   3. Type: vertical centrifugal

3.7.6 Support Systems and Interfaces

A. Control Signals
   1. Automatic
      Upon receipt of an ECCS signal, all pumps are started.
   2. Remote manual
      The SSW pumps can be actuated by remote manual means from the control room.

B. Motive Power
   1. The SSW pumps are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.5. Pump 1A is supplied from DG-1, pump 1B is supplied from DG-2, and pump 2 is supplied from DG-3.

C. Pump cooling and lubrication services are assumed to be local to the pump.

D. Pump room cooling system configuration is not known.

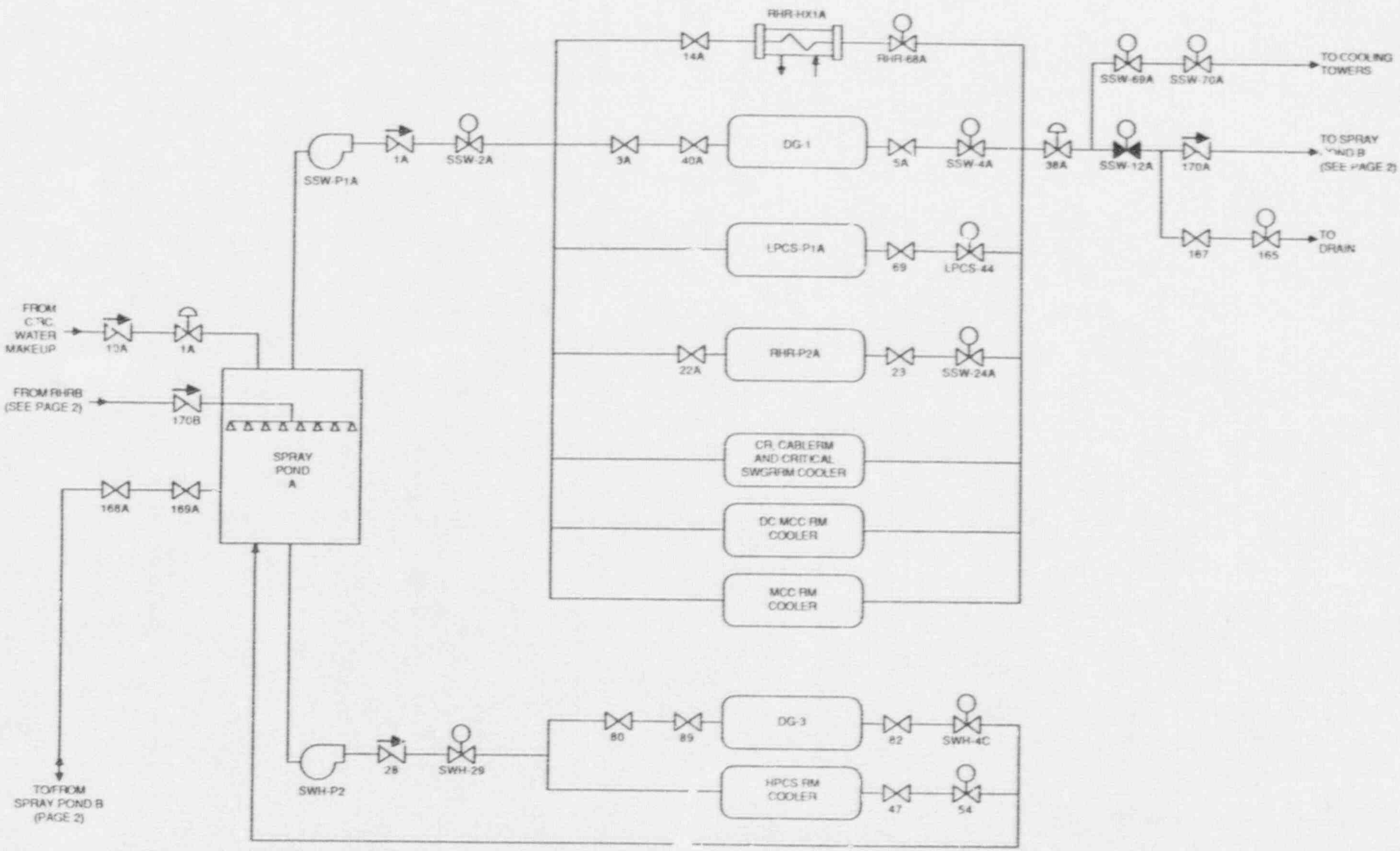


Figure 3.7-1. WNP-2 Standby Service Water System (Page 1 of 2)

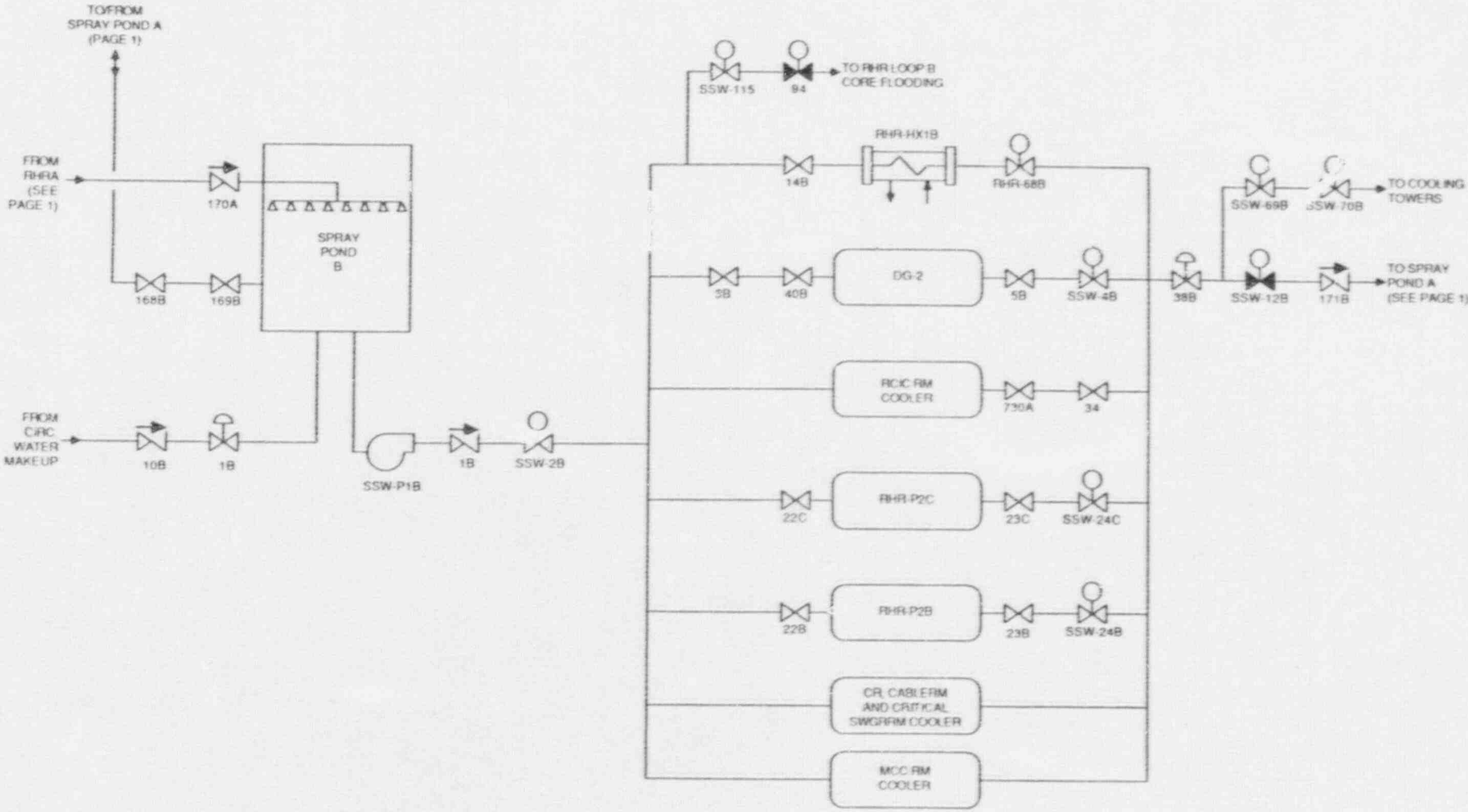
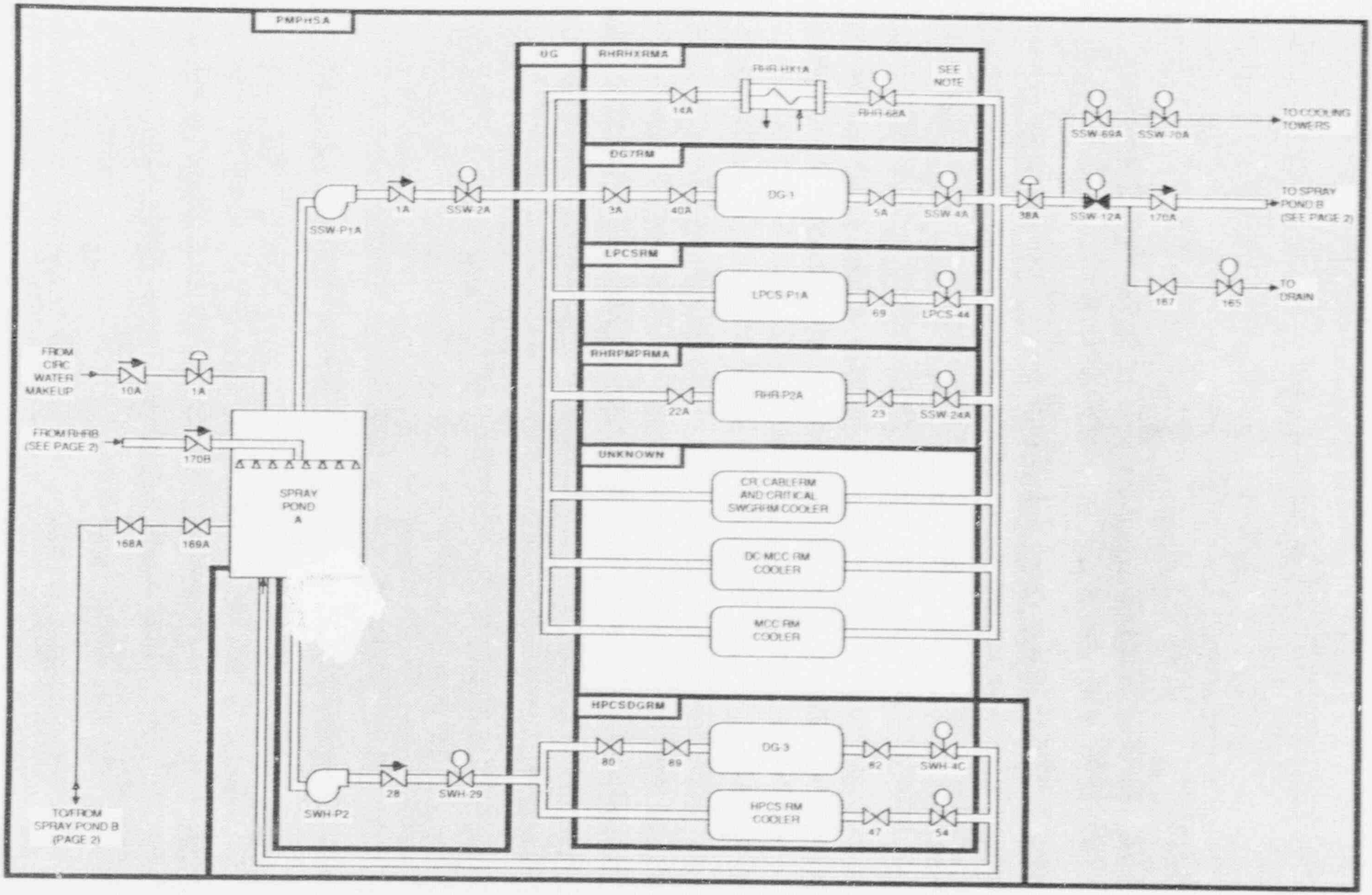
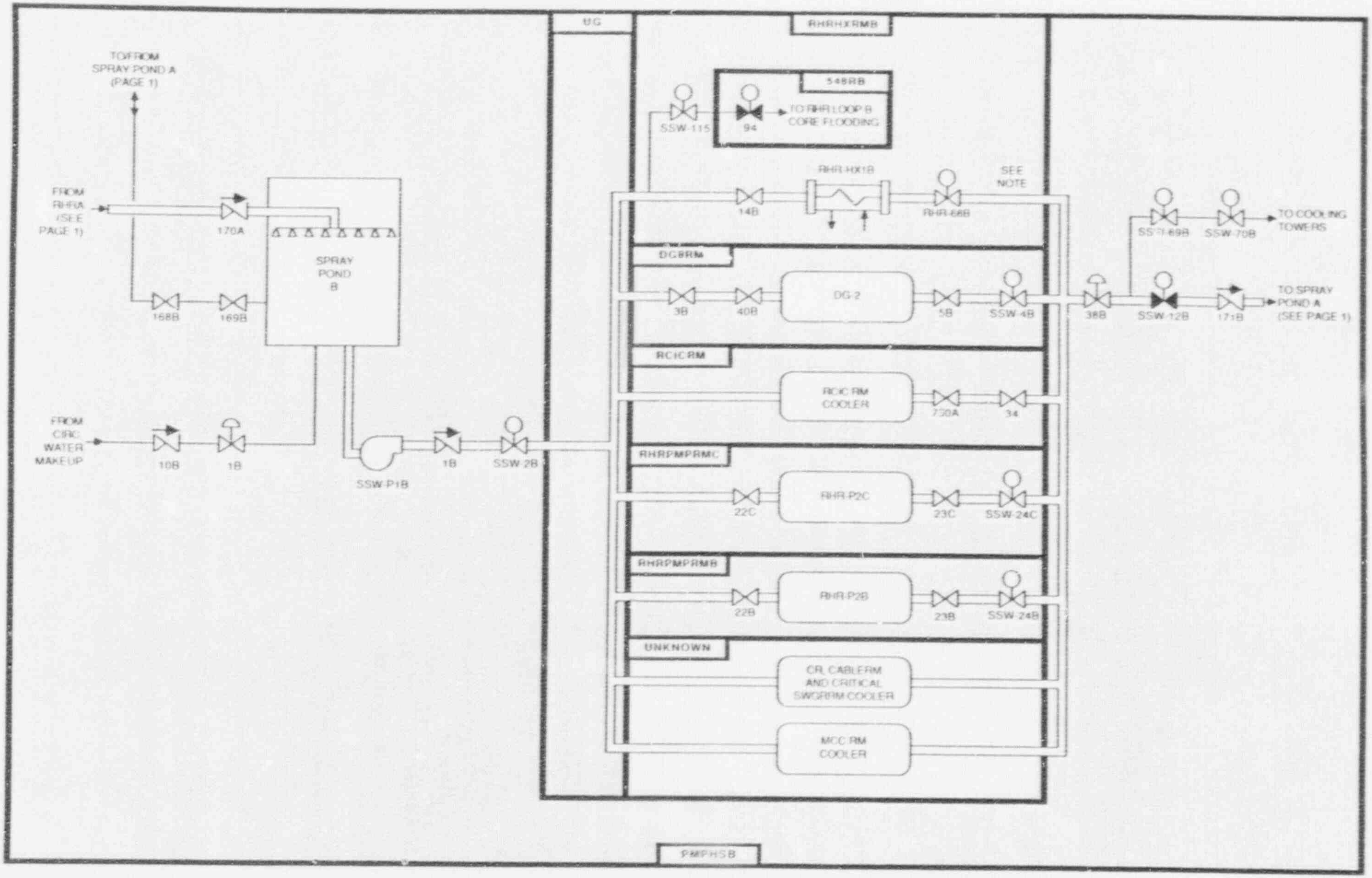


