NUCLEAR POWER PLANT
SYSTEM SOURCEBOOK

CLINTON 1

50-461

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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.

CLINTON 1
RECORD OF REVISIONS

REVISION	ISSUE	COMMENTS
0	1/89	Original report

CLINTON 1 SYSTEM SOURCEBOOK

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

1. SUMMARY DATA ON PLANT

Basic information on the Clinton 1 nuclear power plant is listed below:

- Docket number	50-461
- Operator	Illinois Power Co.
- Location	Illinois, Clinton
- Commercial operation date	November 1987
- Reactor type	BWR/6
- NSSS vendor	General Electric
- Power (MWt/MWe)	2894/985
- Architect-engineer	Sargent and Lundy
- Containment type	Steel and reinforced concrete cylinder (Mark III)

2. IDENTIFICATION OF SIMILAR NUCLEAR POWER PLANTS

The Clinton 1 plant consists of a General Electric BWR/6 nuclear steam supply system with a Mark III containment incorporating the drywell/pressure suppression concept. The plant also has a secondary containment structure of reinforced concrete. Other BWR/6 plants in the United States are as follows:

- Grand Gulf 1 & 2
- Perry 1 & 2
- River Bend 1

Clinton 1 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.

3. SYSTEM INFORMATION

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

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

Table 3-1. Summary of Clinton 1 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	6.3.1.2.1, 6.3.2.2.1
- Low-Pressure Injection & Recirculation	Low-Pressure Core Spray (LPCS) System,	3.3	6.3.1.2.2, 6.3.2.2.3
	Low-Pressure Coolant Injection (LPCI) System (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)	X	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	5.4.6.2.5.3, 5.4.7.1.1.5

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

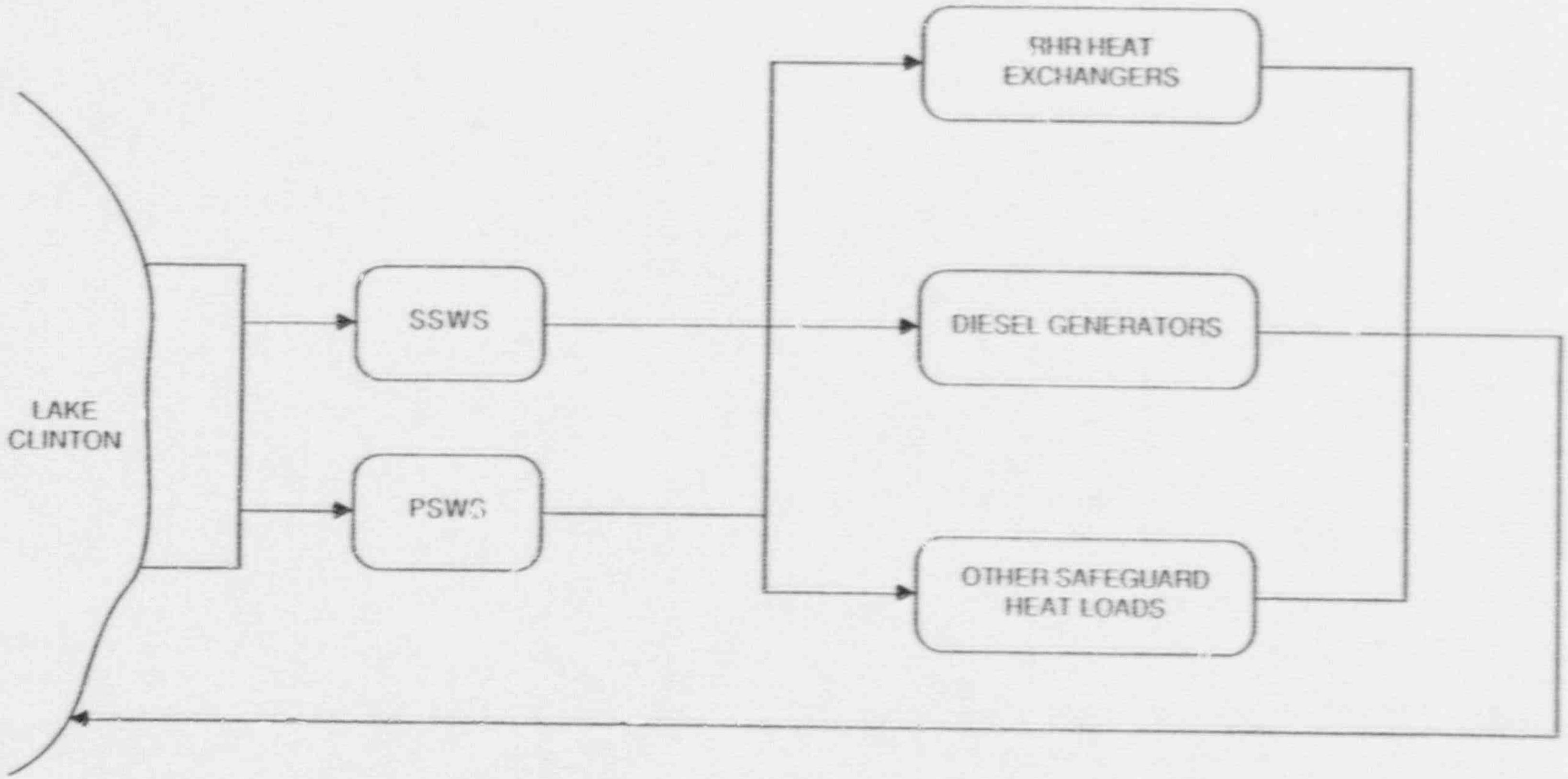
Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Reactor Coolant Inventory Control Systems			
- Reactor Water Cleanup (RWCU) System	Same	X	5.4.8
- ECCS	See above	-	-
- Control Rod Drive Hydraulic System (CRDHS)	Same	3.6	4.6.1.1.2.4
Containment Systems			
- Primary Containment	Containment Structure (drywell and pressure suppression chamber)	X	6.2.1
- Secondary Containment	Same	X	6.2.3
- Standby Gas Treatment System (SGTS)	Same	X	6.2.3.3.1
- Containment Heat Removal Systems			
- Suppression Pool Cooling System	Suppression Pool Cooling Mode (an operating mode of the RHR system)	3.3	5.4.7.1.1.3, 6.2.2
- Containment Spray System	Containment Spray Cooling Mode (an operating mode of the RHR system)	3.3	5.4.7.1.1.4, 6.2.2, 6.5.2
- Containment Fan Cooler System	None	-	-
- Containment Normal Ventilation Systems	Containment Building Ventilation System, Continuous Containment Purge System, Drywell Cooling System	X	9.4.6, 9.4.7
- Combustible Gas Control Systems	Same	X	6.2.5

Table 3-1. Summary of Clinton 1 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	4.6.1
- Chemical Poison System	Standby Liquid Control System (SLCS)	X	9.3.5
Instrumentation & Control (I&C) Systems			
- Reactor Protection System (RPS)	Same	3.4	7.2
- Engineered Safety Feature Actuation System (ESFAS)	Engineered Safety Feature Systems	3.4	7.3
- Remote Shutdown System	Local control panels	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	8.1.3.2, 8.1.3.4 8.1.3.5, 8.1.4, 8.3.1.1.2
- Non-Class 1E Electric Power System	Same	3.5	8
- Diesel Generator Auxiliary Systems	Same	3.5	9.4.5.1, 9.5.4 to 9.5.8
- Component Cooling Water (CCW) System	Same	X	9.2.2

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

Generic System Name	Plant-Specific System Name	Report Section	FSAR Section Reference
Support Systems (continued)			
- Service Water System (SWS)	Plant Service Water System	3.8	9.2.1.1
- Residual Heat Removal Service Water (RHRSW) System	Shutdown Service Water System	3.7	9.2.1.2
- Other Cooling Water Systems	Turbine Building Closed Cooling Water (TBCCW) System	X	9.7
- Fire Protection Systems	Same	X	9.5.1
- Room Heating, Ventilating, and Air-Conditioning (HVAC) Systems	Same	X	9.4
- Instrument and Service Air Systems	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 = Shutdown Service Water System
PSWS = Plant Service Water System

Figure 3-1. Cooling Water System Functional Diagram for Clinton 1

3.1 REACTOR COOLANT SYSTEM (RCS)

3.1.1 System Function

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

3.1.2 System Definition

The RCS includes: (a) the reactor vessel, (b) two recirculation loops, (c) recirculation pumps, (d) 16 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.

About 1/2 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 safety/relief valves on the main steam lines. A LOCA inside containment or operation of the Automatic Depressurization System (ADS) also dumps heat to the suppression chamber. Makeup to the RCS is provided by the Reactor Core Isolation Cooling (RCIC) system (see Section 3.2) or by the Emergency Core Cooling System (ECCS, see Section 3.3). Heat is transferred from the containment 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: 16,030 ft^3
2. Water volume: 9,170 ft^3 (including recirculation loops).
3. Steam volume: 6,770 ft^3
4. Steam flow: 12.453 x 10^6 lb/hr.
5. Normal operating pressure: 1040 psia

B. Safety/Relief Valves (16)
1. Set pressure: 1103 to 1123 psig
2. Relief capacity: 895,000 to 913,000 lb/hr (each)

C. Recirculation Pumps (2)
1. Rated flow: 32,172 gpm @ 815 ft. head (353 psid)
2. Type: Vertical centrifugal

D. Jet Pumps (20)
1. Total flow: 24.3 x 10^6 lb/hr @ 85.4 ft. head (37 psid)

3.1.6 Support Systems and Interfaces

A. Motive Power
1. The recirculation pumps are supplied with Nonclass 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.

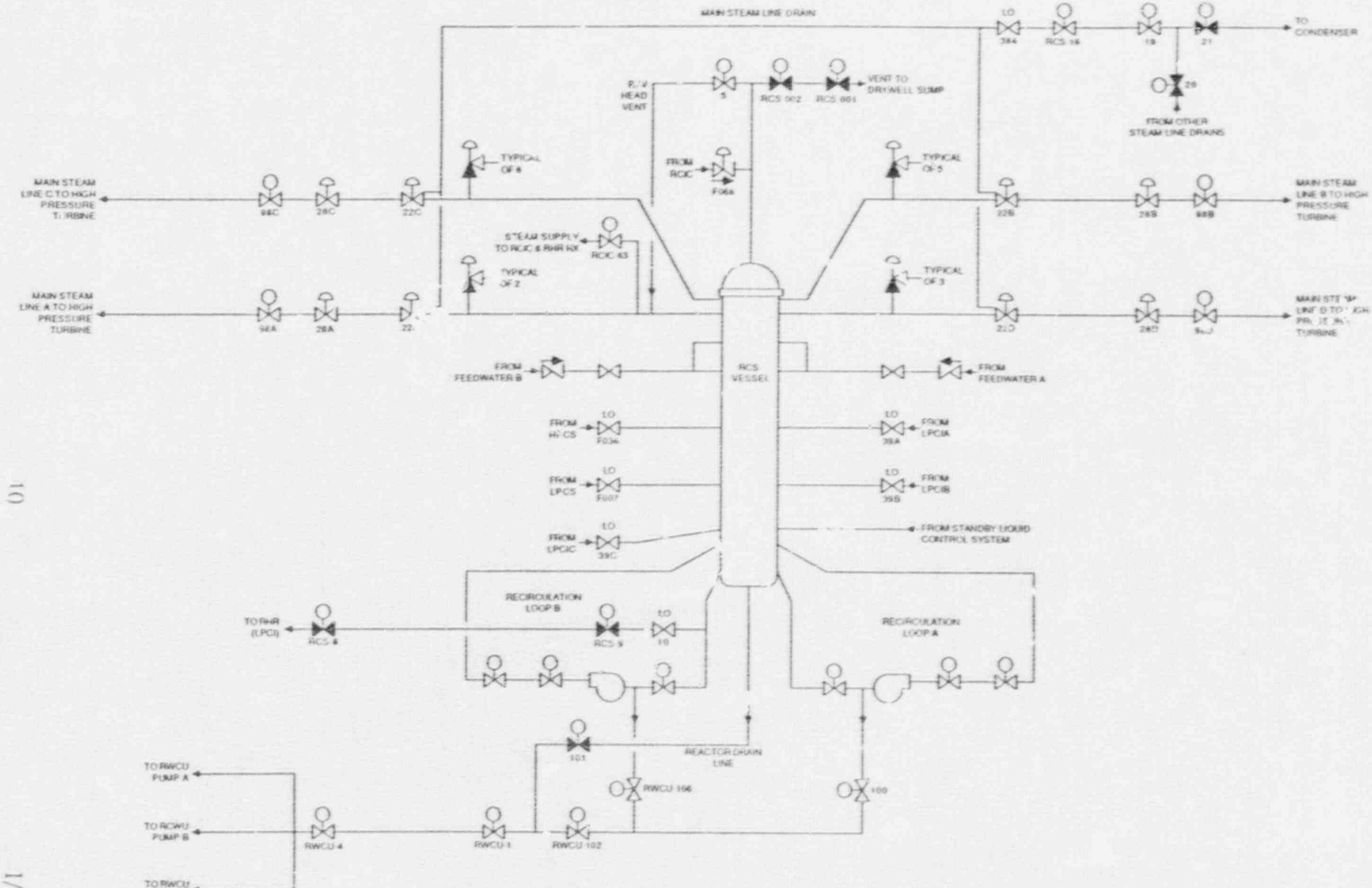


Figure 3.1-1. Clinton 1 Reactor Coolant System

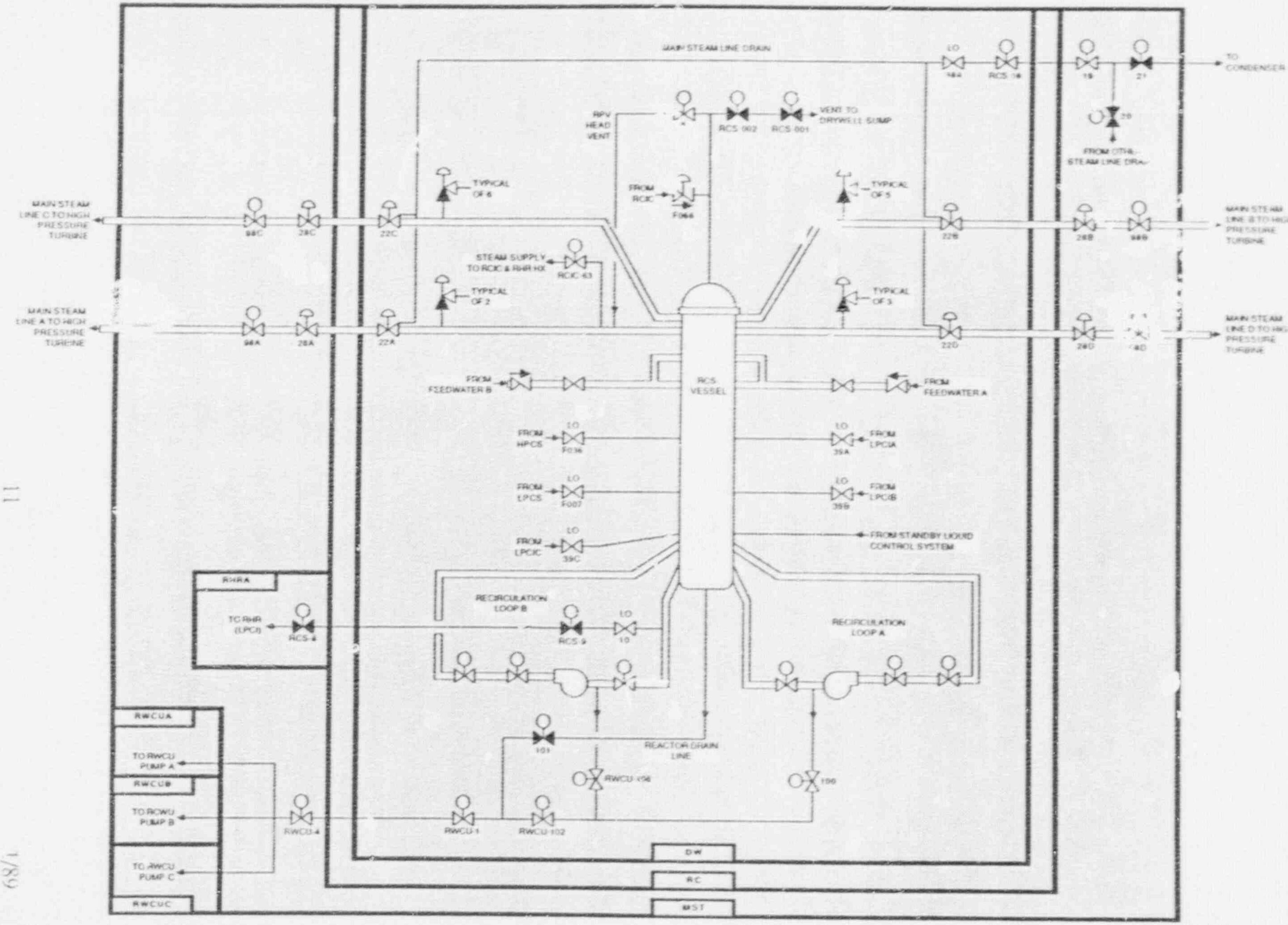


Figure 3.1-2. Clinton 1 Reactor Coolant System Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RCS-001	MOV	DW	EP-MCC-1F	480	ABMCC1F	AC/A
RCS-002	MOV	DW	EP-MCC-1G	480	ABMCC1G	AC/B
RCS-16	MOV	DW	EP-BS-1B	480	ESFB	AC/B
RCS-8	MOV	RHRA	EP-BS-1A	480	ESFA	AC/A
RCS-9	MOV	DW	EP-BS-1B	480	ESFB	AC/B
RWCU-1	MOV	DW	EP-BS-1B	480	ESFB	AC/B
RWCU-4	MOV	MST	EP-BS-1A	480	ESFA	AC/A

3.2 REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.2.1 System Function

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

3.2.2 System Definition

The reactor core isolation cooling system consists of a steam-driven turbine pump and associated valves and piping for delivering makeup water from the condensate storage tank or the suppression pool to the reactor pressure vessel. The RCIC 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 an 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 RCIC storage tank. This tank is part of the larger condensate storage facility. The suppression pool is used as a backup water supply. Reactor core heat is dumped to the suppression pool via the safety/relief valves which cycle as needed to limit RCS pressure. The RCIC turbine also exhausts to the suppression pool.

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

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 @ 2980 ft. head (1192 psid)
   2. Rated Capacity: 100%
   3. Type: centrifugal

B. RCIC Storage Tank
   1. Capacity: 125,000 gal (for use by 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. The RCIC pump is automatically tripped on a reactor vessel high water level signal signal. 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.

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

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

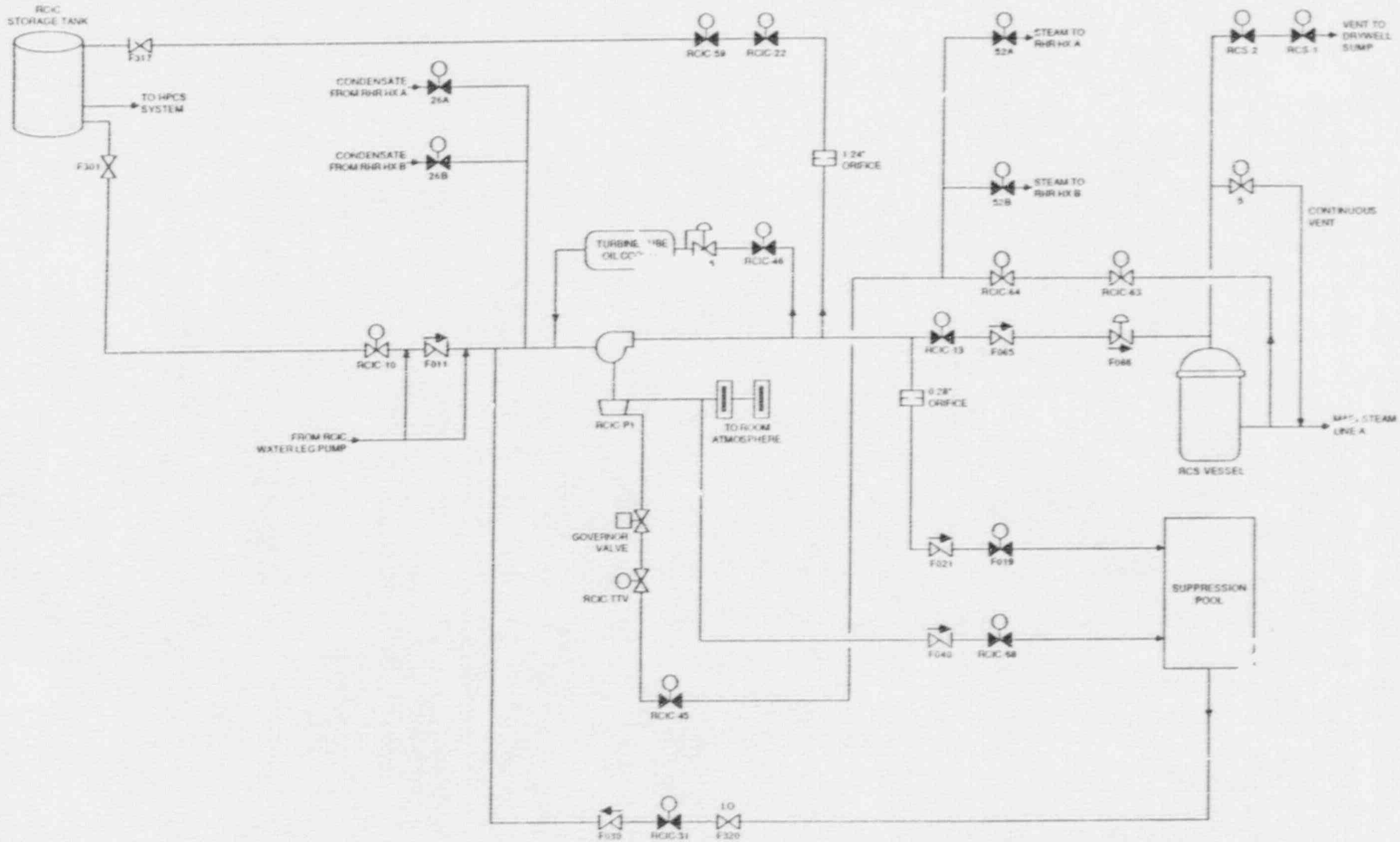


Figure 3.2-1. Clinton 1 Reactor Core Isolation Cooling System

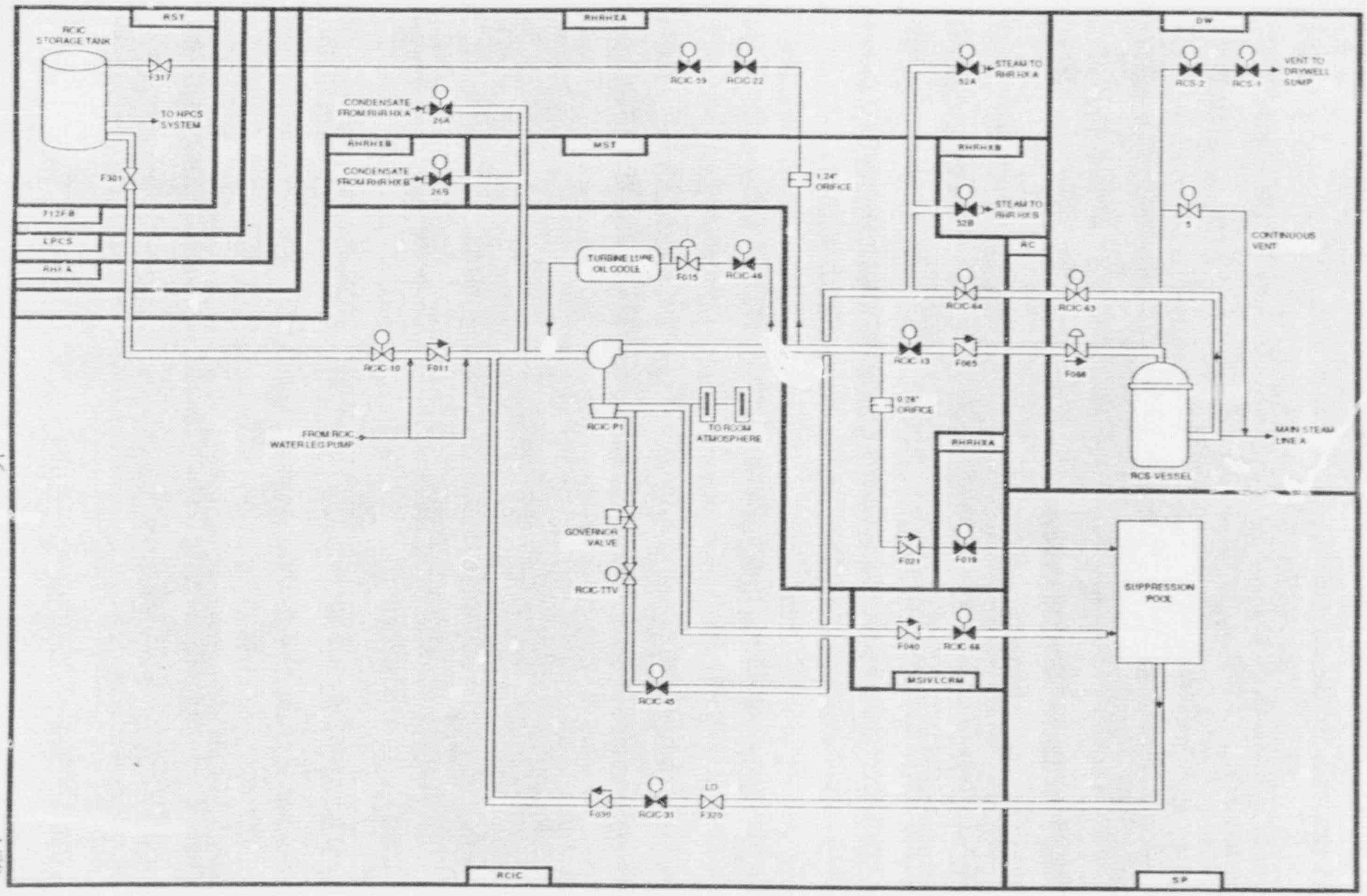


Figure 3.2-2. Clinton 1 Reactor Core Isolation Cooling System Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RCIC-10	MOV	RCIC	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-13	MOV	MST	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-22	MOV	RHRHXA	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-31	MOV	RCIC	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-45	MOV	RCIC	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-59	MOV	RHRHXA	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-63	MOV	DW	EP-BS-1A	480	ESFA	AC/A
RCIC-63	MOV	DW	EP-BS-1A	480	ESFA	AC/A
RCIC-64	MOV	MST	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-64	MOV	MST	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-68	MOV	MSIVLCRM	EP-DCMCC-1A	125	ESFA	DC/1
RCIC-P1	TDP	RCIC				
RCIC-TTV	HV	RCIC				
RST	TANK	RST				
SUPP. POOL	TANK	SP				

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 utilize 7 of the 16 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 LPCIA, LPCIB, and LPCIC. 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. The RHR heat exchangers also can be aligned for steam condensing operation in conjunction with the RCIC system (see Section 3.2). This is not an ECCS function.

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. A flow diagram of LPCIA is shown in Figures 3.3-5 and 3.3-6, LPCIB is shown in Figures 3.3-7 and 3.3-8, and LPCIC is shown in Figures 3.3-9 and 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 RCIC Storage Tank (RST). 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 Automatic Depressurization System 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 systems 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 Clinton 1 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 shutdown 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: 467 gpm @ 1177 psid, 1400 gpm @ 1147 psid, 4900 gpm @ 200 psid (vessel to pump suction)
   2. Rated capacity: 100%
   3. Type: centrifugal

B. Motor-driven LPCS pump P1
   1. Rated flow: 4,900 gpm @ 113 psid (vessel to drywell)
   2. Rated capacity: 33 1/3%
   3. Type: centrifugal

C. Motor-driven LPCI pumps P1A, P1B, P1C
   1. Rated flow: 14,900 gpm @ 20 psid (vessel to drywell)
   2. Rated capacity: 100%
   3. Type: centrifugal

D. RHR Heat Exchangers 1A and 1B
   1. Heat transfer capability: 116.7×10^6 Btu/hr
   2. Rated capacity: 100%
   3. Type: shell and tube

E. Automatic-depressurization valves (7)
   1. Rated flow: 800,000 lb/hr @ 1125 psig (each)

F. Pressure Suppression Chamber
   1. Design temperature: 185°F
   2. Maximum operating temperature: 100°F
   3. Minimum water volume: 135,700 ft^3

3.3.6 Support Systems and Interfaces

A. Control signals
   1. Automatic
      a. The HPCS pump, LPCS pump, and the LPCI pumps, and all their associated valves function upon receipt of low water level in the reactor vessel or high pressure in the drywell.
      b. The HPCI 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-min delay.
      d. HPCS pump suction is automatically switched to the suppression pool on high suppression pool 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 generators, as described in Section 3.5.
2. The components of the HPCS are powered from a dedicated diesel generator (Diesel generator 1C, see Section 3.5).

C. Other

1. Lubrication and cooling for the ECCS pumps are assumed to be supplied locally.
2. ECCS pump room ventilation systems are cooled by standby service water (see Section 3.7).
3. The standby service water system provides cooling water to the RHR heat exchangers and the RHR pump seals (see Section 3.7).