Figure 3.7-1. WNP-2 Standby Service Water System (Page 2 of 2)



NOTE: PIPING SECTIONS ARE EXPOSED IN ROOM 471RB, 501RB, 522RB AND CRDPMPRM. EXACT CONFIGURATION IS NOT KNOWN

Figure 3.7-2. WNP-2 Standby Service Water System Showing Component Locations (Page 1 of 2)



NOTE: PIPING SECTIONS ARE EXPOSED IN ROOM 471RB, 501RB, 522RB AND CRDPMPRM. EXACT CONFIGURATION IS NOT KNOWN.

Figure 3.7-2. WNP-2 Standby Service Water System Showing Component Locations (Page 2 of 2)

Table 3.7-1. WNP-2 Standby Service Water System Data Summary for Selected Components

SYSTEM	COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SW	SSW-115	MOV	RHRHXRMB	MCC8A	480	RPSRM2	AC/B
SW	SSW-12A	MOV	PMPHSA	MCC7A	480	RPSRM1	AC/A
SW	SSW-12B	MOV	PMPHSB	MCC8A	480	RPSRM2	AC/B
SW	SSW-2A	MOV	PMPHSA	MCC7A	480	RPSRM1	AC/A
SW	SSW-2B	MOV	PMPHSB	MCC8A	480	RPSRM2	AC/B
SW	SSW-69A	MOV	PMPHSA	MCC7A	480	RPSRM1	AC/A
SW	SSW-69B	MOV	PMPHSB	MCC8A	480	RPSRM2	AC/B
SW	SSW-70A	MOV	PMPHSA	MCC8A	480	RPSRM2	AC/B
SW	SSW-70B	MOV	PMPHSB	MCC7A	480	RPSRM1	AC/A
SW	SSW-P1A	MDP	PMPHSA	BUSSM7	4160	SWGRSM7RM	AC/A
SW	SSW-P1B	MDP	PMPHSB	BUSSM8	4160	SWGRSM8RM	AC/B
SW	SWH-29	MOV	PMPHSA	MCC4A	480	HPCSDGRM	AC/C
SW	SWH-4C	MOV	PMPHSA	MCC4A	480	HPCSDGRM	AC/C
SW	SWH-P2	MDP	PMPHSA	BUSSM4	4160	HPCSDGRM	AC/C

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The WNP-2 nuclear plant is located in the southeast area of the U.S. Department of Energy's Hanford Site in Benton County, Washington, approximately eight miles north of North Richland. Figure 4-1 (from Ref. 1) shows a general view of the site and the surrounding area.

The major structures at this facility include the reactor building, turbine generator building, radwaste building, diesel generator building, control building, and cooling towers. The site general arrangement is shown in Figures 4-2 and 4-3. The reactor building is located on the south side of the turbine building. This building contains the primary containment housing the reactor vessel, ECCS and RCIC components and recirculation piping, the spent fuel pool, and various motor control centers. Elevation views of the WNP-2 reactor building are shown in Figure 4-4. The diesel generator building is located south of the reactor building and houses the emergency diesel generators. The radwaste building is west of the diesel generator building and contains the control room, switchgear and electrical equipment rooms, cable room, reactor protection system and remote shutdown rooms. Spray ponds and SSW pump houses are located southeast of the reactor building. The SSW cooling towers are located to the south of the reactor building and serve as the plant's ultimate heat sink.

4.2 FACILITY LAYOUT DRAWINGS

Figures 4-5 through 4-14 are simplified building plan drawings. Some outlying buildings are not shown on these drawings. Major rooms, stairways, elevators, and doorways are shown in the simplified layout drawings, however, many interior walls have been omitted for clarity. Labels printed in uppercase correspond to the location codes listed in Table 4-1 and used in the component data listings and system drawings in Section 3. Some additional labels are included for information and are printed in lowercase type.

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

4.3 SECTION 4 REFERENCES

1. Heddleson, F.A., "Design Data and Safety Features of Commercial Nuclear Power Plants.", ORNL-NSIC-55, Volume 2, Oak Ridge National Laboratory, Nuclear Safety Information Center, January 1972.

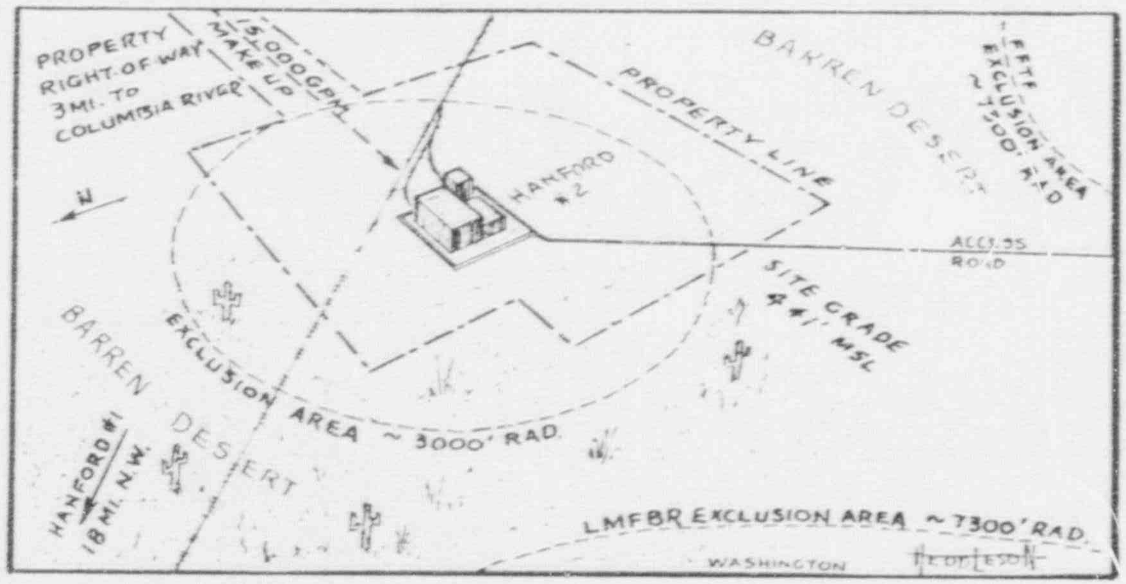


Figure 4-1. General View of the WNP-2 Site and Vicinity

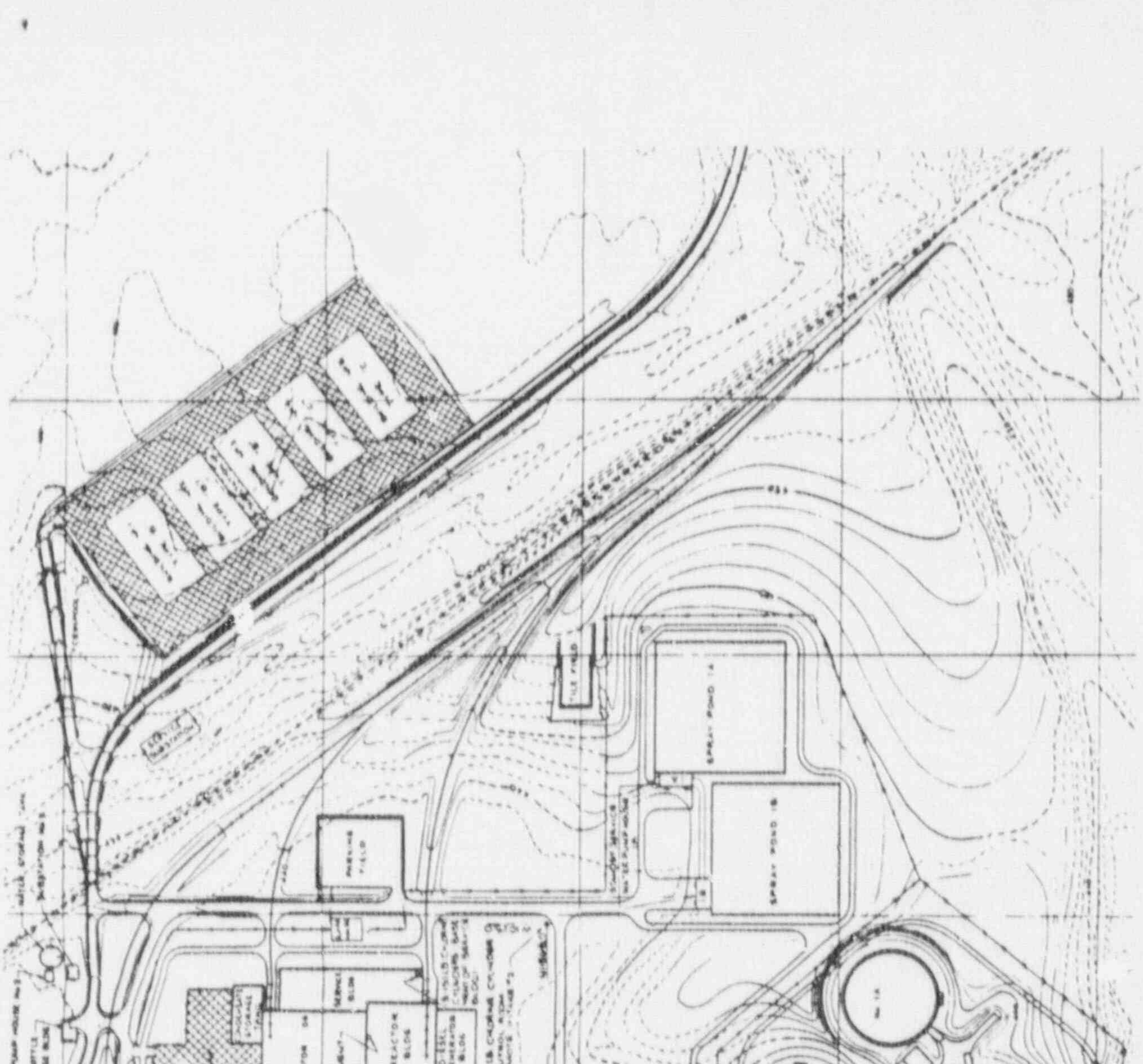


Figure 4-2. WNP-2 Site Map

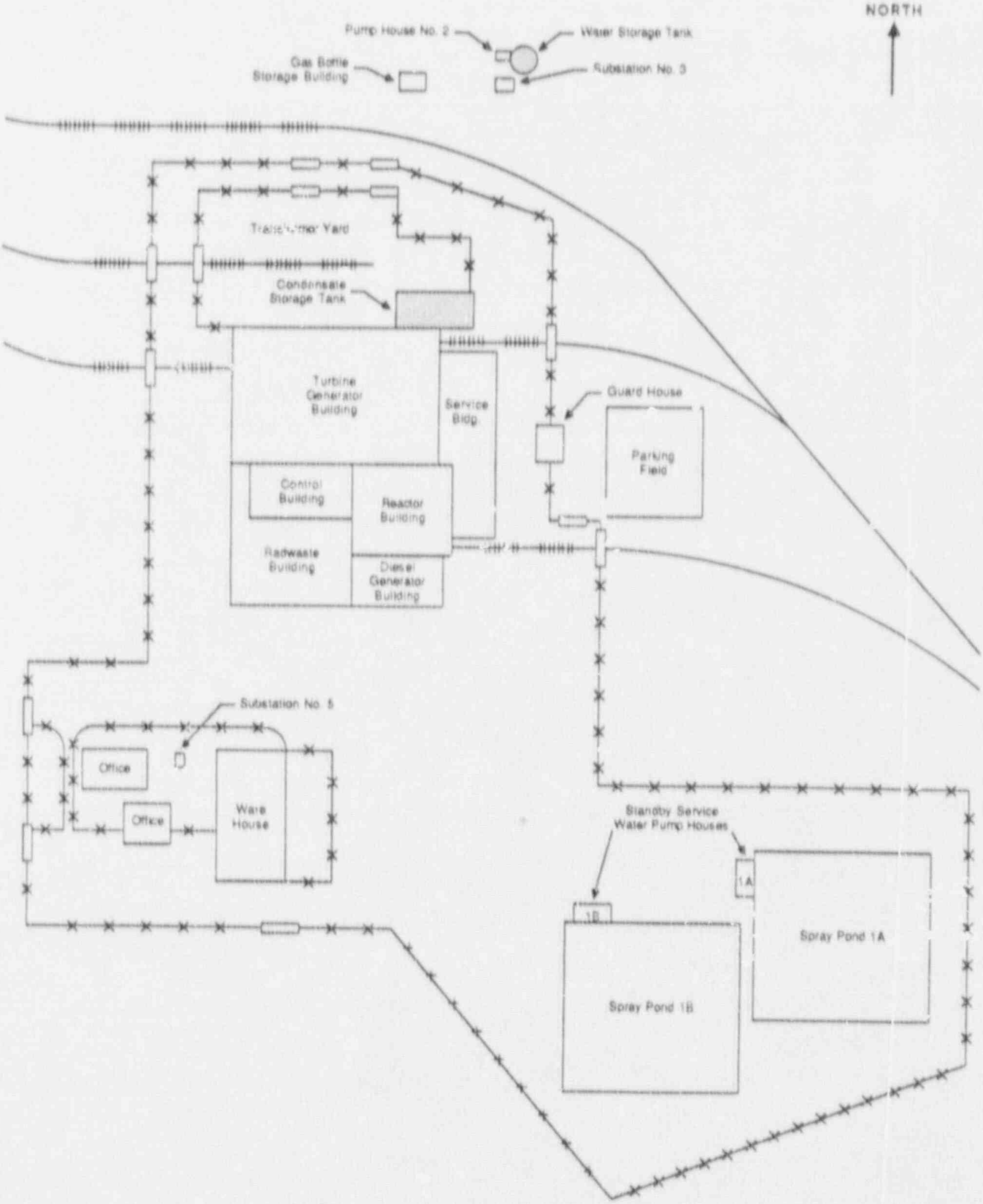


Figure 4-3. WNP-2 Simplified Site Plan

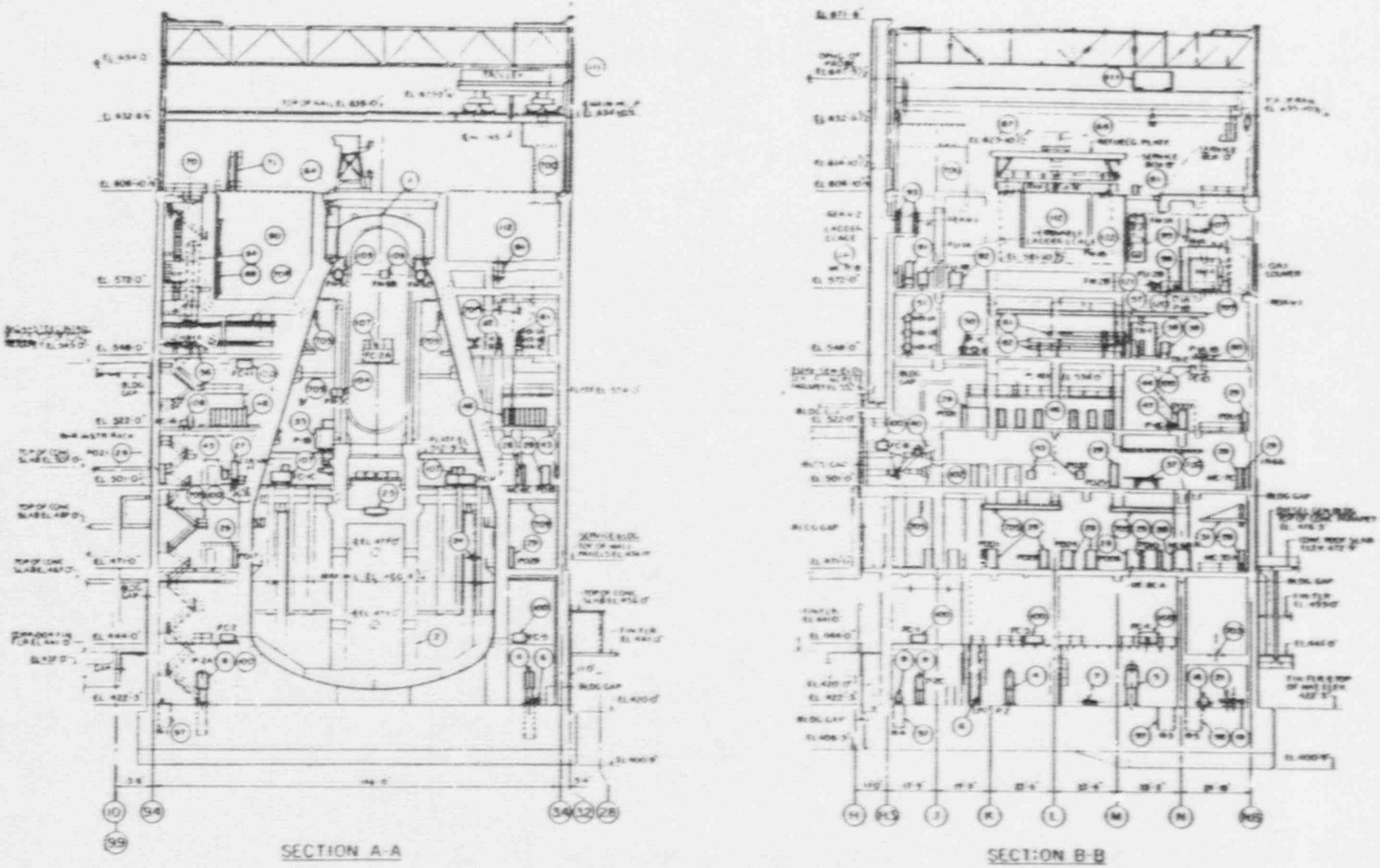


Figure 4-4. Elevation Views of WNP-2 Reactor Building

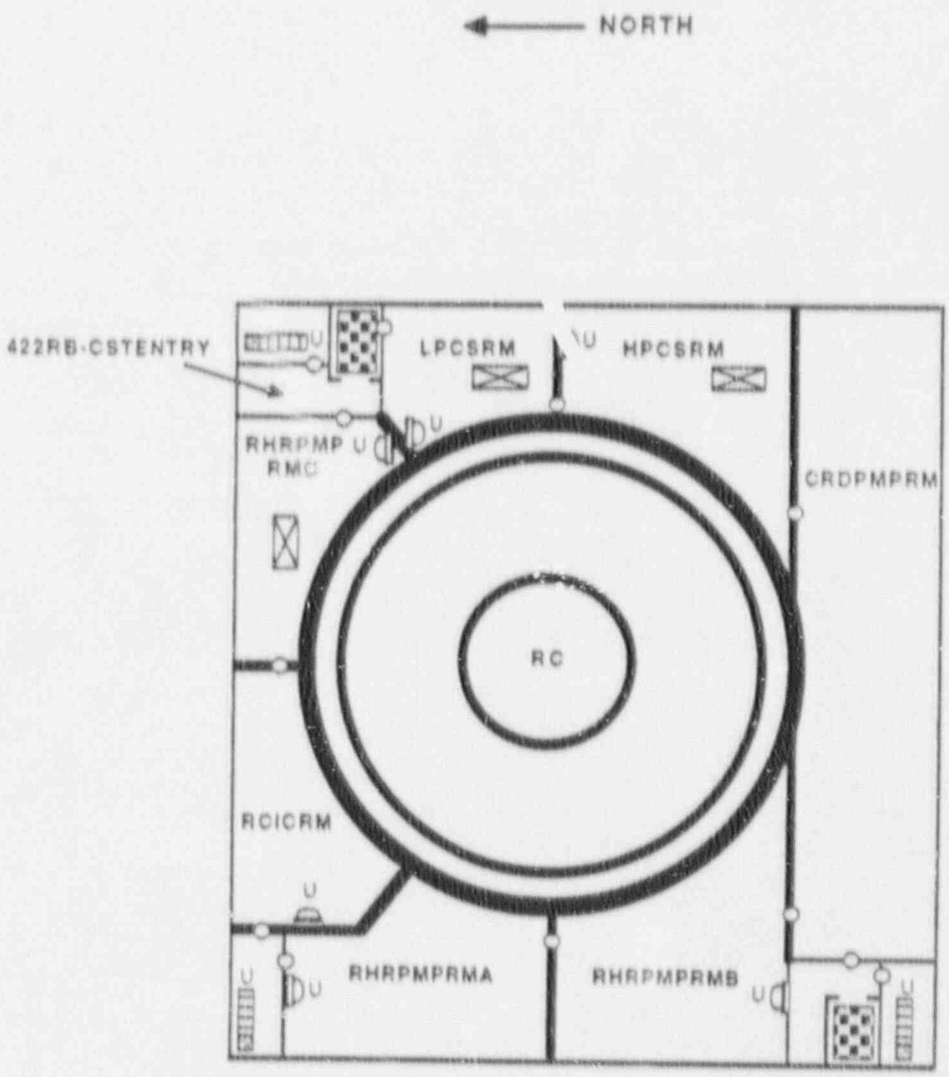


Figure 4-5. WNP-2 Reactor Building Elevation 422'3"