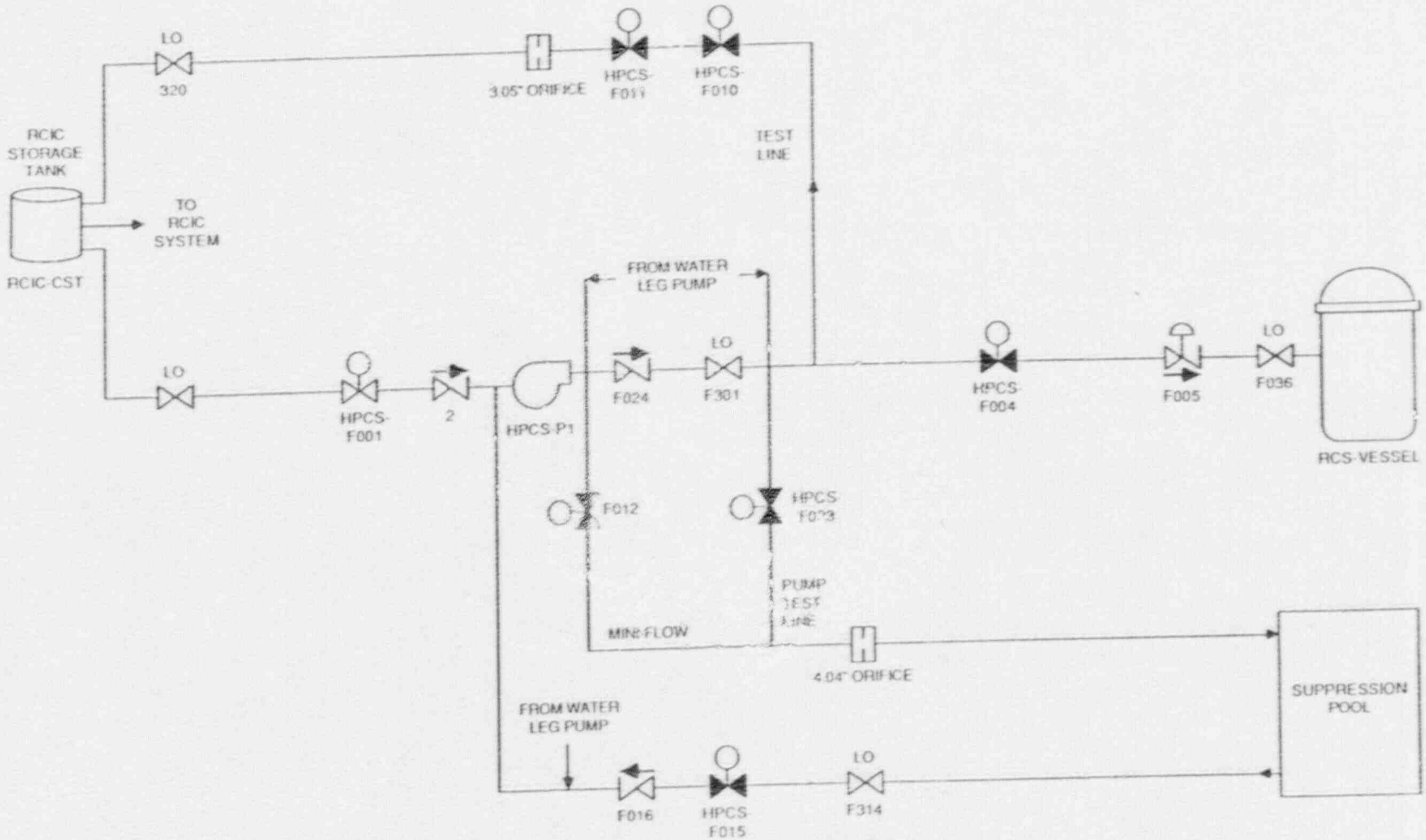


Figure 3.3-1. Clinton 1 High Pressure Core Spray System

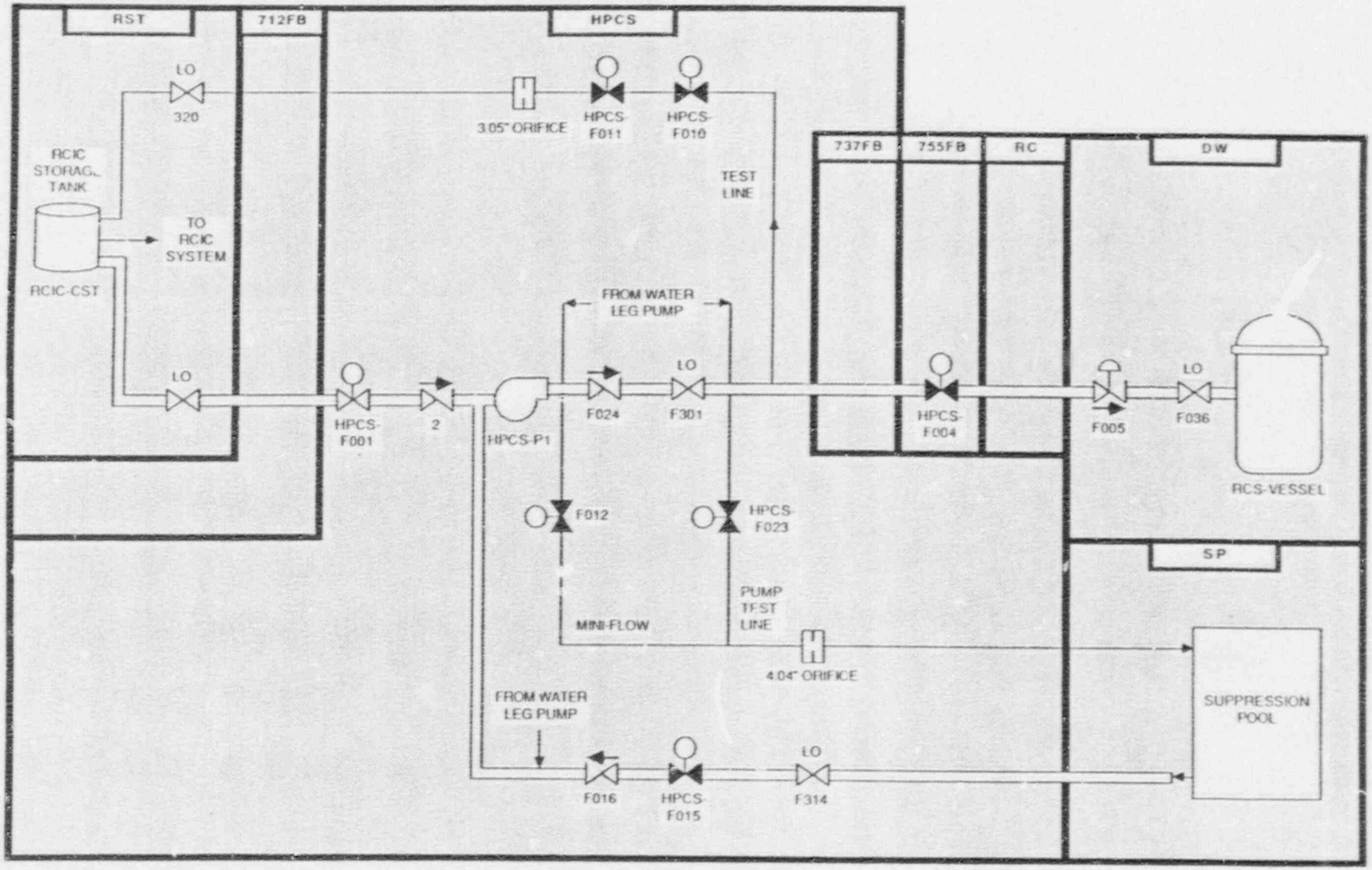


Figure 3.3-2. Clinton 1 High Pressure Core Spray System Showing Component Locations

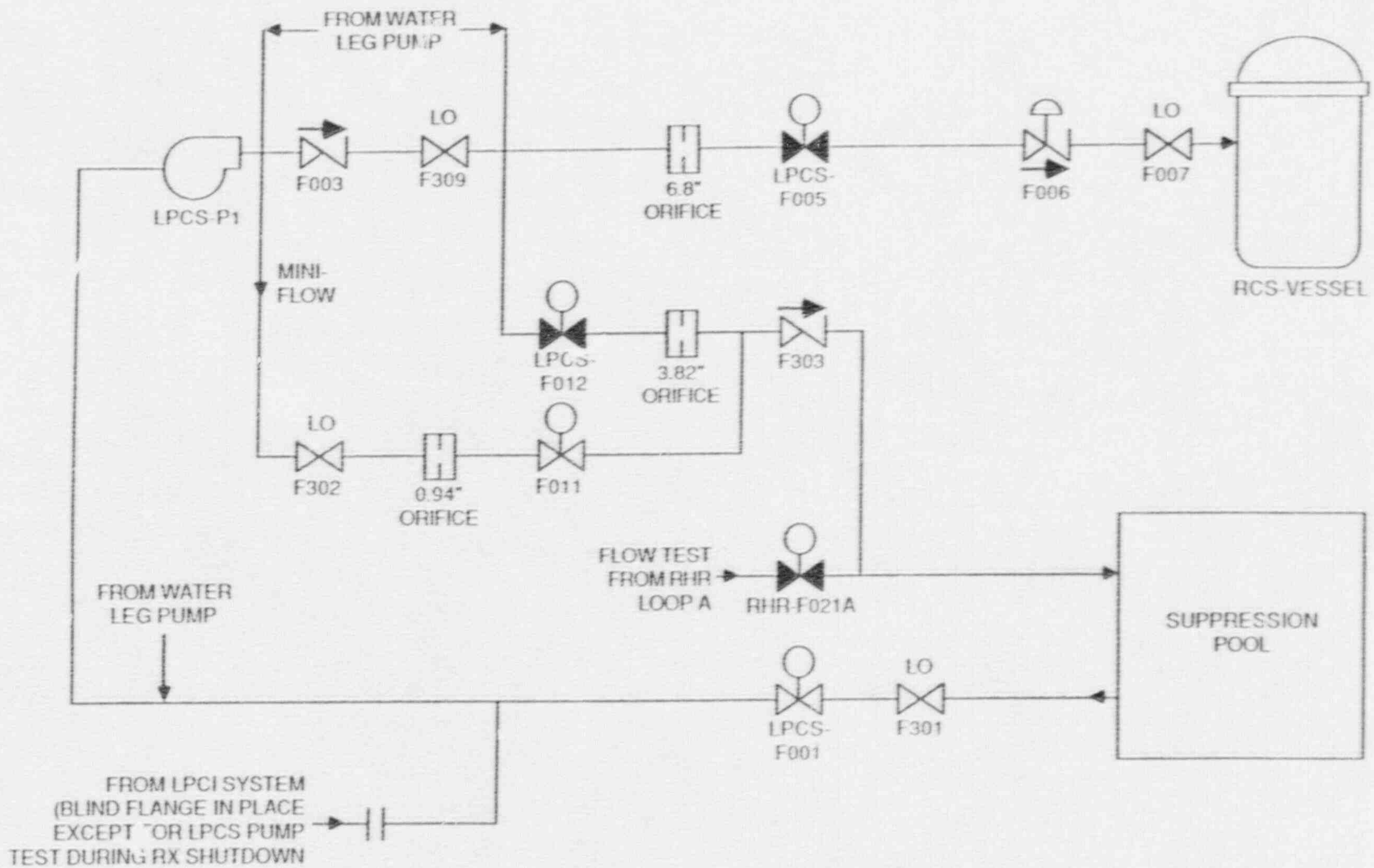


Figure 3.3-3. Clinton 1 Low Pressure Core Spray System

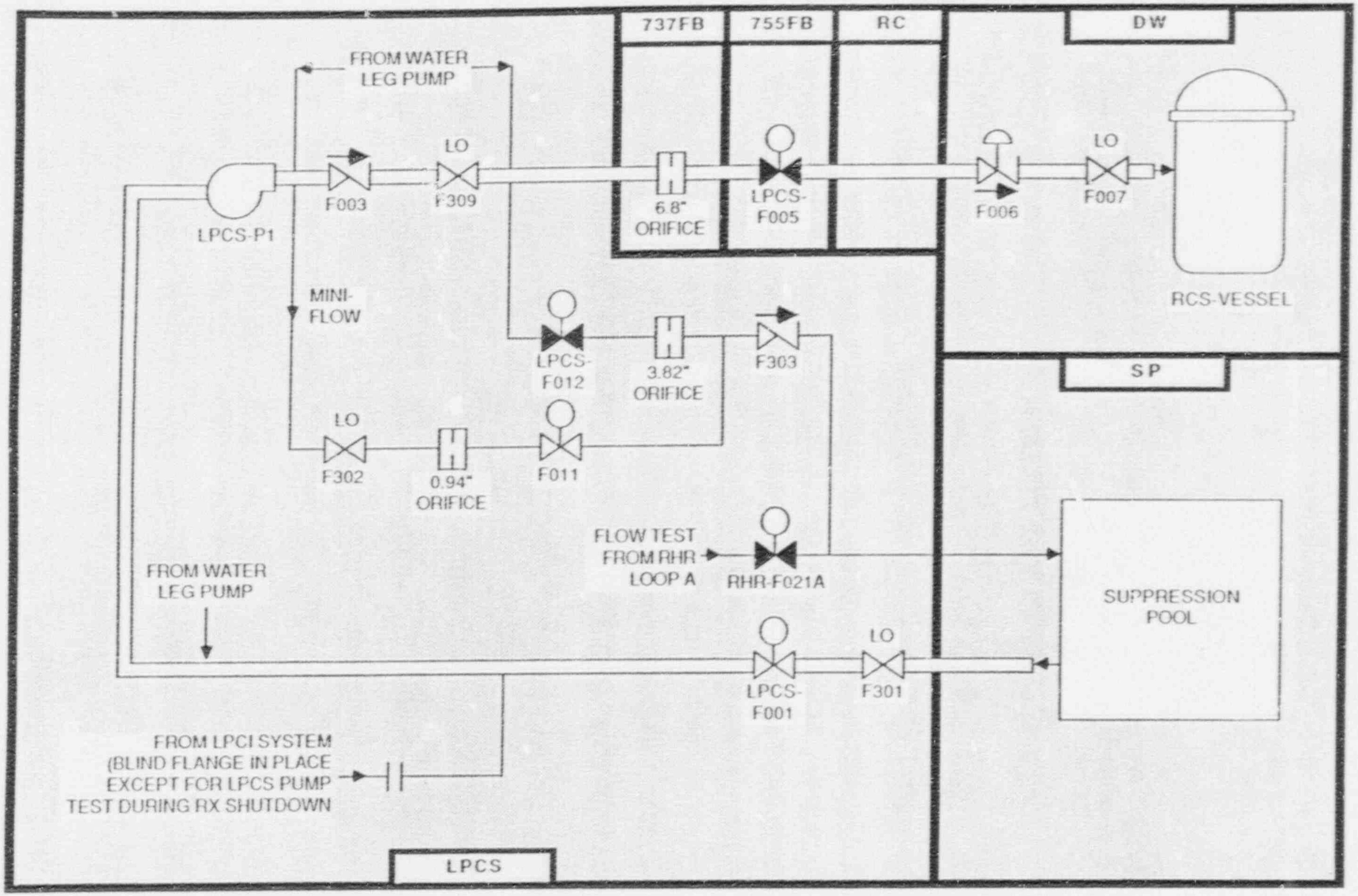


Figure 3.3-4. Clinton 1 Low Pressure Core Spray System Showing Component Locations

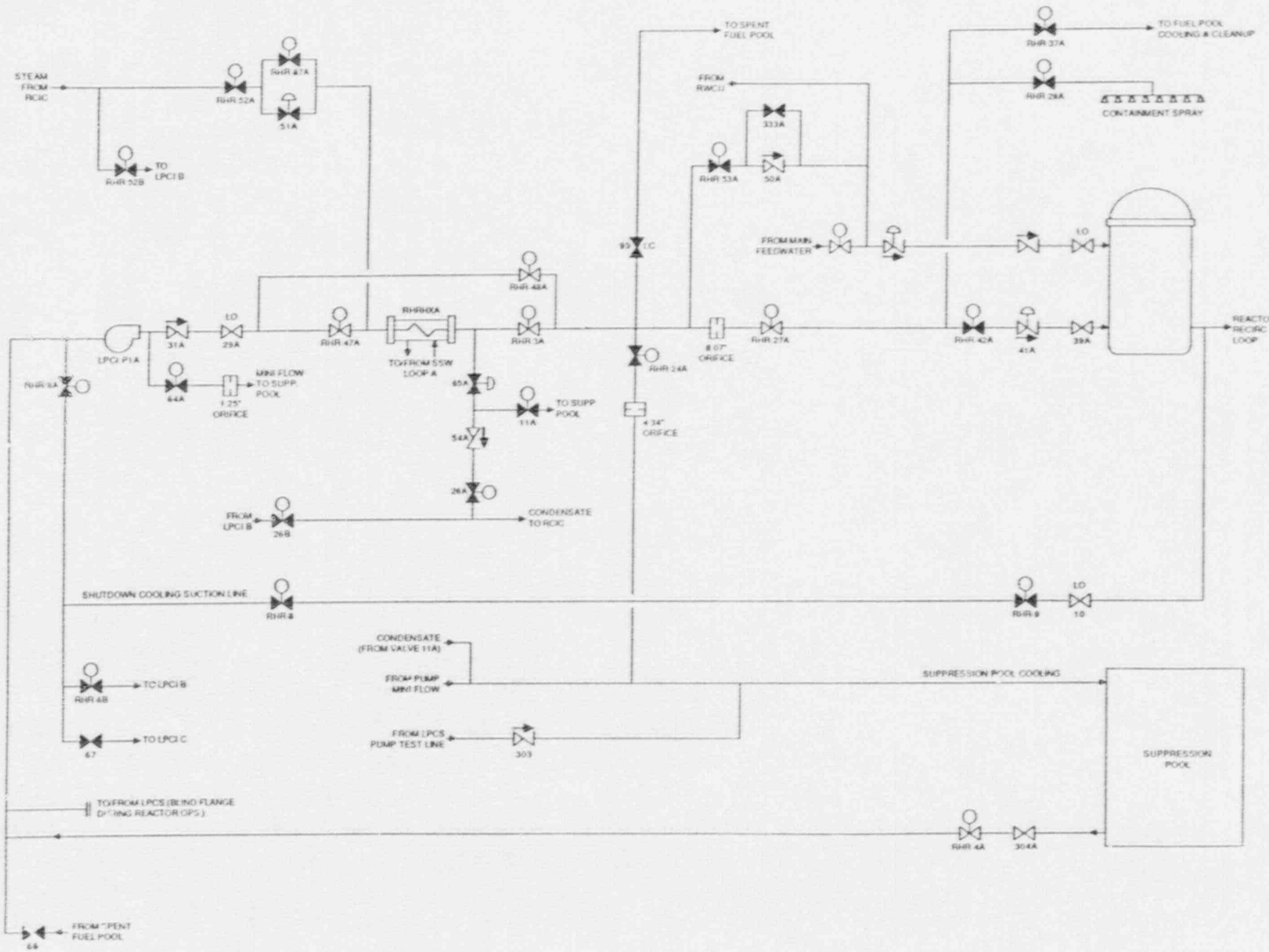


Figure 3.3-5. Clinton 1 Residual Heat Removal System, Loop A

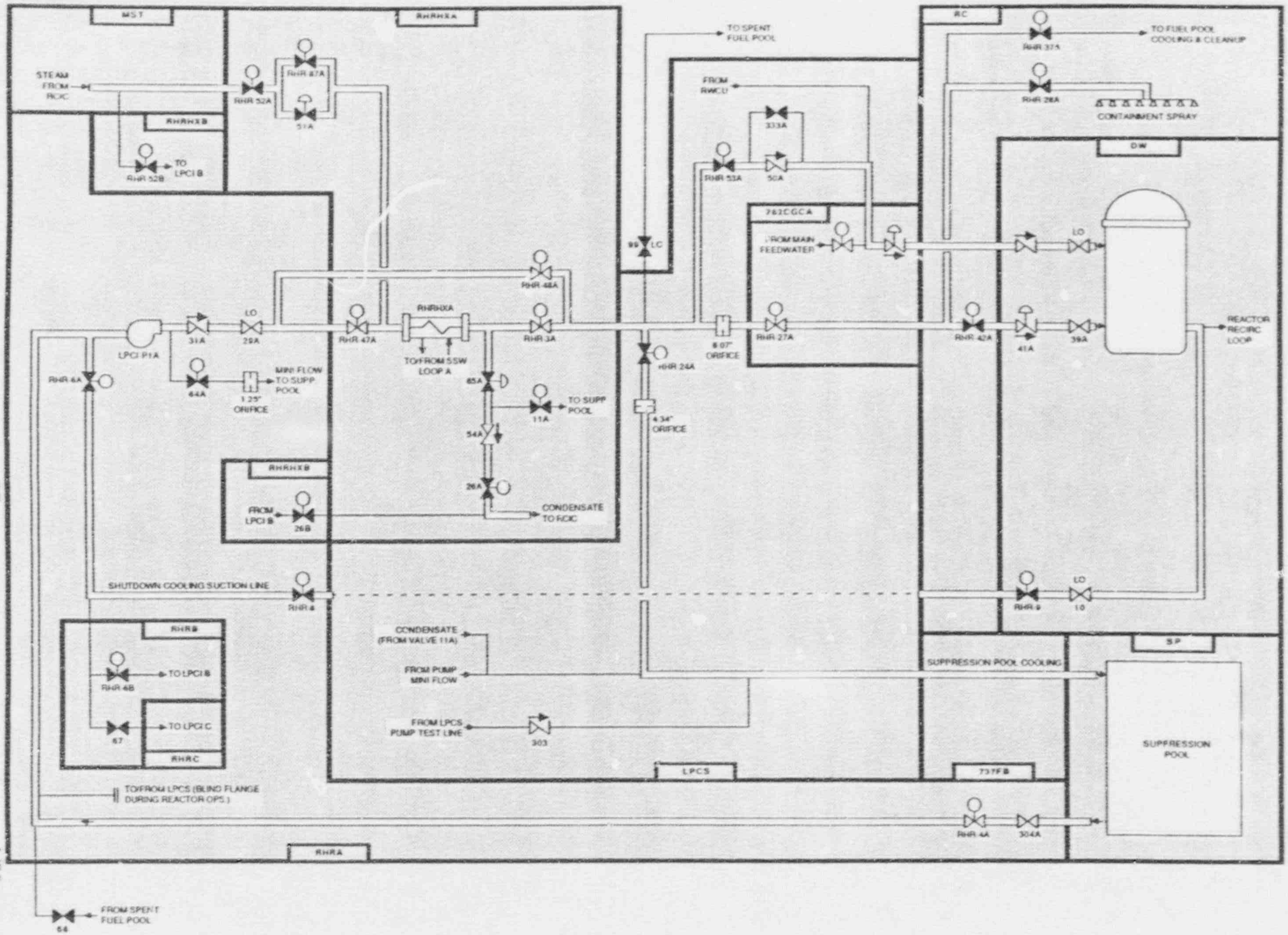


Figure 3.3-6. Clinton 1 Residual Heat Removal System, Loop A Showing Component Locations