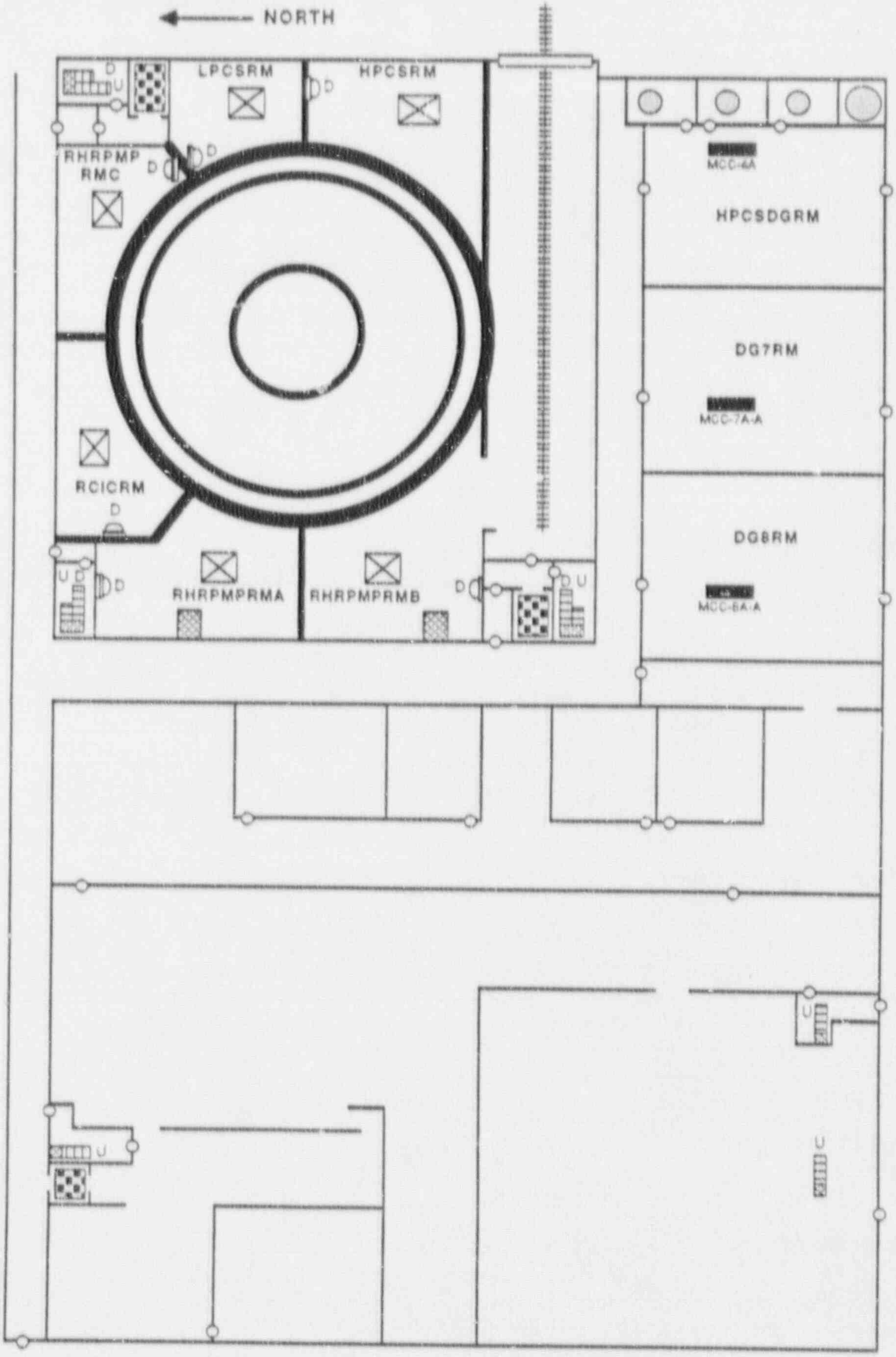


Figure 4-6. WNP-2 Reactor Building Elevation 441'0" to 444'0", Diesel Generator Building Elevation 441'0" and Radwaste Building Elevation 437'0"

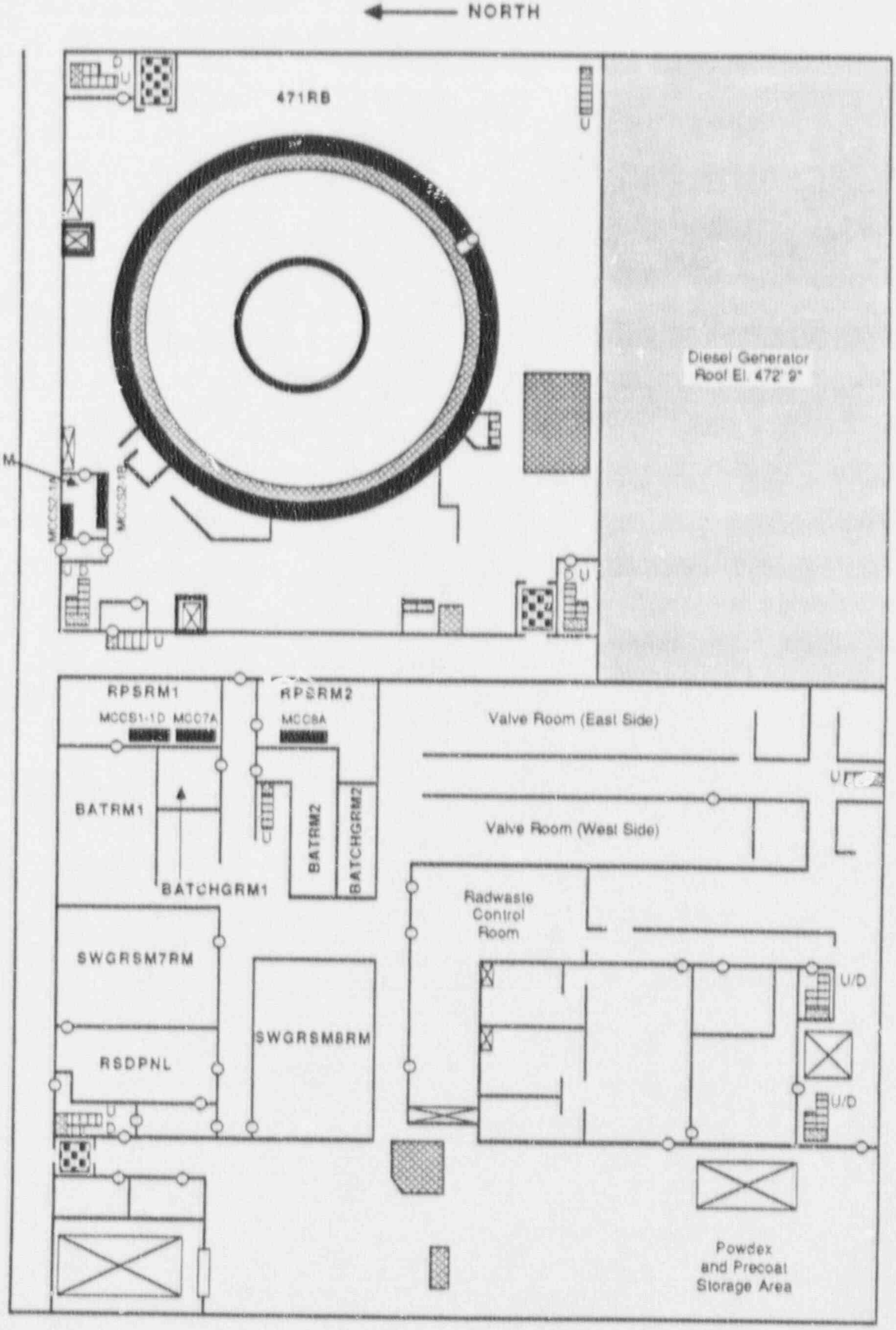


Figure 4-7. WNP-2 Reactor Building Elevation 471'0" and Control and Radwaste Buildings Elevation 467'0"

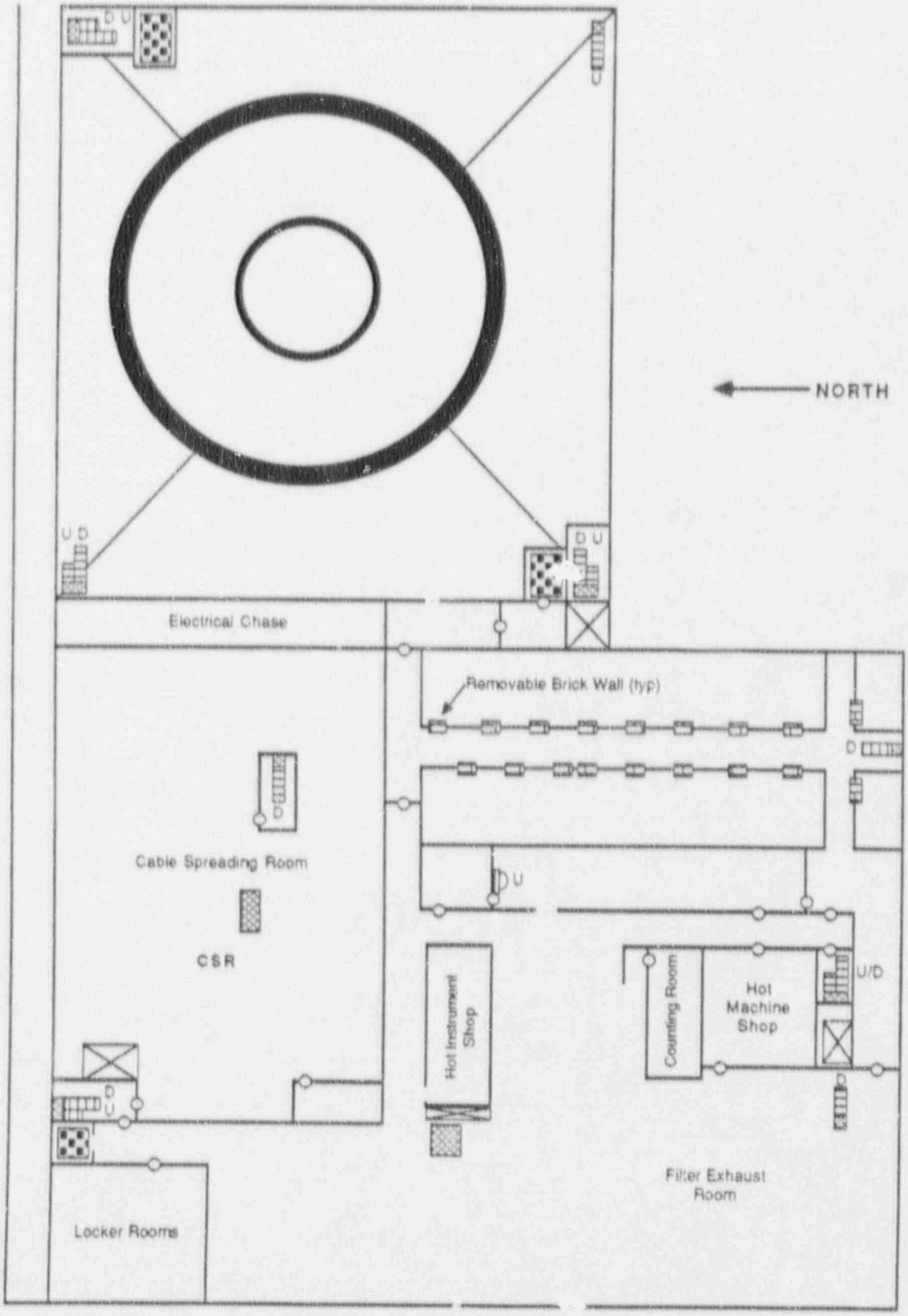


Figure 4-8. WNP-2 Reactor, Control and Radwaste Buildings Elevations 484' 0" and 487'0"

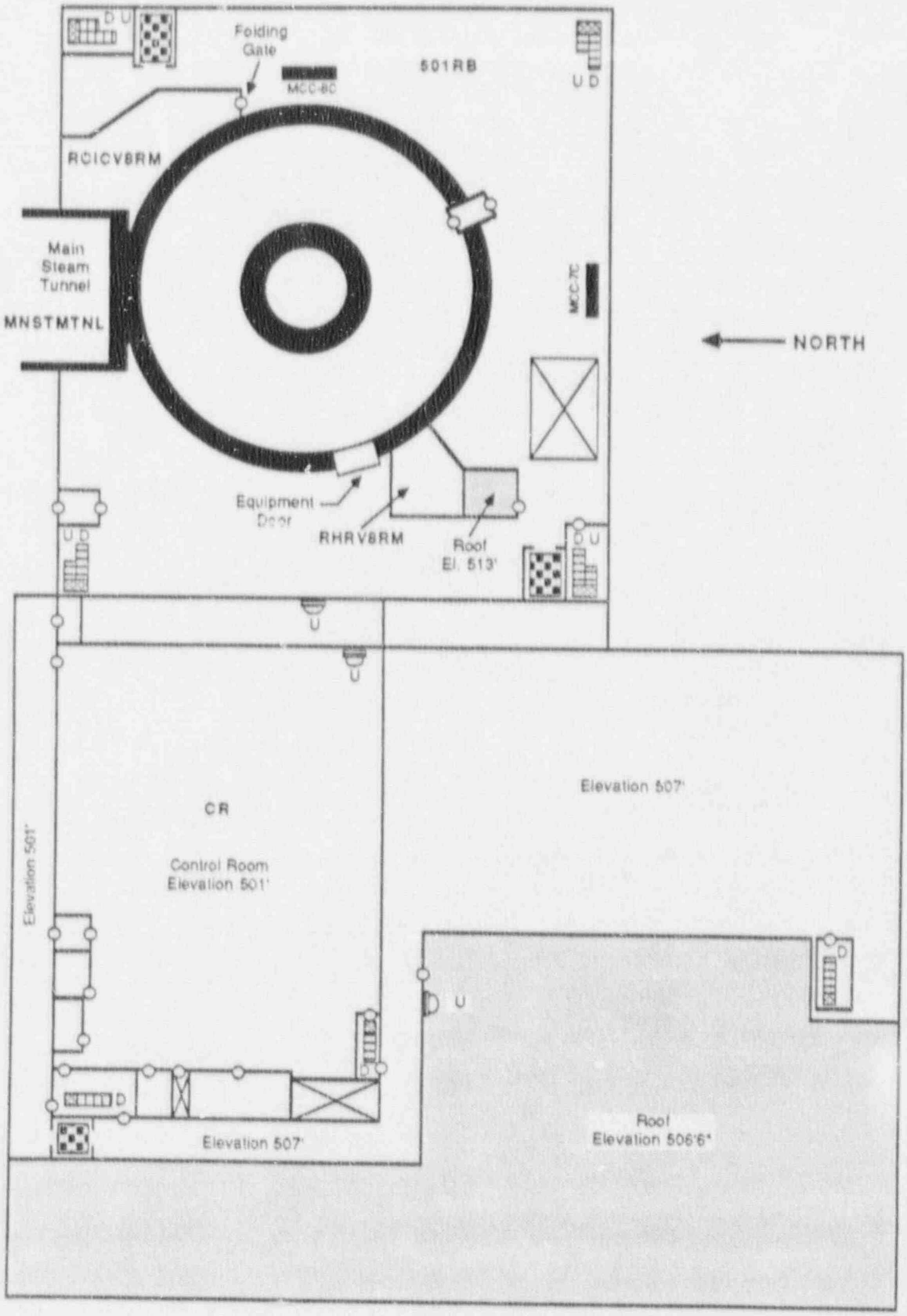


Figure 4-9. WNP-2 Reactor Building, Elevation 501' 0" and Control and Radwaste Buildings, Elevations 501' 0" and 507' 0"

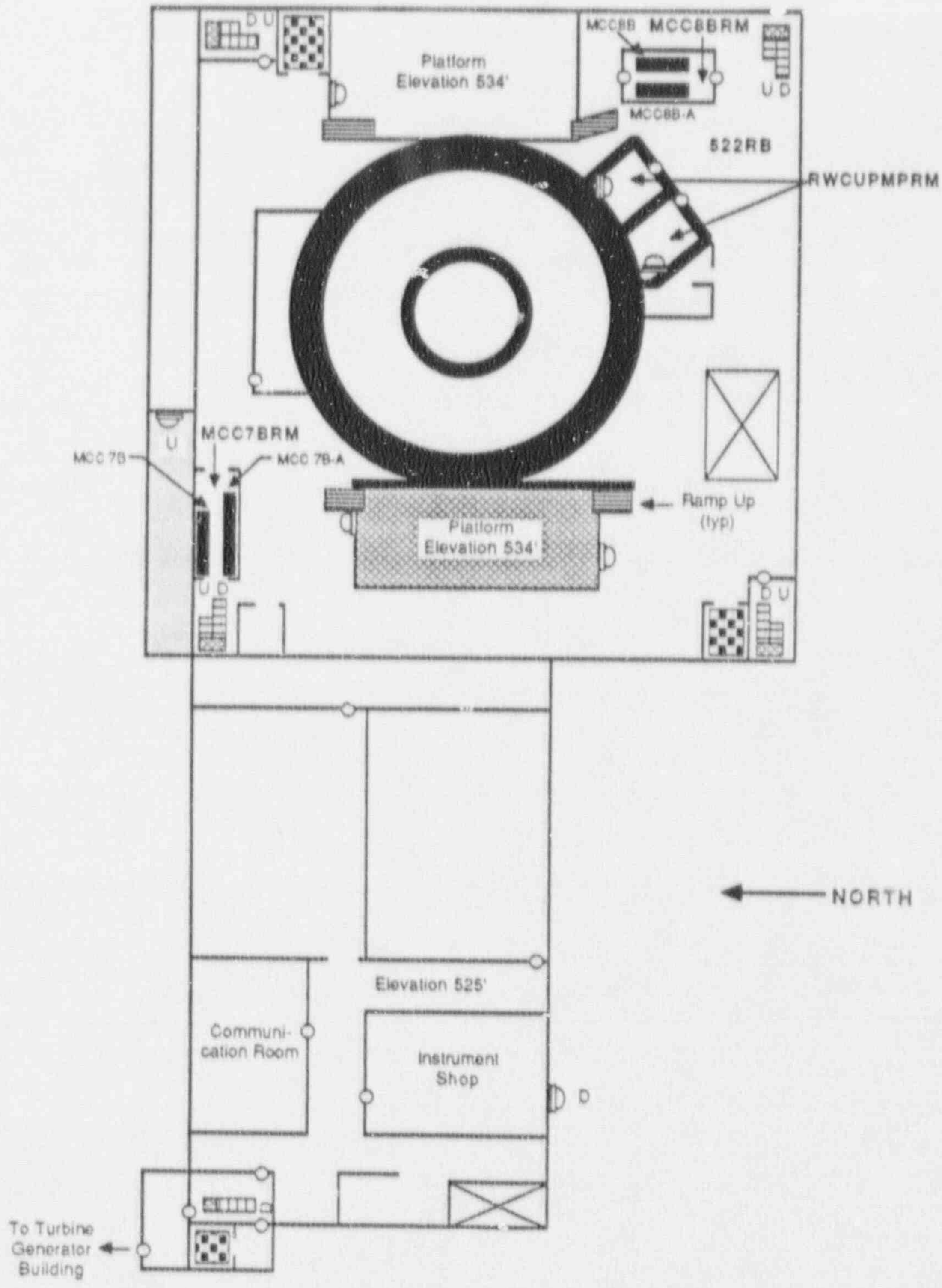


Figure 4-10. WNP-2 Reactor Building, Elevation 522'0" to 534'0" and Control and Radwaste Buildings, Elevation 525'0"

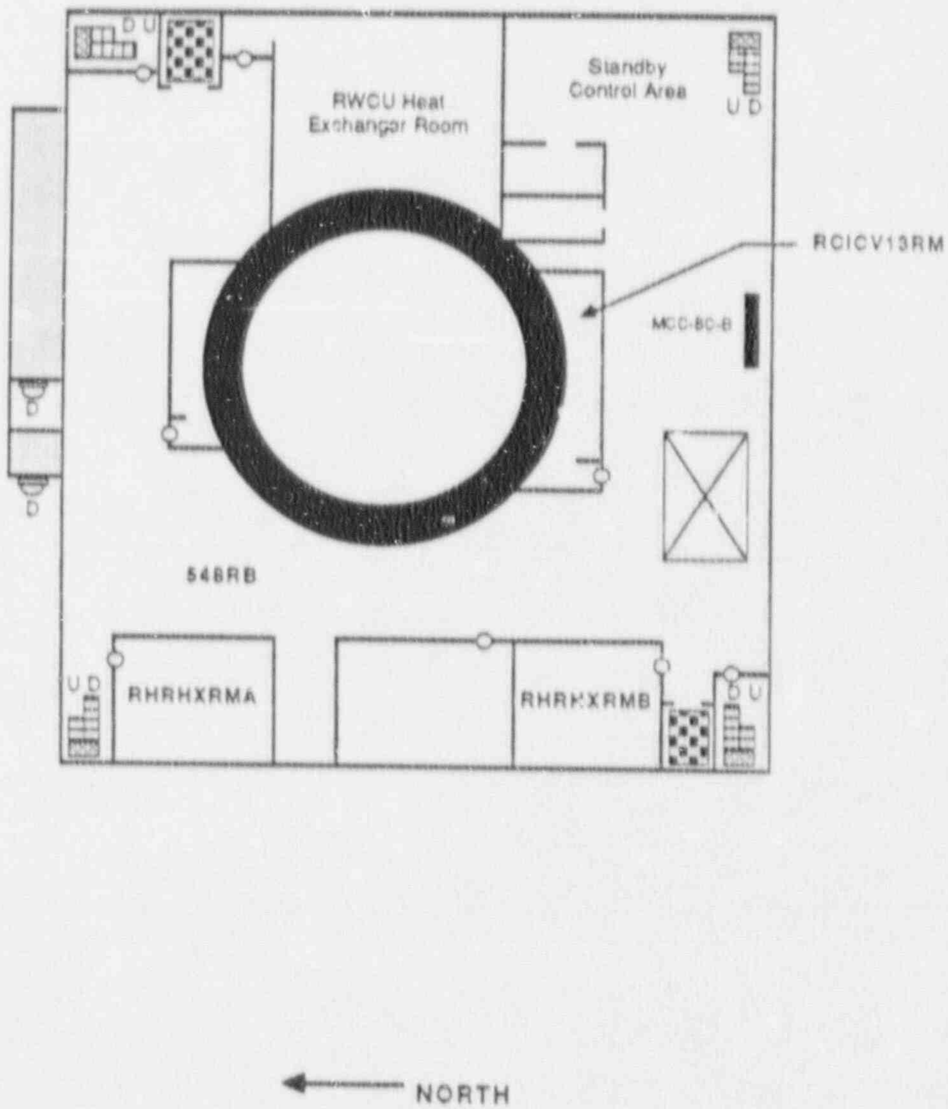


Figure 4-11. WNP-2 Reactor Building, Elevation 548' 0"