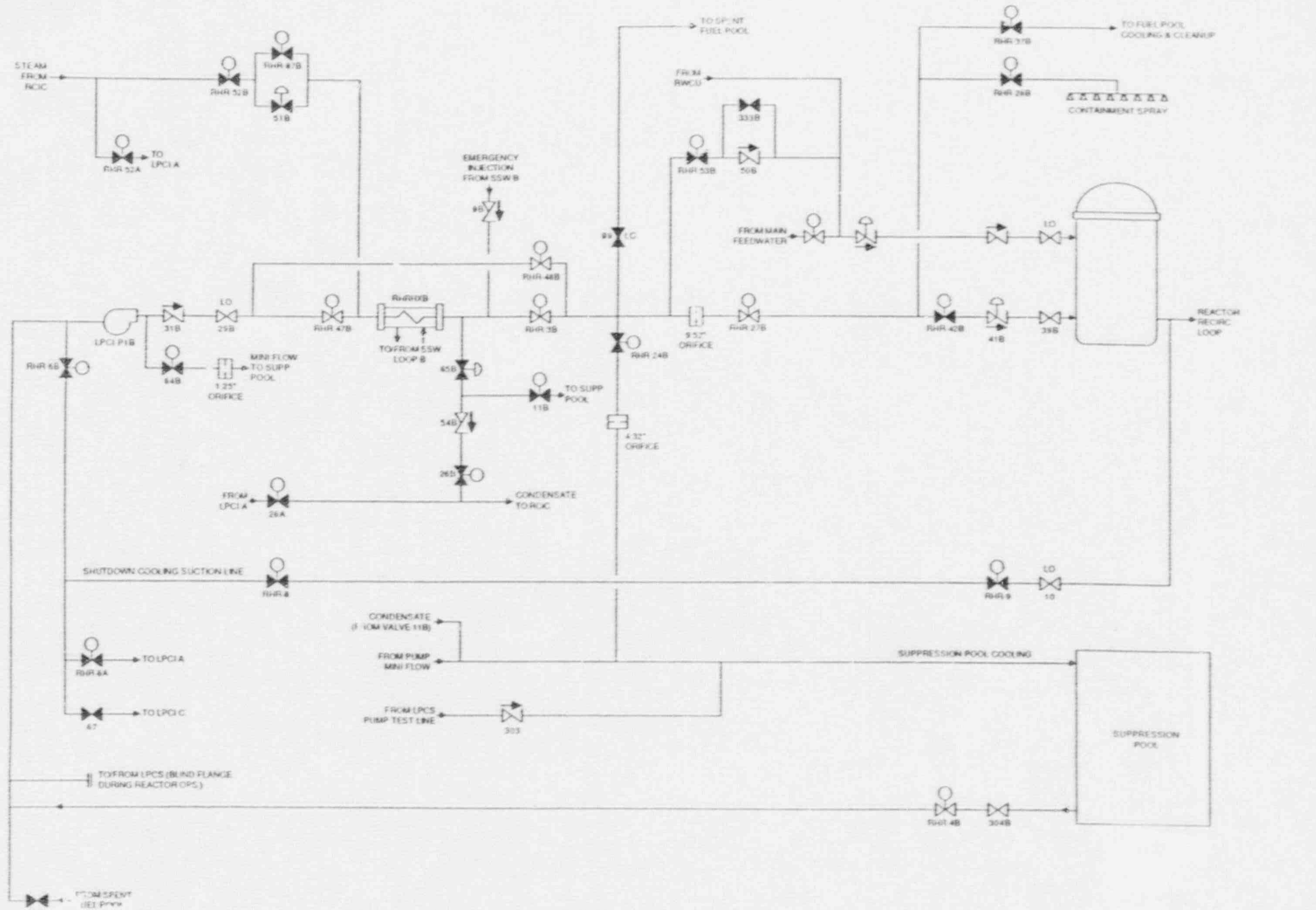


Figure 3.3-7. Clinton 1 Residual Heat Removal System, Loop B

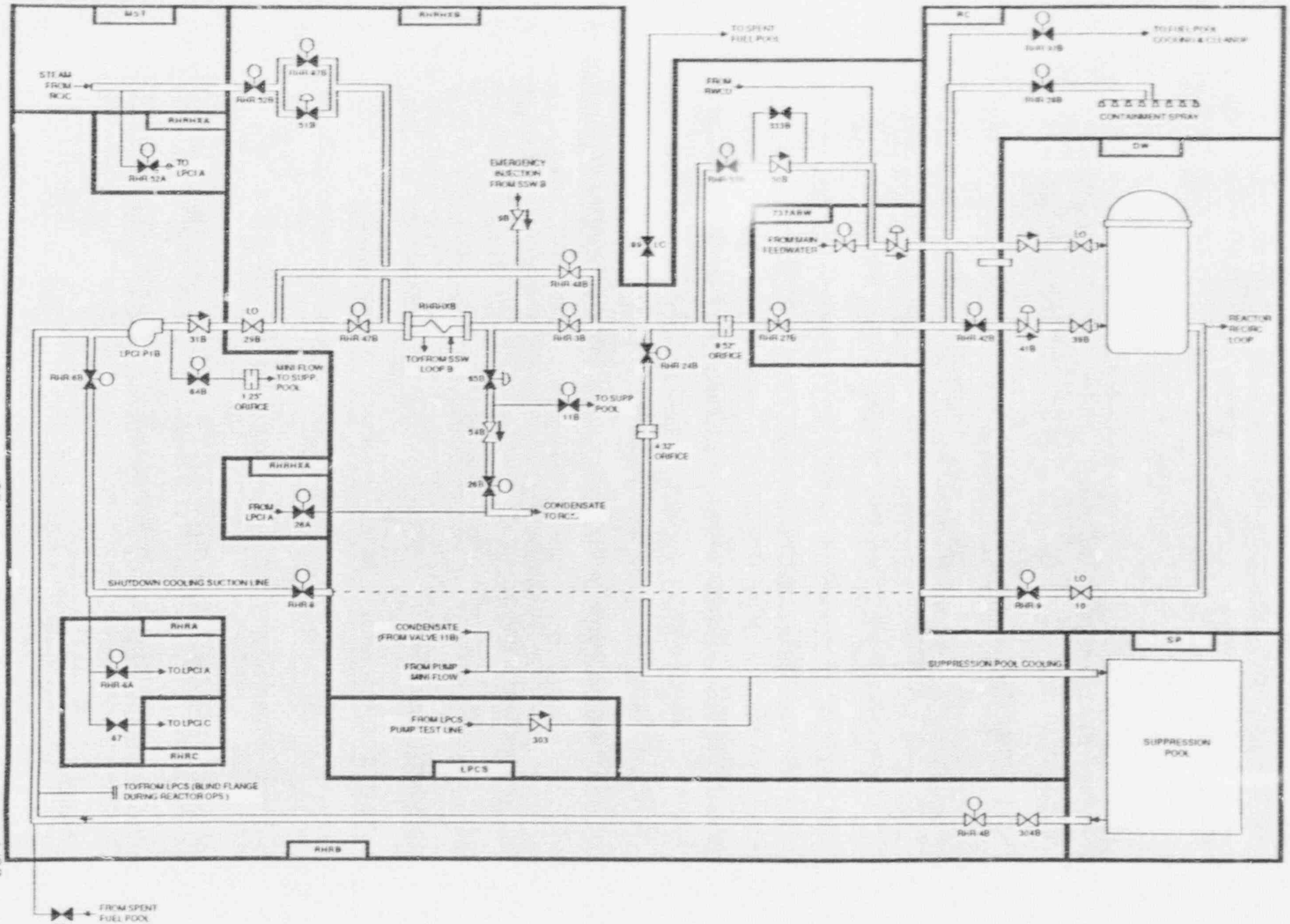


Figure 3.3-8. Clinton 1 Residual Heat Removal System, Loop B Showing Component Locations

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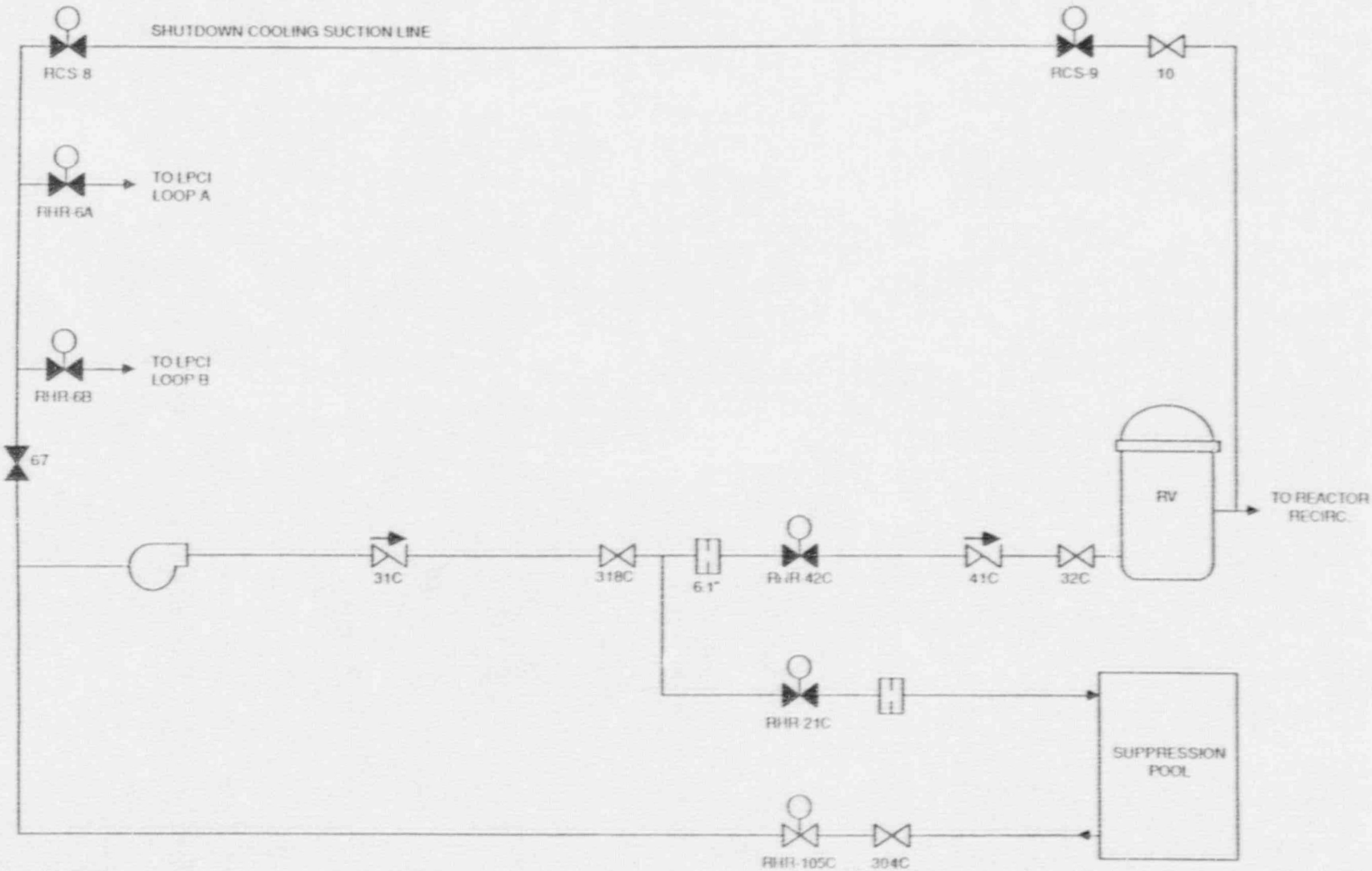


Figure 3.3-9. Clinton 1 Low Pressure Injection System Loop C

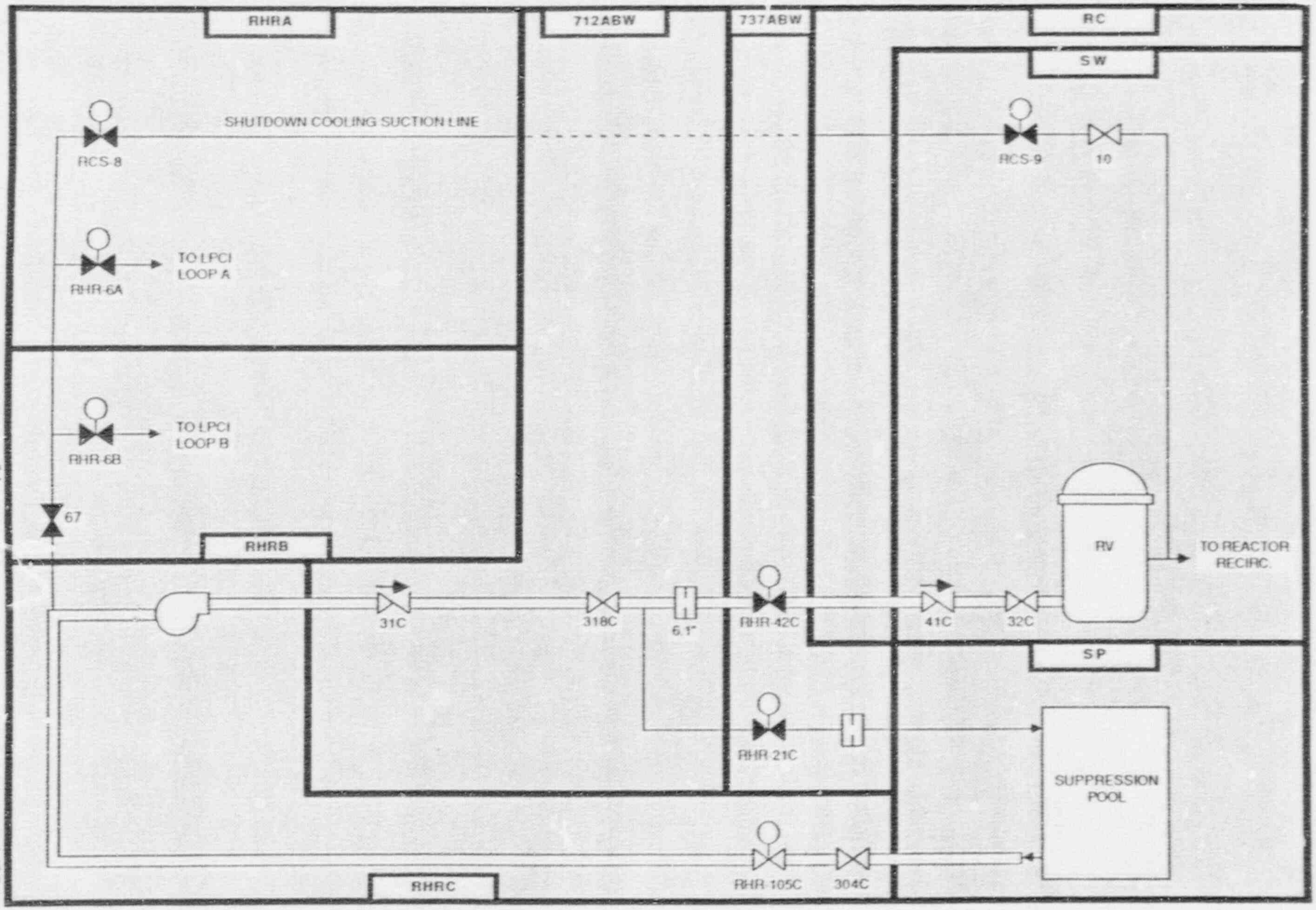


Figure 3.3-10. Clinton 1 Low Pressure Injection System Loop C Showing Component Locations