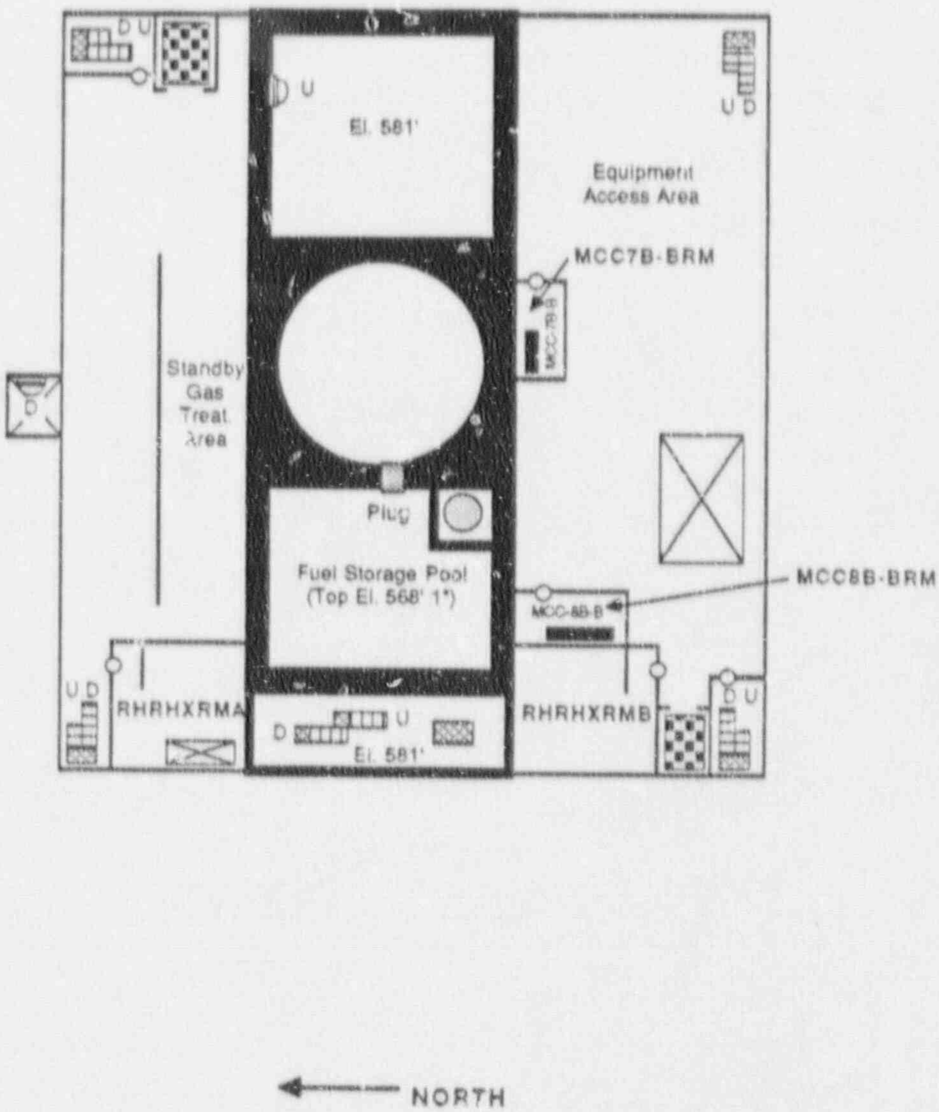


Figure 4-12. WNP-2 Reactor Building, Elevation 572' 0"

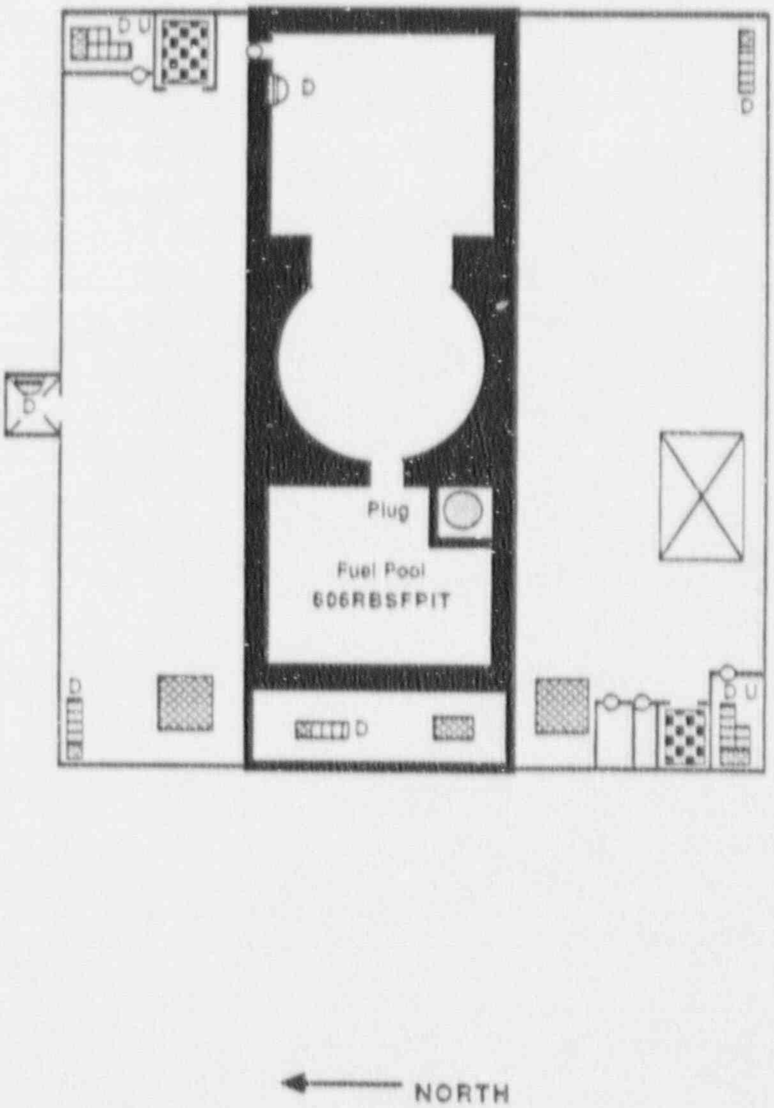
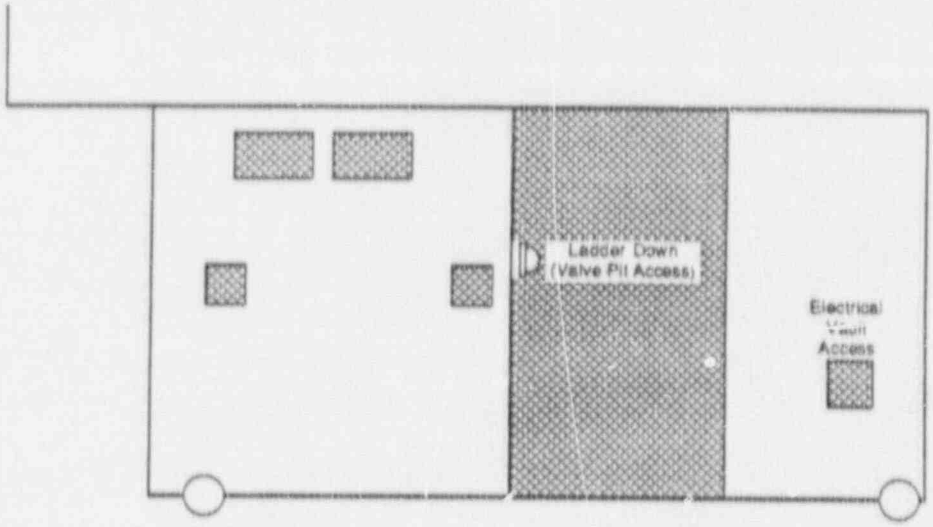
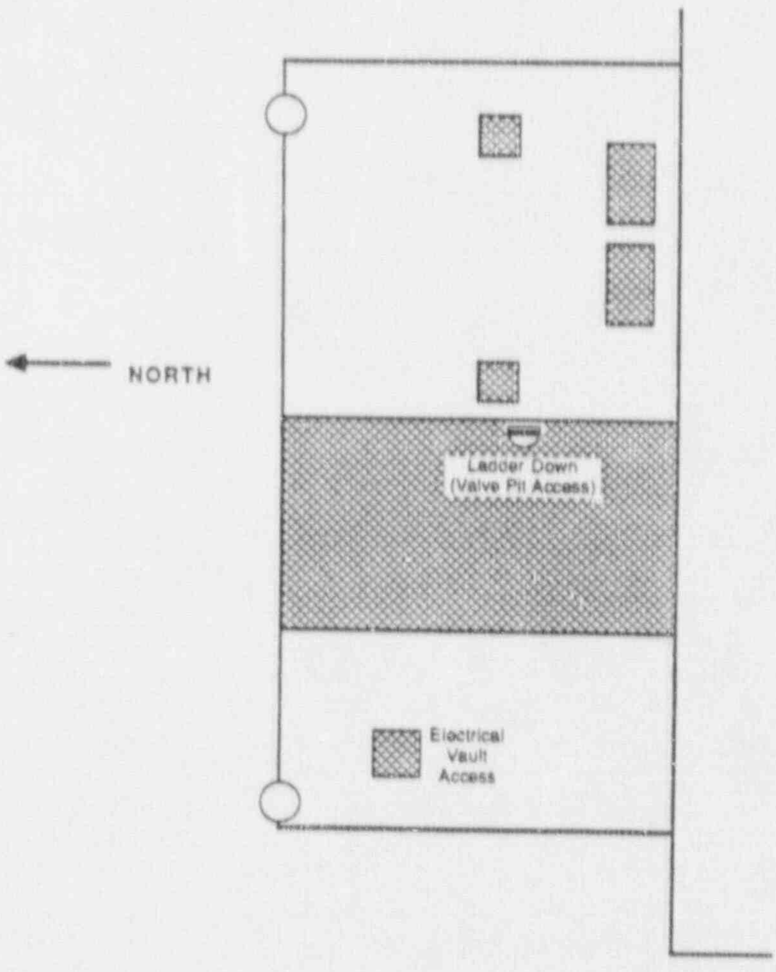


Figure 4-13. WNP-2 Reactor Building, Elevation 606'10"



Pump House 1A



Pump House 1B

Figure 4-14. WNP-2 Pumphouses, Elevation 441'0"