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
HPCS-F001	MOV	HPCS	EP-HPMCC-1C	480	ESFC	AC/C
HPCS-F004	MOV	755FB	EP-HPMCC-1C	480	ESFC	AC/C
HPCS-F010	MOV	HPCS	EP-HPMCC-1C	480	ESFC	AC/C
HPCS-F011	MOV	HPCS	EP-HPMCC-1C	480	ESFC	AC/C
HPCS-F015	MOV	HPCS	EP-HPMCC-1C	480	ESFC	AC/C
HPCS-F023	MOV	HPCS	EP-HPMCC-1C	480	ESFC	AC/C
HPCS-P1	MDP	HPCS	EP-BS-1C1	4160	ESFC	AC/C
LPCI-P1A	MDP	RHRA	EP-BS-1A1	4160	ESFA	AC/A
LPCI-P1B	MDP	RHRB	EP-BS-1B1	4160	ESFB	AC/B
LPCI-P1C	MDP	RHRC	EP-BS-1B1	4160	ESFB	AC/B
LPCS-F001	MOV	LPCS	EP-BS-1A	480	ESFA	AC/A
LPCS-F005	MOV	755FB	EP-BS-1A	480	ESFA	AC/A
LPCS-F012	MOV	LPCS	EP-BS-1A	480	ESFA	AC/A
LPCS-P1	MDP	LPCS	EP-BS-1A1	4160	ESFA	AC/A
RHR-105C	MOV	RHRC	EP-BS-1B	480	ESFB	AC/B
RHR-21C	MOV	737ABW	EP-BS-1B	480	ESFB	AC/B
RHR-24A	MOV	LPCS	EP-BS-1A	480	ESFA	AC/A
RHR-24A	MOV	LPCS	EP-BS-1A	480	ESFA	AC/A
RHR-24B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-24B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-27A	MOV	762CGCA	EP-BS-1A	480	ESFA	AC/A
RHR-27A	MOV	762CGCA	EP-BS-1A	480	ESFA	AC/A
RHR-27B	MOV	737ABW	EP-BS-1B	480	ESFB	AC/B
RHR-27B	MOV	737ABW	EP-BS-1B	480	ESFB	AC/B
RHR-28A	MOV	RC	EP-BS-1A	480	ESFA	AC/A
RHR-28A	MOV	RC	EP-BS-1A	480	ESFA	AC/A
RHR-28B	MOV	RC	EP-BS-1B	480	ESFB	AC/B

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
RHR-28B	MOV	RC	EP-BS-1B	480	ESFB	AC/B
RHR-37A	MOV	RC	EP-BS-1A	480	ESFA	AC/A
RHR-37B	MOV	RC	EP-BS-1B	480	ESFB	AC/B
RHR-3A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
RHR-3B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-42A	MOV	RC	EP-BS-1A	480	ESFA	AC/A
RHR-42B	MOV	RC	EP-BS-1B	480	ESFB	AC/B
RHR-42C	MOV	737ABW	EP-BS-1B	480	ESFB	AC/B
RHR-47A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
RHR-47B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-48A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
RHR-48A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
RHR-48B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-48B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-4A	MOV	RHRA	EP-BS-1A	480	ESFA	AC/A
RHR-52A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
RHR-52B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-53A	MOV	LPCS	EP-BS-1A	480	ESFA	AC/A
RHR-53B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-6A	MOV	RHRA	EP-BS-1A	480	ESFA	AC/A
RHR-6B	MOV	RHRB	EP-BS-1B	480	ESFB	AC/B
RHR-87A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
RHR-87B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
RHR-HXA	HX	RHRHXA				
RHR-HXB	HX	RHRHXB				
RHR4B	MOV	RHRB	EP-BS-1B	480	ESFB	AC/B
RST	TANK	RST				

3.4 INSTRUMENTATION AND CONTROL (I&C) SYSTEMS

3.4.1 System Function

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

3.4.2 System Definition

The RPS includes sensor and transmitter units, logic units, and output trip relays that interface with the control circuits for components in the Control Rod Drive Hydraulic System (see Section 3.6). The ESF actuation systems include independent sensor and transmitter units, logic units, and relays that interface with the control circuits for the many different components that can be actuated. Operator instrumentation display systems consist of display panels that are powered by 125 VDC or 120 VAC power. The remote shutdown panel contains Division I controls and indications for equipment used as the primary means to cool the reactor to the cold condition from outside the main control room. A back up means of accomplishing the cool down is provided by Division II controls and indications on the panel and equipment operation from Division II motor control centers A list of the controls available on the remote shutdown panel is provided in Table 3.4-1.

3.4.3 System Operation

A. RPS

The RPS has four input instrument channels and two output actuation trains. The RPS monitors and automatically initiates a scram based on the following variables:

- Neutron monitoring (APRM) system
- Neutron monitoring (IRM) system
- Neutron monitoring (SRM) system (REFUEL mode only)
- Reactor vessel high pressure
- Reactor vessel low water level
- Reactor vessel high water level (RUN mode only)
- Turbine stop valve closure
- Turbine control valve fast closure
- Main steam line isolation valve closure (RUN mode only)
- Scram discharge volume high water level
- Drywell high pressure
- Main steam line high radiation

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

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

- Emergency Core Cooling System
  - HPCS
  - LPCS
  - LPCI/RHR
  - ADS
- Standby power systems
- Shutdown service water system
- Various room cooling systems
  - ECCS equipment room HVAC system
  - Essential switchgear heat removal HVAC system
  - Diesel generator HVAC system
  - Shutdown service water pump room HVAC system
  - Main control room HVAC system

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

C. Remote Shutdown
The main control room and the remote shutdown panel and the Division II motor control centers are each served by separate HVAC systems located in different areas of the plant. It is expected that an event which causes evacuation of the main control room will not restrict accessibility of the remote shutdown panel or Division II MCC's.

Some of the systems used in the 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 from outside the main control room irrespective of shorts, opens, or grounds in the control circuit in the main control room that may have resulted from the event causing an evacuation. The functions needed for remote shutdown control are provided with manual transfer devices which override controls in the main control room and transfer the controls to the remote shutdown panel. All necessary power supplies are also transferred. Remote shutdown control is not possible without actuation of the transfer devices. Operation of the transfer devices causes an alarm in the main control room. The remote shutdown panel is located in the Auxiliary Building. Access to this panel is administratively controlled.

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 Clinton 1 have not been determined.

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

C. Manually-Initiated Protective Actions
When reasonable time is available, certain protective actions may be performed manually by plant personnel. The control room operators are capable of operating individual components using normal control circuitry, or operating groups of components by manually tripping the RPS or other actuation subsystem. The control room operators also may send qualified persons into the plant to operate components locally or from some other remote control location (i.e., the remote shutdown panel or a motor control center). To make these judgments, data on key plant parameters must be available to the operators.

3.4.5 Support Systems and Interfaces

A. Control Power
1. RPS
The RPS is powered from the 120 VAC RPS system. Backup scram valves are powered from the 125 VDC system.
2. ESF Actuation Systems
The control power interfaces for the various front-line systems are summarized in Table 3.4-2.
3. Operator Instrumentation
Operator instrumentation displays are powered from the 125 VDC system as summarized in Table 3.4-2.

3.4.6 Section 3.4 References

1. Clinton Final Safety Analysis Report, Section 7.4.1.4.

Table 3.4-1. Controls Available on the Clinton 1 Remote Shutdown Panel

Description	Number
RCIC System MOVs	2E, 10, 13, 19, 22, 31, 45, 46, 59, 63, 64, 68, 76, 77, 78, 95
RCIC System Air Compressor	2F
RHR System MOVs	3A, 4A, 6A, 6B, 8, 9, 11A, 14A, 24A, 26A, 27A, 28A, 37A, 42A, 47A, 48A, 52A, 52B, 53A, 64A, 68A
RHR System Pump	2A
Nuclear Boiler System	Air Operated Relief Valves (Division I and II)
Shutdown Service Water System MOVs	3A, 4A, 8A
Shutdown Service Water System Pump	A
Miscellaneous MOVs	2A, 7A, 11A, 12A, 16A, 62A, 73A, 76A

Transfer switches for essential equipment cubicle HVAC systems are also located on the remote shutdown panel. Controls are provided by local instrumentation.

Table 3.4-2. Matrix of Clinton 1 Control Power Sources

SYSTEM	125 VDC Division			
	1	2	3	4
RCIC	■			
HPCS			■	
ADS A	■			
ADS B		■		
RHR (LPCI) A	■			
RHR (LPCI) B		■		
RHR (LPCI) C		■		
LPCS	■			
DIESEL 1 & AUXILIARIES	■			
DIESEL 2 & AUXILIARIES		■		
DIESEL 3 & AUXILIARIES			■	
SSW A	■			
SSW B		■		
SSW C			■	
I & C *	A&C	B&F	C&G	D&H
OUTBOARD MSIV'S	■			
INBOARD MSIV'S		■		

* Letters listed are the suffixes for the instrumentation supported by each division. Instrumentation includes reactor protection system source range and intermediate range monitors and GE engineered safety features control and instrumentation systems.

3.5 ELECTRIC POWER SYSTEM

3.5.1 System Function

The electric power sy..em 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 in. rumentation needed to est blish and maintain a sa.. shutdown plant condition following . ccident, when the no.mal electric power sources are not available.

3.5.2 System Definition

The onsite Class 1E electric power system consists of three independent 4160 and 480 VAC trains, denoted A, B, and C. Train C is dedicated to components of the HPCS system. Each AC power division has a standby diesel generator which serves as the AC power source when both the preferred and alternate sources of offsite power are unavailable.

The 125 VDC and 120 VAC power systems consist of four independent divisions denoted 1, 2, 3, and 4. Each division has a separate battery charger, battery, and inverter to support the connected loads.

Simplified one-line diagrams of the electric power system are shown in Figures 3.5-1 to 3.5-6. A summary of data on selected electric power system components is presented in Table 3.5-1. A ... al listing of electrical sources and loads is presented in Table 3.5-2.

3.5.3 System Operation

During normal operating conditions, the Class 1E AC power system is supplied .. the 345 kV offsite power system via the 345 kV switchyard and the Reserve Auxiliary .ansformer. The alternate source of offsite power is the 138 Clinton Tap Line which is supplied via the Emergency Reserve Auxiliary Transformer and is physically and electrically separated from the 345 kV switchyard.

The three standby diesel generators are started automatically upon either loss of voltage on the associated standby 4160 VAC bus, or a LOCA signal, or a manual start signal. Diesel generator 1A is connected to 4160 VAC bus 1A1, diesel generator 1B is connected to 4160 VAC bus 1B1, and the HPCS diesel generator 1C is connected to 4160 VAC bus 1C1. Bus 1A1 feeds the 480 VAC load center buses A and 1A, which in turn feed various Train A motor control centers (MCCs). Bus 1B1 feeds 480 VAC buses B and 1B, which in turn feed various Train B MCCs. Bus 1C1 feeds the 480 VAC load center 1C1 which supplies the HPCS MCC 1C and SSW MCC 1C. Details of the 4160 and 480 VAC systems are shown in Figures 3.5-1 through 3.5-4.

The 125 VDC and 120 VAC independent Class 1E power systems consist of four independent electrical divisions. These systems are shown in detail in Figures 3.5-5 and 3.5-6. The DC power portion of each division consists of a main DC motor control center that distributes power to: (a) a 125 VDC distribution panel, (b) an inverter which is the normal power source for the associated 120 VAC system, and (c) various DC loads that are powered directly from the MCC. A battery charger powered from a 480 VAC MCC normally supplies power to all DC loads and maintains the associated 125 VDC battery in a fully charged state. The 125 VDC system is a required control power source for most front-line systems. The particular 125 VDC divisions required to support the operation of the individual trains of front-line systems are identified in Section 3.4

The 120 VAC Class 1E power system supplies power to instrumentation systems, including the reactor protection system (RPS). Normal power is supplied to the 120 VAC system via inverters from the associated 125 VDC motor control centers. Alternate sources of power are from the 480 VAC MCC. .a regulated isolation transformers.

Redundant safeguards equipment such as motor driven pumps and motor operated valves are supplied by different buses or MCCs. For the purpose of discussion, this equipment has been grouped into "load groups". Load group "AC/A" contains components receiving electric power either directly of indirectly from 4160 bus 1A1. Load group "AC/B" contains components powered either directly or indirectly from 4160 bus 1B1. Load group "AC/C" contains components powered either directly or indirectly from 4160 bus 1C1. Components receiving DC power are assigned to load groups "DC/1" to "DC/4", based on the battery source. The 120 VAC instrument power divisions are identified as load groups "AC/1" to "AC/4".

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 1A, 1B
   1. Continuous power rating: 3500 kW
   2. 2-hour rating: 3850 kW
   3. Rated voltage: 4160 VAC
   4. Manufacturer: unknown

B. HPCS diesel generator 1C
   1. Continuous power rating: 2200 kW
   2. Rate voltage: 4160 VAC
   3. Manufacturer: unknown

C. Station batteries 1A, 1B, 1C, and 1D
   1. Type: Lead-acid
   2. Rated voltage: 125 VDC
   3. Design capacity: unknown

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
   2. Remote manual
      The diesel generators can be started, and many distribution circuit breakers can be operated from the main control room.

B. Diesel Generator Auxiliary Systems

The following auxiliaries are provided for each emergency diesel generator:

- Cooling
  The shutdown service water system (see Section 3.7) provides for diesel cooling.
- Fueling
  An independent day tank is provided for each diesel. Long-term fuel tanks are located below the diesel generator rooms.
- Lubrication
  Each diesel generator has a self-contained lubrication system.
- Starting
  An independent starting air accumulator is provided for each diesel generator.
- Control power
  Each diesel generator is dependent on 125 VDC power from a station battery for control power.
- Diesel room ventilation fans provide room cooling during diesel operation.

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).

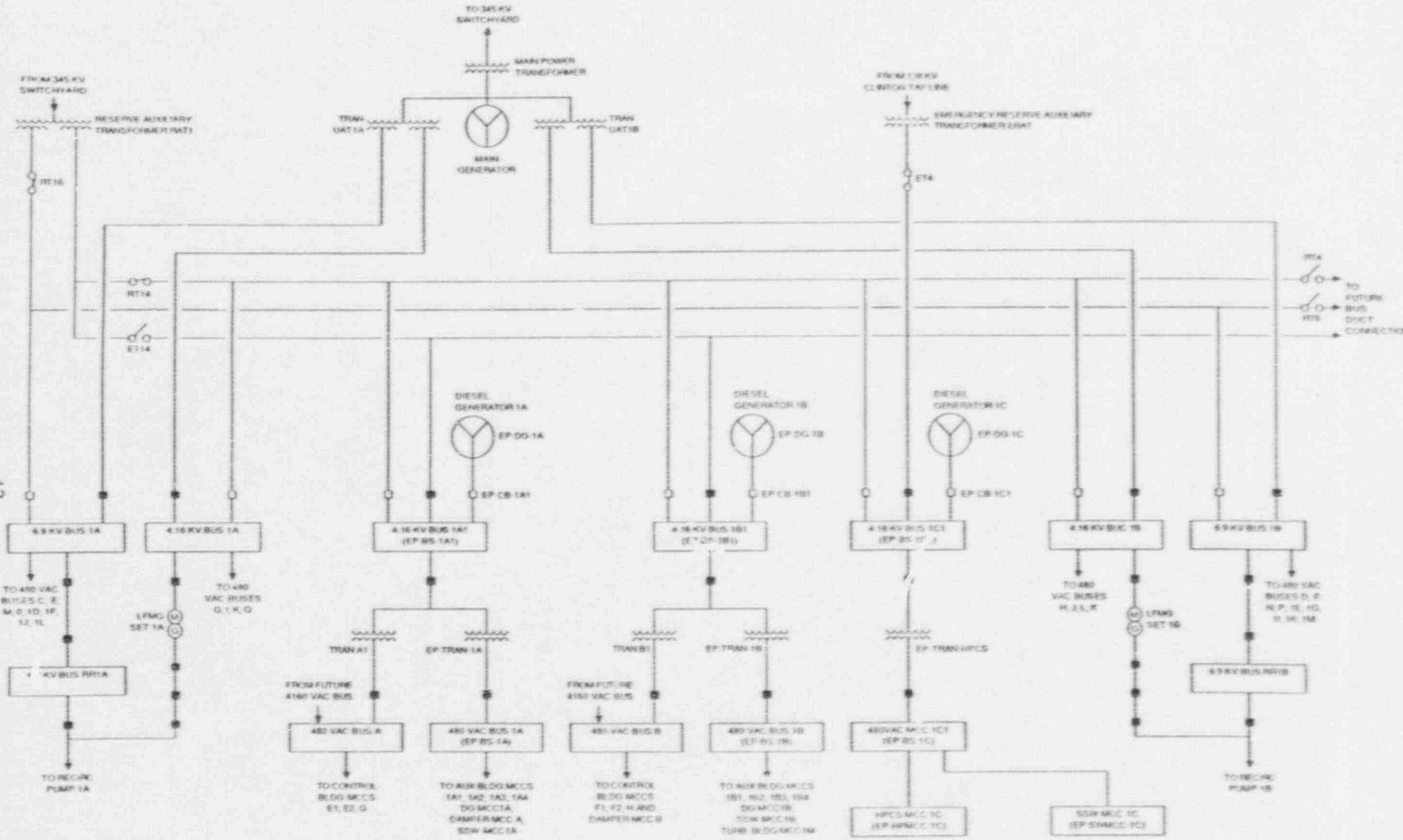


Figure 3.5-1. Clinton 1 4160 VAC and 480 VAC Electric Power Distribution System

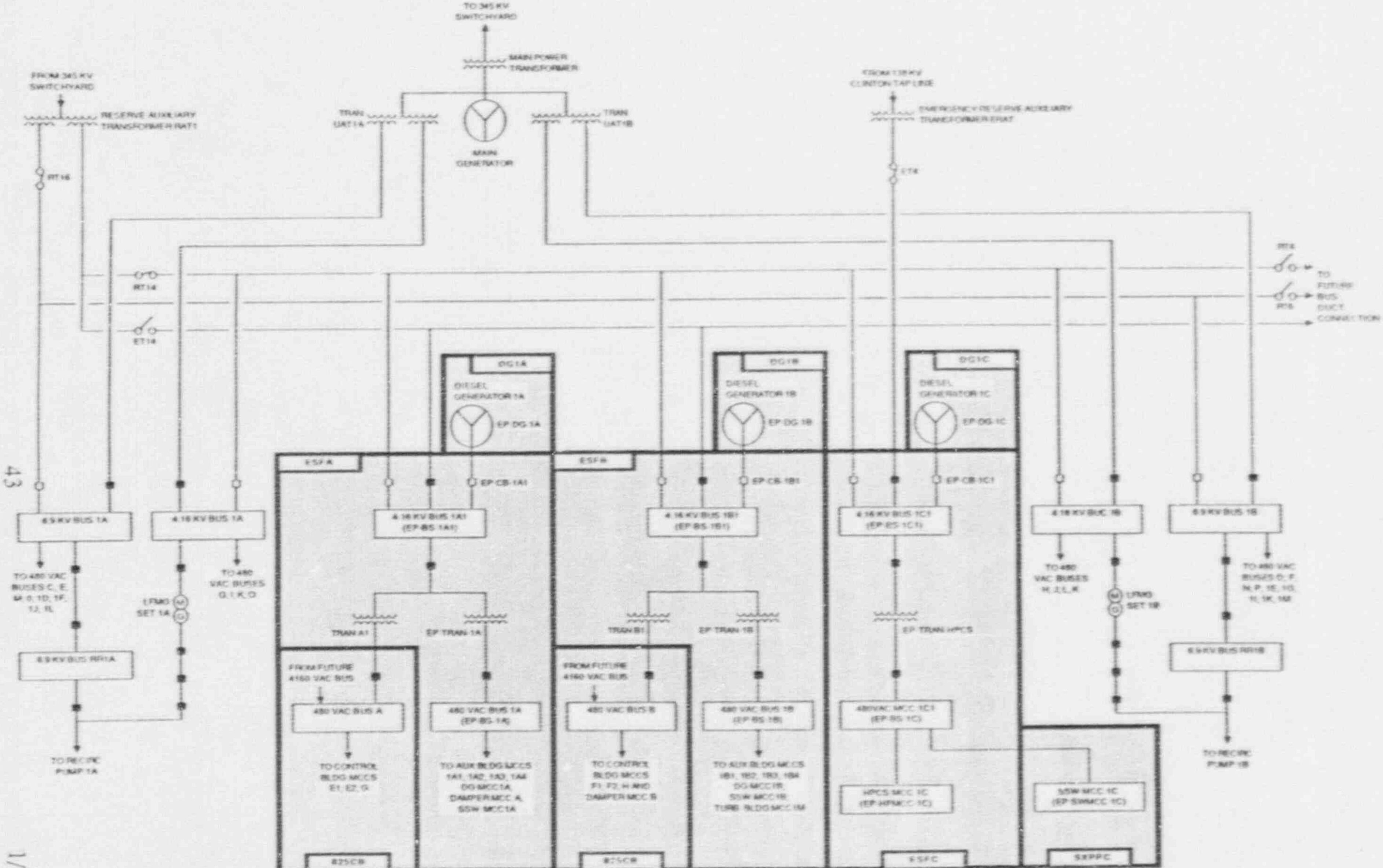


Figure 3.5-2. Clinton 1 4160 VAC and 480 VAC Electric Power Distribution System Showing Component Locations

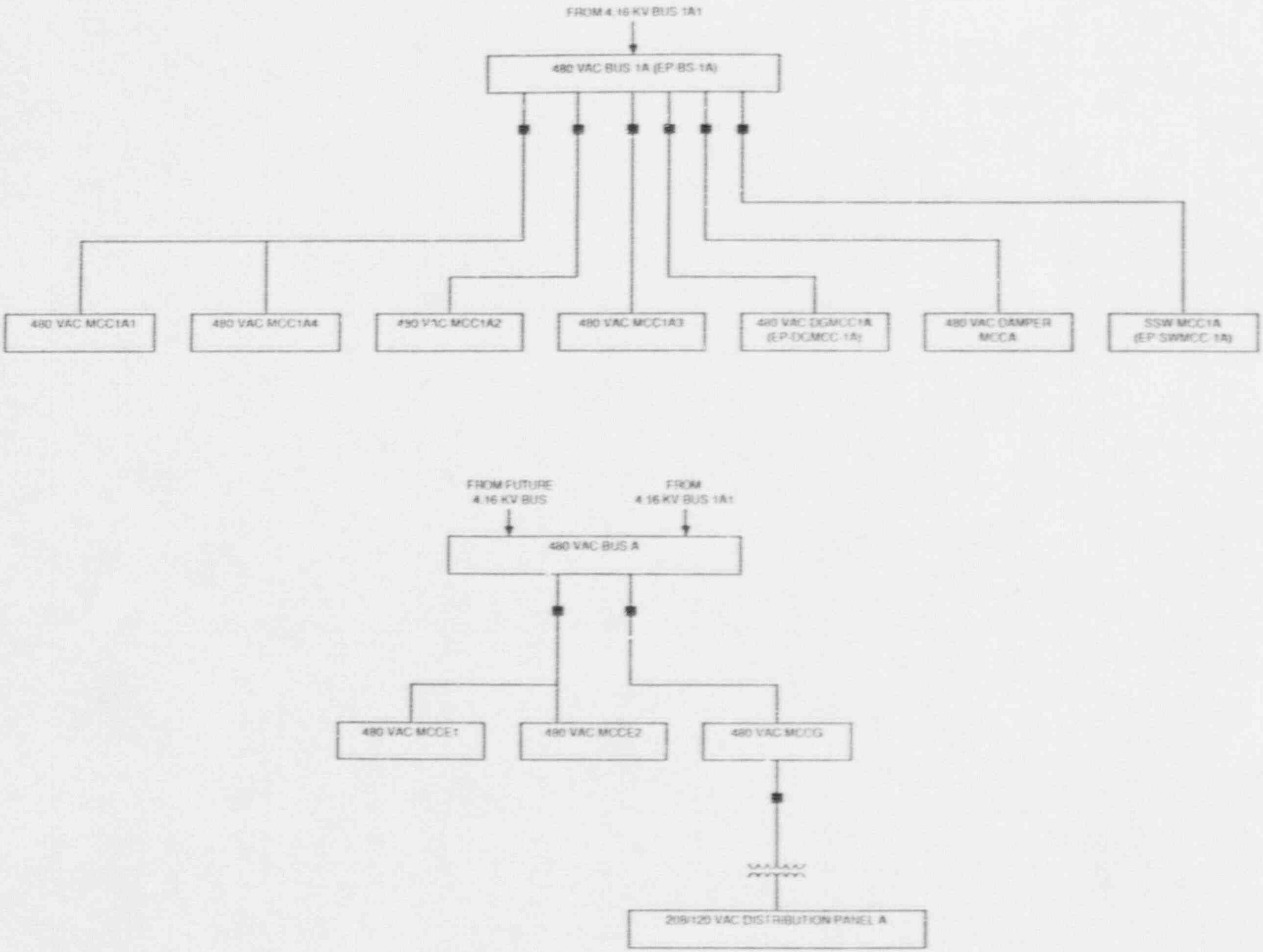


Figure 3.5-3. Clinton 1 Details of 480 VAC Electric Power Distribution System (Sheet 1 of 2)

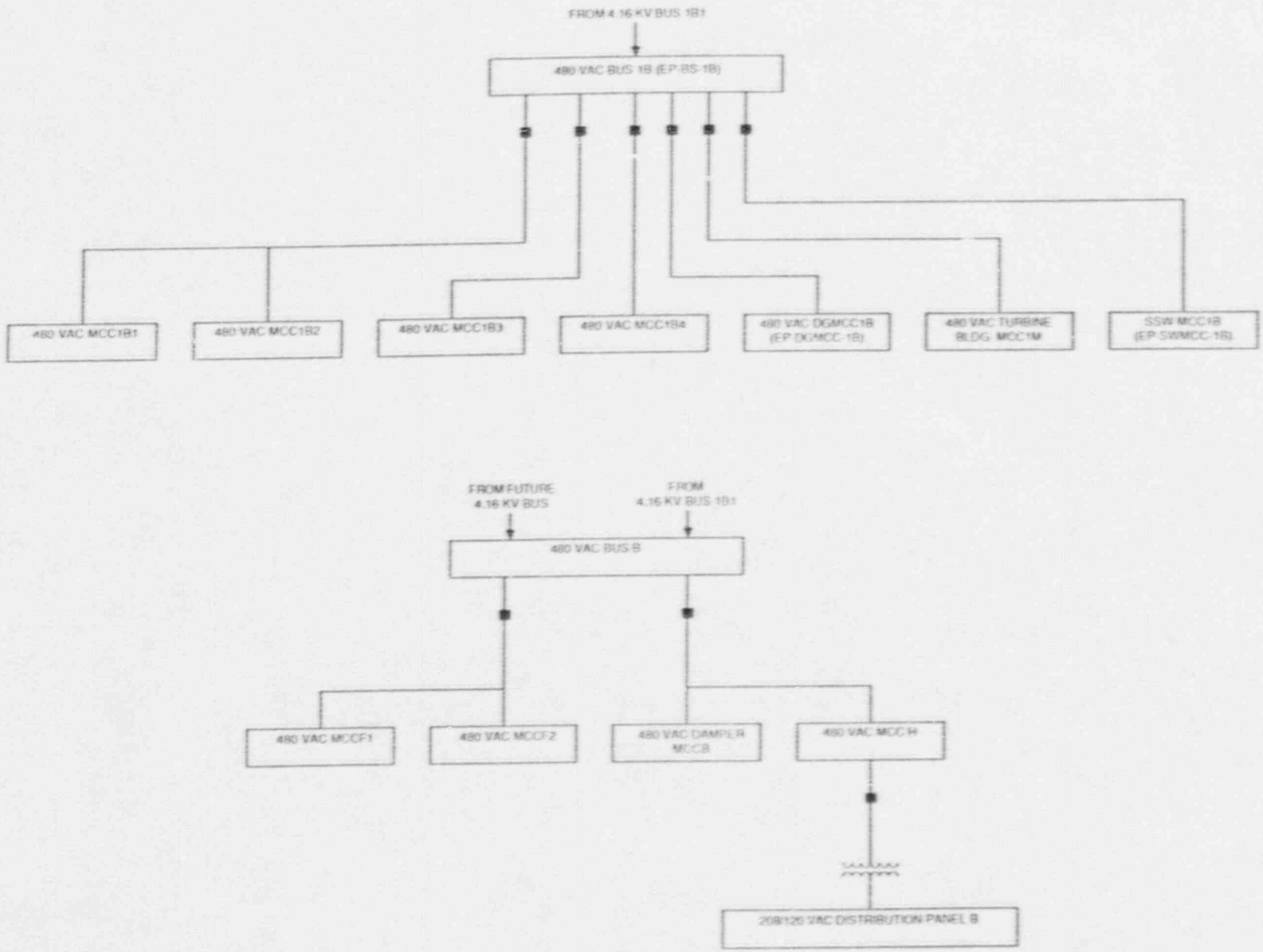


Figure 3.5-3. Clinton 1 Details of 480 VAC Electric Power Distribution System (Sheet 2 of 2)

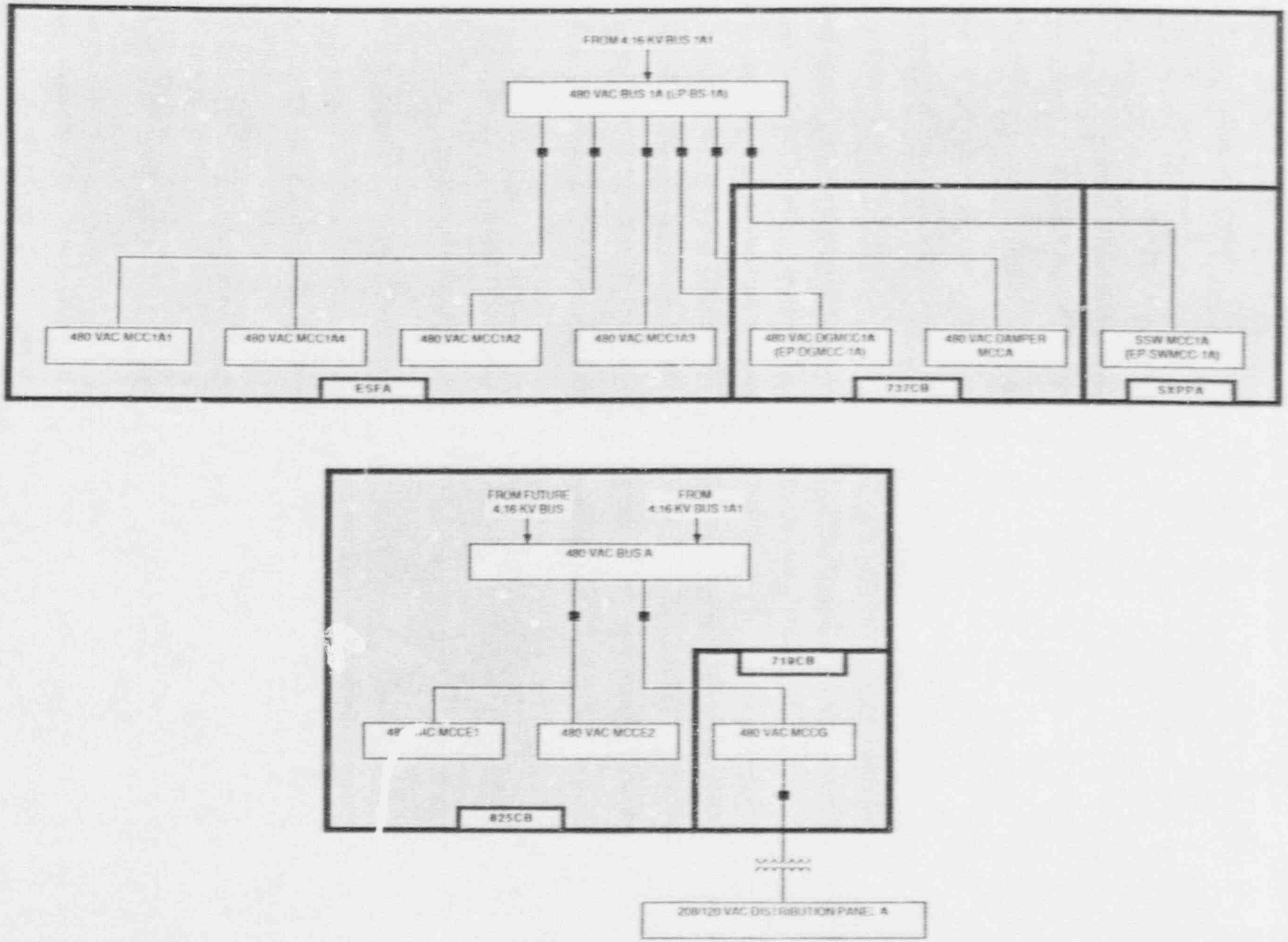


Figure 3.5-4. Clinton 1 Details of 480 VAC Electric Power Distribution System Showing Component Locations (Sheet 1 of 2)