Table 4-1. Definition of WNP-2 Building and Location Codes

	Codes	Descriptions
1.	422RB-CSTENTRY	Northeast Stair Well on the 422' elevation of the Reactor Building where pipe from the CST enters
2.	471RB	471' elevation of the Reactor Building
3.	501RB	501' elevation of the Reactor Building
4.	522RB	522' elevation of the Reactor Building
5.	548RB	548' elevation of the Reactor Building
6.	606RBSFPIT	Top Level of Spent Fuel Pit on the 606' elevation of the Reactor Building
7.	BATCHGRM1	Battery Charger Room No.1 on the 467' elevation of the Radwaste Building
8.	BATCHGRM2	Battery Charger Room No.2 on the 467' elevation of the Radwaste Building
9.	BATRM1	Battery Room No. 1 on the 467' elevation of the Radwaste Building
10.	BATRM2	Battery Room No. 2 on the 467' elevation of the Radwaste Building
11.	CR	Control Room on the 501' elevation of the Radwaste Building
12.	CRDPMPRM	Control Rod Drive Pump Room on the 422' elevation of the Reactor Building
13.	CSR	Cable Spreading Room on the 484' elevation of the Radwaste Building
14.	CST	Condensate Storage Tank, located outside adjacent to the Turbine Building
15.	DG1PNLRM	Diesel Generator 1 Distribution Panel D--S1-1E Room (Location Unknown)
16.	DG2PNLRM	Diesel Generator 2 Distribution Panel D--S1-2E Room (Location Unknown)
17.	DG7RM	Diesel Generator No. 1 Room on the 441' elevation of the ground level of the Generator Building

Table 4-1. Definition of WNP-2 Building and Location Codes (Continued)

Codes	Descriptions
18. DG8RM	Diesel Generator No. 2 Room on the 441' elevation of the ground level of the Generator Building
19. HPCSDGRM	High Pressure Core Spray Pump Diesel Generator Room on the 441' elevation of the Diesel Generator Building
20. HPCSRM	High Pressure Core Spray Pump Room on the 42' elevation of the Reactor Building
21. LPCSRM	Low Pressure Core Spray Pump Room on the 422' elevation of the Reactor Building
22. MCC7BRM	Motor Control Center 7B Room on the 522' elevation of the Reactor Building
23. MCC7B-BRM	Motor Control Center 7B-B Room on the 522' elevation of the Reactor Building
24. MCC8BRM	Motor Control Center 8B Room on the 572' elevation of the Reactor Building
25. MCC8B-BRM	Motor Control Center 8B-B Room on the 572' elevation of the Reactor Building
26. MCCS2-1RM	Motor Control Center S2-1 Room on the 471' elevation of the Reactor Building
27. MNSTMTNL	Main Steam Tunnel from Reactor Containment to Turbine Building on the 501' elevation of the Reactor Building
28. PMPHSA	Standby Service Water Pumphouse 1A at Spray Pond 1A, located southwest of the Reactor Building
29. PMPHSB	Standby Service Water Pumphouse 1A at Spray Pond 1B, located southwest of the Reactor Building
30. RC	Reactor Containment
31. RCICRM	Reactor core Isolation Cooling Pump Room on the 422' and 444' elevations of the Reactor Building
32. RCICV8RM	RCIC Valve No.8 Room on the 501' elevation of the Reactor Building
33. RCICV13RM	RCIC Valve No.13 Room on the 548' elevation of the Reactor Building

Table 4-1. Definition of WNP-2 Building and Location Codes (Continued)

Codes	Descriptions
34. RHRHXRMA	Residual Heat Exchanger A Room from 548' elevation to 606' elevation of the Reactor Building
35. RHRHXRMB	Residual Heat Exchanger B Room from 548' elevation to 606' elevation of the Reactor Building
36. RHRPMPRMA	Residual Heat Removal Pump A Room on 422' elevation and 444' elevation of the Reactor Building
37. RHRPMPRMB	Residual Heat Removal Pump B Room on 422' elevation and 444' elevation of the Reactor Building
38. RHRPMPRMC	Residual Heat Removal Pump C Room on 422' elevation and 444' elevation of the Reactor Building
39. RHRV8RM	Residual Heat Removal System Valve No. 8 Room on 501' elevation of Reactor Building
40. RPSRM1	Reactor Protection System Room No. 1 on the 467' elevation of the Radwaste Building
41. RPSRM2	Reactor Protection System Room No. 2 on the 467' elevation of the Radwaste Building
42. RSDPNL	Remote Shutdown Panel on 467' elevation of the Radwaste Building in Remote Shutdown Room
43. RWCUPMPRM	Reactor Water Cleanup Pump Room on the 522' elevation of the Reactor Building
44. SWGRSM7RM	Switchgear Room No. 1 on the 467' elevation of the Radwaste Building
45. SWGRSM8RM	Switchgear Room No. 2 on the 467' elevation of the Radwaste Building
46. TB	Turbine Building

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
471RB	ECCS	RHR-24A	MOV
471RB	ECCS	RHR-24B	MOV
471RB	ECCS	RHR-24A	MOV
471RB	ECCS	RHR-24B	MOV
522RB	ECCS	RHR-42B	MOV
522RB	ECCS	HPCS-4	MOV
522RB	ECCS	LPCS-5	MOV
522RB	ECCS	RHR-42A	MOV
522RB	ECCS	RHR-42C	MOV
548RB	ECCS	RHR-16A	MOV
548RB	ECCS	RHR-16B	MOV
548RB	ECCS	RHR-17B	MOV
548RB	ECCS	RHR-17A	MOV
548RB	ECCS	RHR-16A	MOV
548RB	ECCS	RHR-16B	MOV
548RB	ECCS	RHR-17A	MOV
548RB	ECCS	RHR-17B	MOV
548RB	RCS	RCIC-64	MOV
BATCHGRM1	EP	BC-S2-1	BC
BATCHGRM1	EP	BUSS1-1	BUS
BATCHGRM1	EP	BC-1	BC
BATCHGRM1	EP	BUSS2-1	BUS
BATCHGRM2	EP	BUSS1-2	BUS
BATCHGRM2	EP	BC-2	BC
BATRM1	EP	BT-B2-1	BATT
BATRM1	EP	BT-B1-1	BATT
BATRM2	EP	BT-B1-2	BATT
CST	ECCS	RCIC-CST	TANK
CST	RCIC	RCIC-CST	TANK
CST	RCIC	RCIC-CST	TANK

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
DG1PNLRM	EP	BUSS1-1E	PNL
DG2PNLRM	EP	BUSS1-2E	PNL
DG7RM	EP	DG-1	DG
DG7RM	EP	SSW-4A	MOV
DG8RM	EP	DG-2	DG
DG8RM	EP	SSW-4B	MOV
HPCSDGRM	EP	BUSSM4	BUS
HPCSDGRM	EP	CB4	CB
HPCSDGRM	EP	DG-3	DG
HPCSDGRM	EP	SWH-4C	MOV
HPCSDGRM	EP	DG3PB	PNL
HPCSDGRM	EP	BUSHPCS	BUS
HPCSDGRM	EP	BT-B1-HPCS	BATT
HPCSDGRM	EP	TR4-41	TRAN
HPCSDGRM	EP	MCC4A	MCC
HPCSRM	ECCS	HPCS-10	MOV
HPCSRM	ECCS	HPCS-11	MOV
HPCSRM	ECCS	HPCS-1	MOV
HPCSRM	ECCS	HPCS-15	MOV
HPCSRM	ECCS	HPCS-23	MOV
HPCSRM	ECCS	HPCS-P1	MDP
HPCSRM	ECCS	HPCS-12	MOV
LPCSRM	ECCS	LPCS-1	MOV
LPCSRM	ECCS	LPCS-12	MOV
LPCSRM	ECCS	LPCS-P1	MDP
LPCSRM	ECCS	LPCS-44	MOV
LPCSRM	ECCS	LPCS-11	MOV
PMPHSA	EP	SWH-29	MOV
PMPHSA	EP	SSW-2A	MOV
PMPHSA	SW	SWH-29	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
PMPHSA	SW	SWH-P2	MDP
PMPHSA	SW	SSW-2A	MOV
PMPHSA	SW	SSW-70A	MOV
PMPHSA	SW	SSW-69A	MOV
PMPHSA	SW	SSW-12A	MOV
PMPHSA	SW	SSW-P1A	MDP
PMPHSA	SW	SWH-4C	MOV
PMPHSB	EP	SSW-2B	MOV
PMPHSB	SW	SSW-2B	MOV
PMPHSB	SW	SSW-69B	MOV
PMPHSB	SW	SSW-70B	MOV
PMPHSB	SW	SSW-12B	MOV
PMPHSB	SW	SSW-P1B	MDP
RC	ECCS	RCS-SRV	SRV
RC	RCIC	RCIC-63	MOV
RC	RCS	RCS-VESSEL	RV
RC	RCS	RCS-SRV	SRV
RC	RCS	RCS-16	MOV
RC	RCS	RHR-9	MOV
RC	RCS	RCIC-63	MOV
RC	RCS	RCS-1	MOV
RC	RCS	RCS-SRV	SRV
RCICRM	RCIC	RCIC-31	MOV
RCICRM	RCIC	RCIC-10	MOV
RCICRM	RCIC	RCIC-P1	TDP
RCICRM	RCIC	RCIC-45	MOV
RCICRM	RCIC	RCIC-68	MOV
RCICV13RM	RCIC	RCIC-13	MOV
RCICV8RM	RCIC	RCIC-[illegible]	MOV
RCICV8RM	[illegible]	RCIC-8	MOV

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
RHRHXRMA	ECCS	RHR-HX1A	HX
RHRHXRMA	ECCS	RHR-3A	MOV
RHRHXRMA	ECCS	RHR-47A	MOV
RHRHXRMA	ECCS	RHR-48A	MOV
RHRHXRMA	ECCS	RHR-48A	MOV
RHRHXRMA	ECCS	RHR-68A	MOV
RHRHXRMA	SW	RHR-HX1A	HX
RHRHXRMB	ECCS	RHR-HX1B	HX
RHRHXRMB	ECCS	RHR-3B	MOV
RHRHXRMB	ECCS	RHR-47B	MOV
RHRHXRMB	ECCS	RHR-48B	MOV
RHRHXRMB	ECCS	RHR-48B	MOV
RHRHXRMB	ECCS	RHR-68B	MOV
RHRHXRMB	SW	RHR-HX1B	HX
RHRHXRMB	SW	SSW-115	MOV
RHRPMPRMA	ECCS	RHR-4A	MOV
RHRPMPRMA	ECCS	RHR-P2A	MDP
RHRPMPRMA	ECCS	SSW-24A	MOV
RHRPMPRMA	ECCS	RHR-6A	MOV
RHRPMPRMB	ECCS	RHR-4B	MOV
RHRPMPRMB	ECCS	RHR-P2B	MDP
RHRPMPRMB	ECCS	SSW-24B	MOV
RHRPMPRMB	ECCS	RHR-6B	MOV
RHRPMPRMC	ECCS	RHR-4C	MOV
RHRPMPRMC	ECCS	RHR-21	MOV
RHRPMPRMC	ECCS	RHR-P2C	MDP
RHRPMPRMC	ECCS	SSW-24	MOV
RHRV8RM	RCS	RHR-8	MOV
SWGRSM7RM	EP	BUSSM7	BUS
SWGRSM7RM	EP	CB-7	CB

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

LOCATION	SYSTEM	COMPONENT ID	COMP TYPE
SWGRSM7RM	EP	TR-71	TRAN
SWGRSM7RM	EP	TR-73	TRAN
SWGRSM7RM	EP	CB-7-1	CB
SWGRSM7RM	EP	BUS73	BUS
SWGRSM7RM	EP	BUS71	BUS
SWGRSM8RM	EP	BUSSM8	BUS
SWGRSM8RM	EP	CB-8	CB
SWGRSM8RM	EP	BUS81	BUS
SWGRSM8RM	EP	TR-81	TRAN
SWGRSM8RM	EP	BUS83	BUS
SWGRSM8RM	EP	TR-83	TRAN
SWGRSM8RM	EP	CB-8-1	CB

5. BIBLIOGRAPHY FOR WNP-2

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2. NUREG-0892, "Safety Evaluation Report Related to the Operation of WPPSS Nuclear Project No. 2", USNRC, March 1982

3. NUREG-1009, "Technical Specifications for WPPSS Project No. 2", USNRC

4. NUREG/CR-2836, Volume 1, Part 2, " Buckling of Steel Containment Shells, Task 1b, Washington Public Power Supply Systems Plant No. 2 Containment Vessel", Lockheed Palo Alto Research Laboratory, December 1982