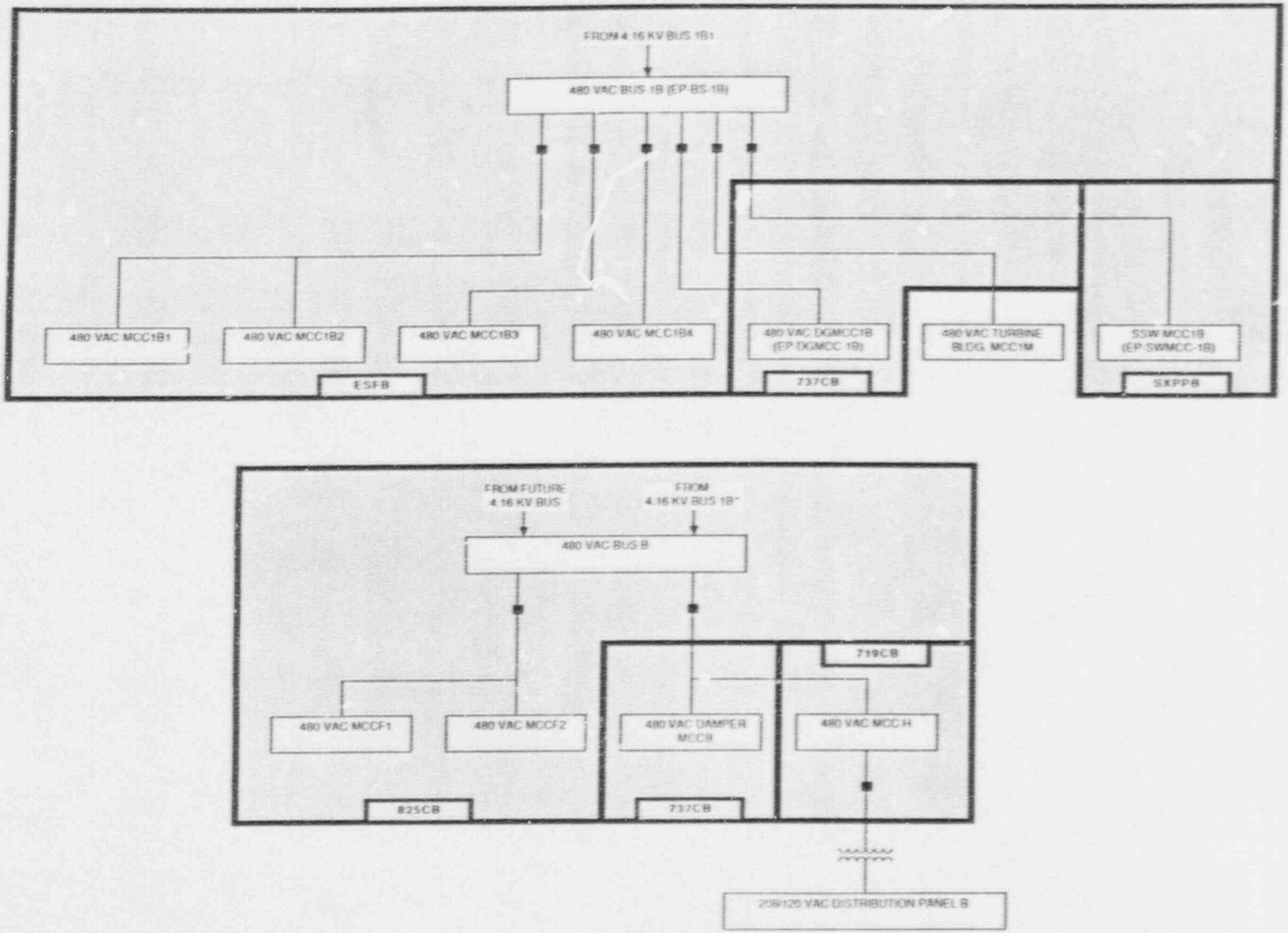


Figure 3.5-4. Clinton 1 Details of 480 VAC Electric Power Distribution System Showing Component Locations (Sheet 2 of 2)

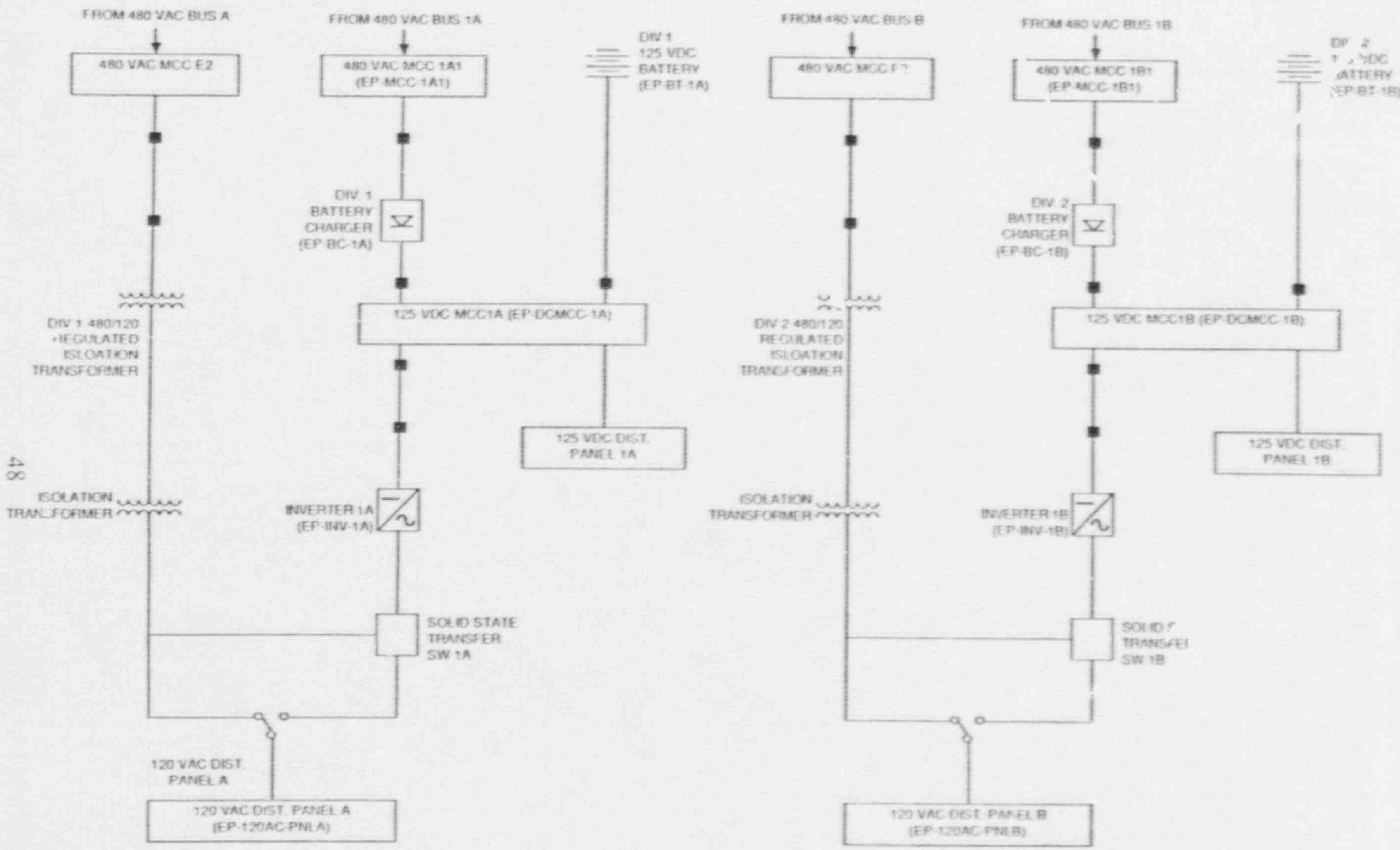


Figure 3.5-5. Clinton 1 125 VDC and 120 VAC Electric Power Distribution System (Sheet 1 of 2)

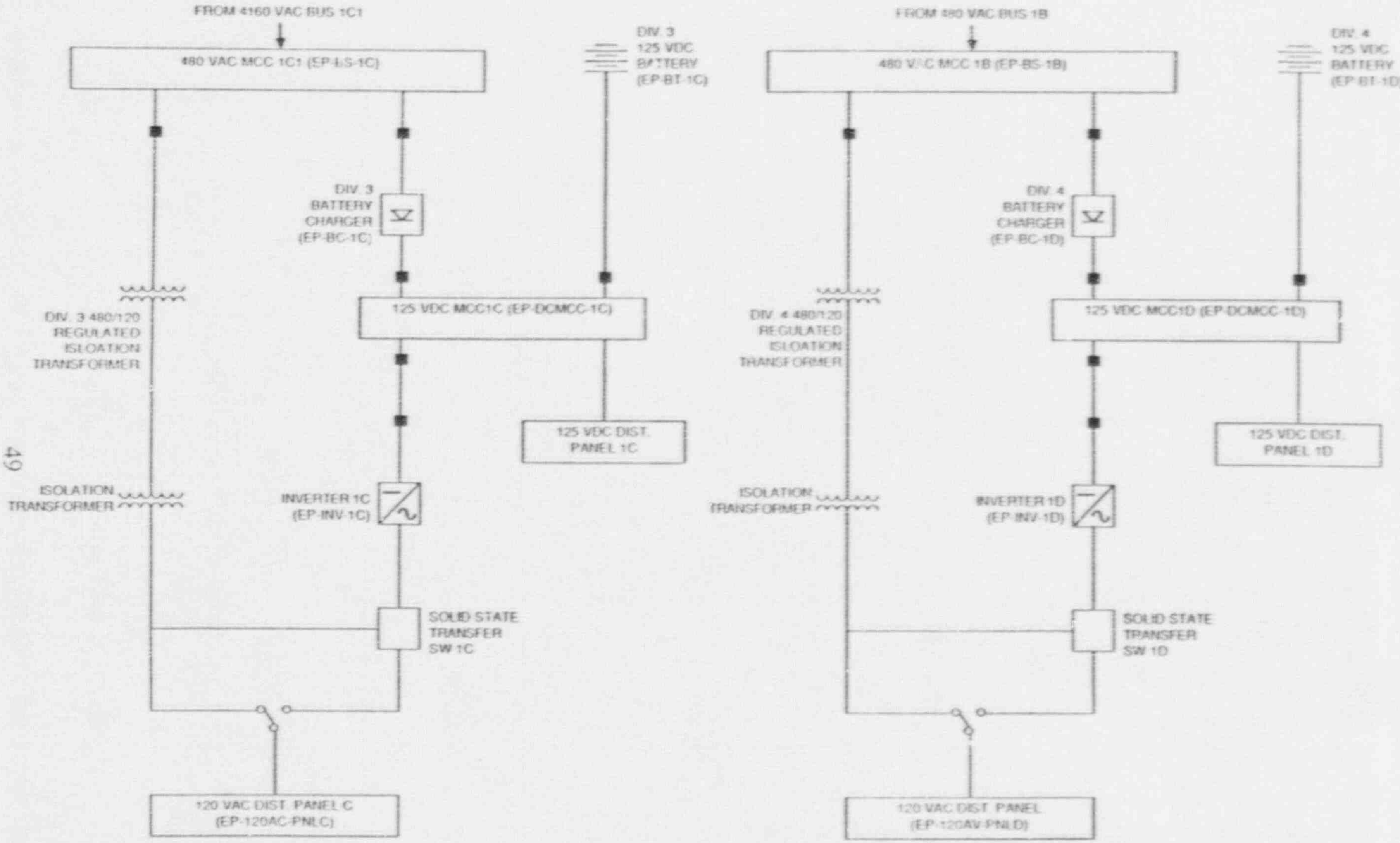


Figure 3.5-5. Clinton 1 125 VDC and 120 VAC Electric Power Distribution System (Sheet 2 of 2)

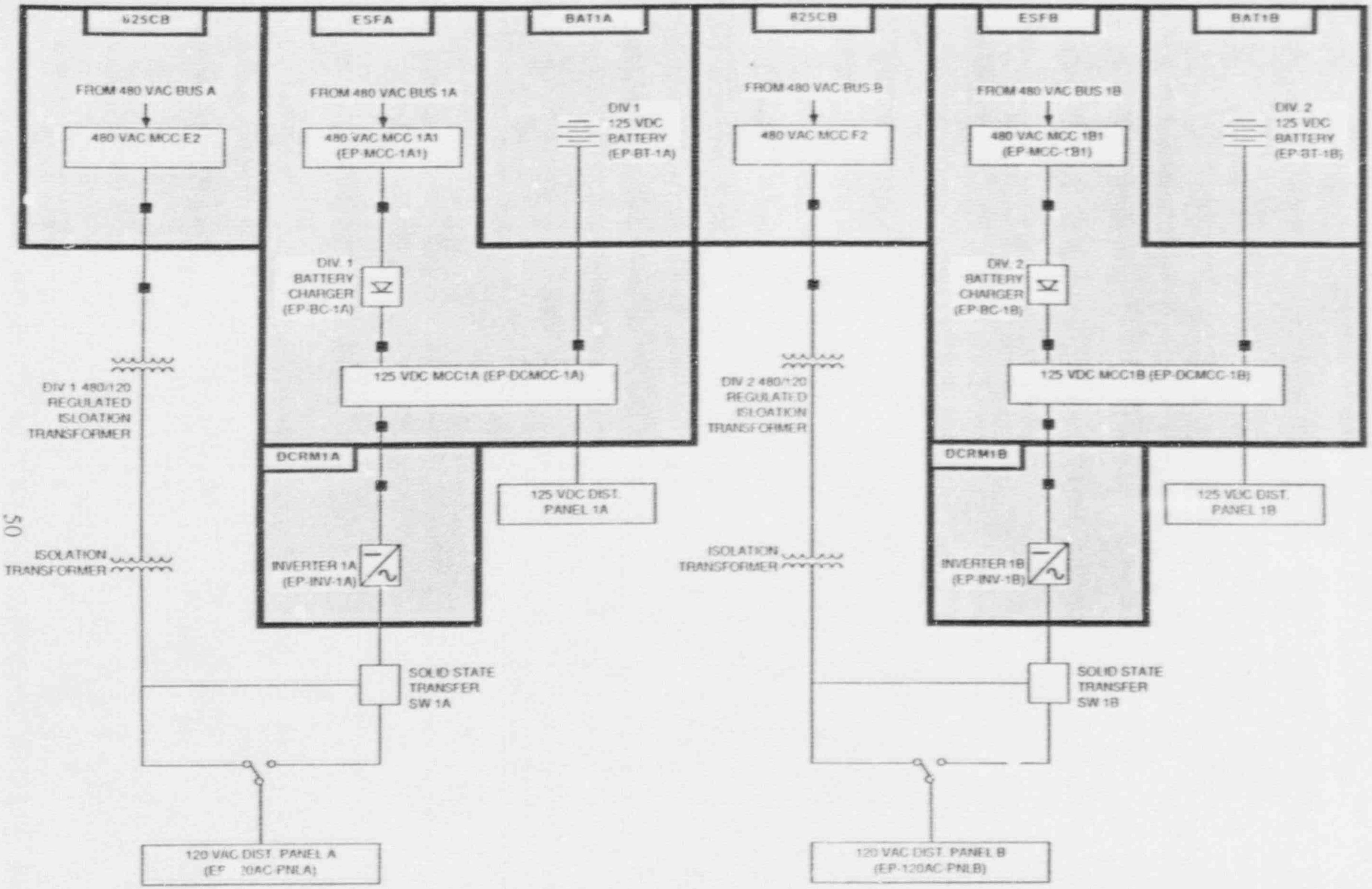


Figure 3.5-6. Clinton 1 125 VDC and 120 VAC Electric Power Distribution System Showing Component Locations (Sheet 1 of 2)