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)

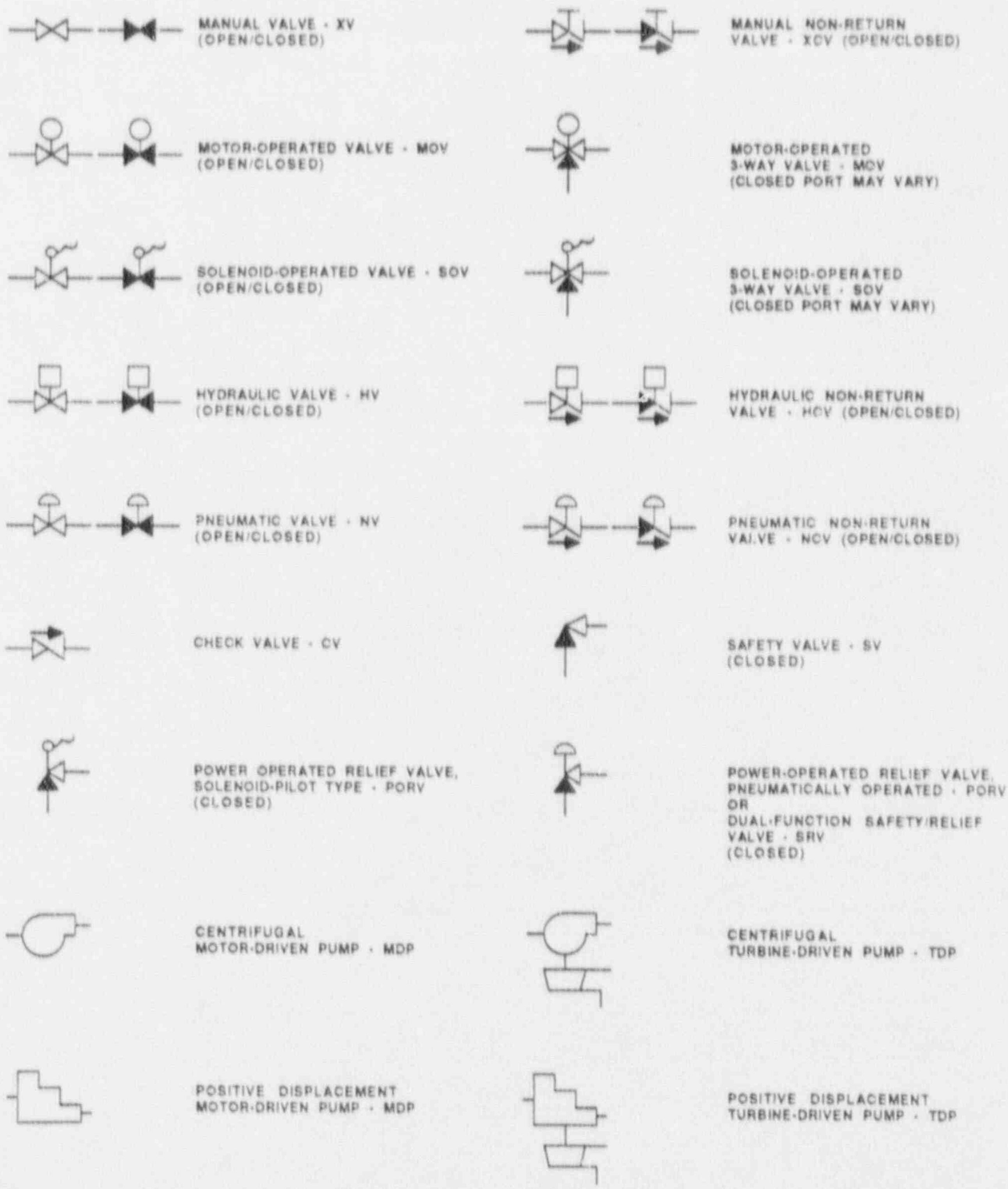

Figure A-1. Key To Symbols In Fluid System Drawings

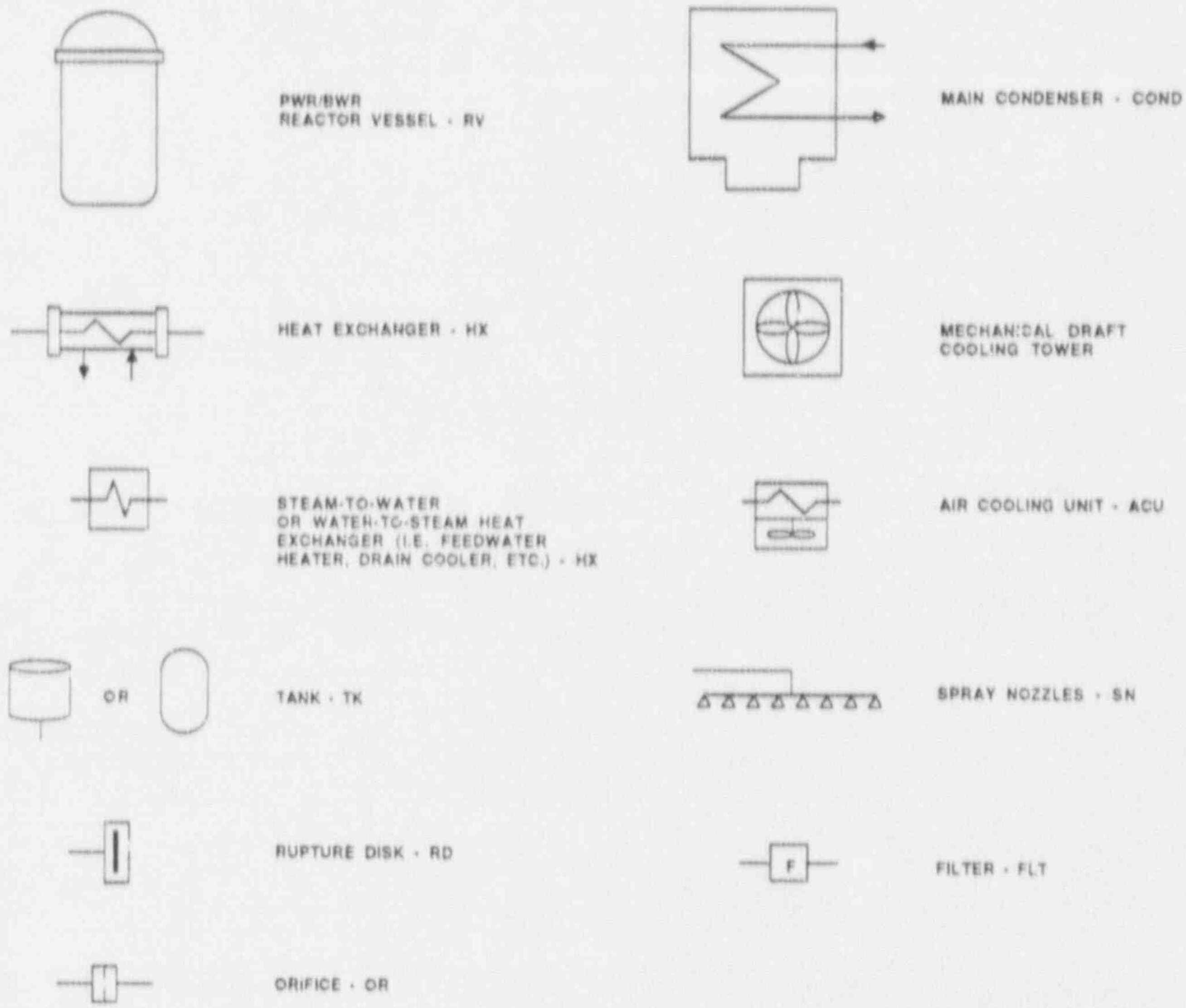

Figure A-1. Key To Symbols In Fluid System Drawings (Continued)

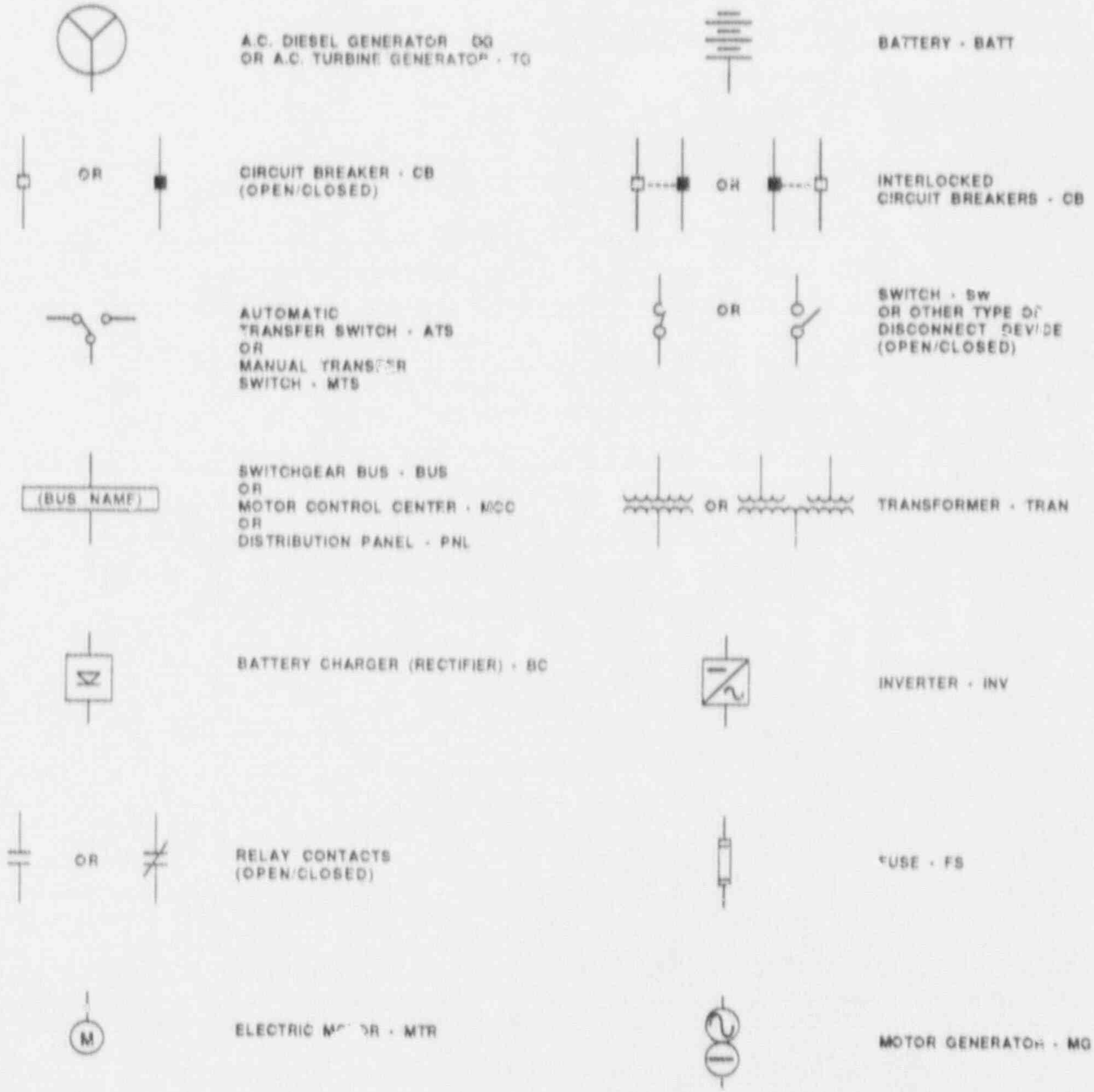

Figure A-2. Key To Symbols In Electrical System Drawings

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 HPCS, LPCS, LPCI and ADS)
EP	Electric Power System
SSW	Standby 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 gene tor (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