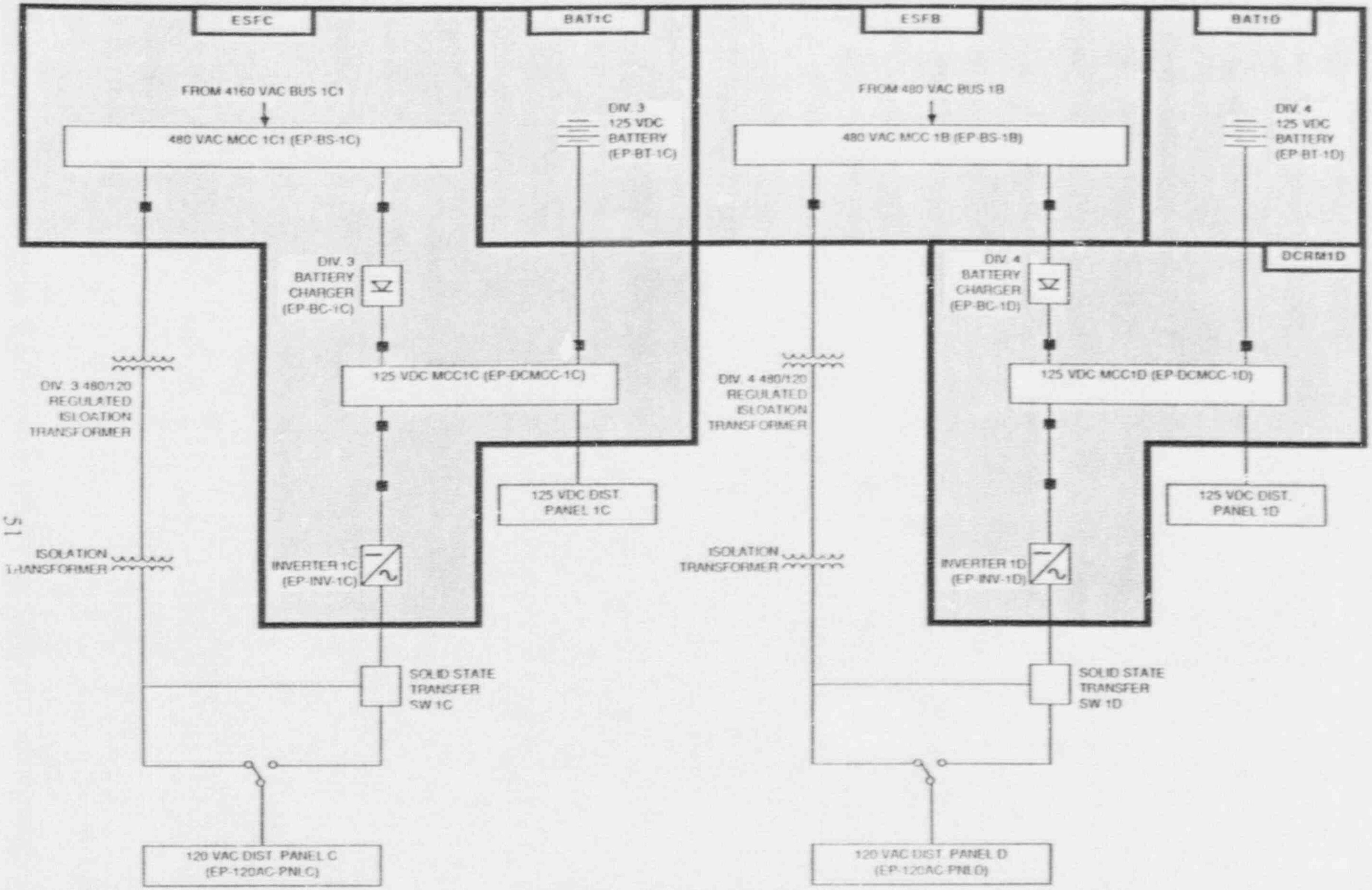


Figure 3.5-6. Clinton 1 125 VDC and 120 VAC Electric Power Distribution System Showing Component Locations (Sheet 2 of 2)

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
EP-120AC-PNLA	PNL	UNKNOWN	EP-INV-1A	120	DCRM1A	AC/1
EP-120AC-PNLB	PNL	UNKNOWN	EP-INV-1B	120	DCRM1B	AC/2
EP-120AC-PNLC	PNL	UNKNOWN	EP-INV-1C	120	ESFC	AC/3
EP-120AC-PNLD	PNL	UNKNOWN	EP-INV-1D	120	DCRM1D	AC/4
EP-B5-1A	BATT	BAT1A		125		DC/1
EP-BC-1A	BC	ESFA	EP-MCC-1A1	480	ESFA	AC/A
EP-BC-1B	BC	ESFB	EP-MCC-1B1	480	ESFB	AC/B
EP-BC-1C	BC	ESFC	EP-BS-1C	480	ESFC	AC/C
EP-BC-1D	BC	DCRM1D	EP-BS-1B	480	ESFB	AC/B
EP-BS-1A	BUS	ESFA	EP-TRAN-1A	480	ESFA	AC/A
EP-BS-1A1	BUS	ESFA	EP-DG-1A	4160	DG1A	AC/A
EP-BS-1A1	BUS	ESFA	OFFSITE			AC/A
EP-BS-1B	BUS	ESFB	EP-TRAN-1B	480	ESFB	AC/B
EP-BS-1B1	BUS	ESFB	EP-DG-1B	4160	DG1B	AC/B
EP-BS-1B1	BUS	ESFC	OFFSITE			AC/B
EP-BS-1C	MCC	ESFC	EP-TRAN-HPCS	480	ESFC	AC/C
EP-BS-1C1	BUS	ESFC	EP-DG-1C	4160	DG1C	AC/C
EP-BS-1C1	BUS	ESFC	OFFSITE			AC/C
EP-BT-1B	BATT	BAT1B		125		DC/2
EP-BT-1C	BATT	BAT1C		125		DC/3
EP-BT-1D	BATT	BAT1D		125		DC/4
EP-CB-1A1	CB	ESFA				
EP-CB-1B1	CB	ESFB				
EP-CB-1C1	CB	ESFC				
EP-DCMCC-1A	MCC	ESFA	EP-BT-1A	125	BAT1A	DC/1
EP-DCMCC-1A	MCC	ESFA	EP-BC-1A	125	ESFA	DC/1
EP-DCMCC-1B	MCC	ESFB	EP-BC-1B	125	ESFB	DC/2

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

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
EP-DCMCC-1B	MCC	ESFB	EP-BT-1B	125	BAT1B	DC/2
EP-DCMCC-1C	MCC	ESFC	EP-BT-1C	125	BAT1C	DC/3
EP-DCMCC-1C	MCC	ESFC	EP-BC-1C	125	ESFC	DC/3
EP-DCMCC-1D	MCC	DCRM1D	EP-BT-1D	125	BAT1D	DC/4
EP-DCMCC-1D	MCC	DCRM1D	EP-BC-1D	125	DCRM1D	DC/4
EP-DG-1A	DG	DG1A		4160		AC/A
EP-DG-1B	DG	DG1B		4160		AC/B
EP-DG-1C	DG	DG1C		4160		AC/C
EP-DGMCC-1A	MCC	737CB	EP-BS-1A	480	ESFA	AC/A
EP-DGMCC-1B	MCC	737CB	EP-BS-1B	480	ESFB	AC/B
EP-HPMCC-1C	MCC	ESFC	EP-BS-1C	480	ESFC	AC/C
EP-INV-1A	INV	DCRM1A	EP-DCMCC-1A	125	ESFA	DC/1
EP-INV-1B	INV	DCRM1B	EP-DCMCC-1B	125	ESFB	DC/2
EP-INV-1C	INV	ESFC	EP-DCMCC-1C	125	ESFC	DC/3
EP-INV-1D	INV	DCRM1D	EP-DCMCC-1D	125	DCRM1D	DC/4
EP-MCC-1A1	MCC	ESFA	EP-BS-1A	480	ESFA	AC/A
EP-MCC-1B1	MCC	ESFB	EP-BS-1B	480	ESFB	AC/B
EP-SWMCC-1A	MCC	SXPPA	EP-BS-1A	480	ESFA	AC/A
EP-SWMCC-1B	MCC	SXPPB	EP-BS-1B	480	ESFB	AC/B
EP-SWMCC-1C	MCC	SXPPC	EP-BS-1C	480	ESFC	AC/C
EP-TRAN-1A	TRAN	ESFA	EP-BS-1A1	4160	ESFA	AC/A
EP-TRAN-1B	TRAN	ESFB	EP-BS-1B1	4160	ESFB	AC/B
EP-TRAN-HPCS	TRAN	ESFC	EP-BS-1C1	4160	ESFC	AC/C

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Clinton 1

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
EP-BC-1A	125	DC/1	ESFA	EP	EP-DCMCC-1A	MCC	ESFA
EP-BC-1B	125	DC/2	ESFB	EP	EP-DCMCC-1B	MCC	ESFB
EP-BC-1C	125	DC/3	ESFC	EP	EP-DCMCC-1C	MCC	ESFC
EP-BC-1D	125	DC/4	DCRM1D	EP	EP-DCMCC-1D	MCC	DCRM1D
EP-BS-1A	480	AC/A	ESFA	ECCS	LPCS-F001	MOV	LPCS
EP-BS-1A	480	AC/A	ESFA	ECCS	LPCS-F005	MOV	755FB
EP-BS-1A	480	AC/A	ESFA	ECCS	LPCS-F012	MOV	LPCS
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-24A	MOV	LPCS
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-24A	MOV	LPCS
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-27A	MOV	762CGCA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-27A	MOV	762CGCA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-28A	MOV	RC
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-28A	MOV	RC
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-37A	MOV	RC
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-3A	MOV	RHRHXA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-42A	MOV	RC
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-47A	MOV	RHRHXA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-48A	MOV	RHRHXA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-48A	MOV	RHRHXA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-4A	MOV	RHRA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-52A	MOV	RHRHXA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-53A	MOV	LPCS
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-6A	MOV	RHRA
EP-BS-1A	480	AC/A	ESFA	ECCS	RHR-87A	MOV	RHRHXA
EP-BS-1A	480	AC/A	ESFA	EP	EP-DGMCC-1A	MCC	737CR
EP-BS-1A	480	AC/A	ESFA	EP	EP-MCC-1A1	MCC	ESFA
EP-BS-1A	480	AC/A	ESFA	EP	EP-SWMCC-1A	MCC	SXPPA
EP-BS-1A	480	AC/A	ESFA	RCIC	RCIC-63	MOV	DW
EP-BS-1A	480	AC/A	ESFA	RCIC	RCIC-63	MOV	DW
EP-BS-1A	480	AC/A	ESFA	RCS	RCS-8	MOV	RHRA
EP-BS-1A	480	AC/A	ESFA	RCS	RWCU-4	MOV	MST

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Clinton 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
EP-BS-1A	480	AC/A	ESFA	SSW	SSW-12A	MOV	712FB
EP-BS-1A	480	AC/A	ESFA	SSW	SSW-14A	MOV	RHRHXA
EP-BS-1A	480	AC/A	ESFA	SSW	SSW-20A	MOV	712FB
EP-BS-1A	480	AC/A	ESFA	SSW	SSW-68A	MOV	RHRHXA
EP-BS-1A1	4160	AC/A	ESFA	ECCS	LPCI-P1A	MDP	RHRA
EP-BS-1A1	4160	AC/A	ESFA	ECCS	LPCS-P1	MDP	LPCS
EP-BS-1A1	4160	AC/A	ESFA	EP	EP-TRAN-1A	TRAN	ESFA
EP-BS-1A1	4160	AC/A	ESFA	SSW	SSW-P1A	MDP	SSPPA
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-105C	MOV	RHRC
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-21C	MOV	737ABW
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-24B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-24B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-27B	MOV	737ABW
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-27B	MOV	737ABW
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-28B	MOV	RC
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-28B	MOV	RC
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-37B	MOV	RC
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-3B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-42B	MOV	RC
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-42C	MOV	737ABW
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-47B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-48B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR 48B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-52B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-53B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-6B	MOV	RHRB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR-87B	MOV	RHRHXB
EP-BS-1B	480	AC/B	ESFB	ECCS	RHR4B	MOV	RHRB
EP-BS-1B	480	AC/B	ESFB	EP	EP-BC-1D	BC	DCRM1D
EP-BS-1B	480	AC/B	ESFB	EP	EP-DGMCC-1B	MCC	737CB
EP-BS-1B	480	AC/B	ESFB	EP	EP-MCC-1B1	MCC	ESFB

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Clinton 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
EP-BS-1B	480	AC/B	ESFB	EP	EP-SWMCC-1B	MCC	SXPPB
EP-BS-1B	480	AC/B	ESFB	RCS	RCS-16	MOV	DW
EP-BS-1B	480	AC/B	ESFB	RCS	RCS-9	MOV	DW
EP-BS-1B	480	AC/B	ESFB	RCS	RWCU-1	MOV	DW
EP-BS-1B	480	AC/B	ESFB	SSW	SSW-12B	MOV	737FB
EP-BS-1B	480	AC/B	ESFB	SSW	SSW-14B	MOV	RHRHX
EP-BS-1B	480	AC/B	ESFB	SSW	SSW-68B	MOV	RHRHXB
EP-BS-1B1	4160	AC/B	ESFB	ECCS	LPCI-P1B	MDP	RHRB
EP-BS-1B1	4160	AC/B	ESFB	ECCS	LPCI-P1C	MDP	RHRC
EP-BS-1B1	4160	AC/B	ESFB	EP	EP-TRAN-1B	TRAN	ESFB
EP-BS-1B1	4160	AC/B	ESFB	SSW	SSW-P1B	MDP	SXPPB
EP-BS-1C	480	AC/C	ESFC	EP	EP-BC-1C	BC	ESFC
EP-BS-1C	480	AC/C	ESFC	EP	EP-HPMCC-1C	MCC	ESFC
EP-BS-1C	480	AC/C	ESFC	EP	EP-SWMCC-1C	MCC	SXPPC
EP-BS-1C	480	AC/C	ESFC	SSW	SSW-06C	MOV	DG1C
EP-BS-1C1	4160	AC/C	ESFC	ECCS	HPCS-P1	MDP	HPCS
EP-BS-1C1	4160	AC/C	ESFC	EP	EP-TRAN-HPCS	TRAN	ESFC
EP-BS-1C1	4160	AC/C	ESFC	SSW	SSW-P1C	MDP	SXPPC
EP-BT-1A	125	DC/1	BAT1A	EP	EP-DCMCC-1A	MCC	ESFA
EP-BT-1B	125	DC/2	BAT1B	EP	EP-DCMCC-1B	MCC	ESFB
EP-BT-1C	125	DC/3	BAT1C	EP	EP-DCMCC-1C	MCC	ESFC
EP-BT-1D	125	DC/4	BAT1D	EP	EP-DCMCC-1D	MCC	DCRM1D
EP-DCMCC-1A	125	DC/1	ESFA	EP	EP-INV-1A	INV	DCRM1A
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-10	MOV	RCIC
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-13	MOV	MST
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-22	MOV	RHRHXA
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-31	MOV	RCIC
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-45	MOV	RCIC
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-59	MOV	RHRHXA
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-64	MOV	MST
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-64	MOV	MST

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Clinton 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
EP-DCMCC-1A	125	DC/1	ESFA	RCIC	RCIC-68	MOV	MSIVLCRM
EP-DCMCC-1B	125	DC/2	ESFB	EP	EP-INV-1B	INV	DCRM1B
EP-DCMCC-1C	125	DC/3	ESFC	EP	EP-INV-1C	INV	ESFC
EP-DCMCC-1D	125	DC/4	DCRM1D	EP	EP-INV-1D	INV	DCRM1D
EP-DG-1A	4160	AC/A	DG1A	EP	EP-BS-1A1	BUS	ESFA
EP-DG-1B	4160	AC/B	DG1B	EP	EP-BS-1B1	BUS	ESFB
EP-DG-1C	4160	AC/C	DG1C	EP	EP-BS-1C1	BUS	ESFC
EP-DGMCC-1A	480	AC/A	737CB	SSW	SSW-63A	MOV	DG1A
EP-DGMCC-1B	480	AC/B	737CB	SSW	SSW-20B	MOV	737FB
EP-DGMCC1B	480	AC/B	737CB	SSW	SSW-63B	MOV	DG1B
EP-HPMCC-1C	480	AC/C	ESFC	ECCS	HPCS-F001	MOV	HPCS
EP-HPMCC-1C	480	AC/C	ESFC	ECCS	HPCS-F004	MOV	755FB
EP-HPMCC-1C	480	AC/C	ESFC	ECCS	HPCS-F010	MOV	HPCS
EP-HPMCC-1C	480	AC/C	ESFC	ECCS	HPCS-F011	MOV	HPCS
EP-HPMCC-1C	480	AC/C	ESFC	ECCS	HPCS-F015	MOV	HPCS
EP-HPMCC-1C	480	AC/C	ESFC	ECCS	HPCS-F023	MOV	HPCS
EP-INV-1A	120	AC/1	DCRM1A	EP	EP-120AC-PNL A	PNL	UNKNOWN
EP-INV-1B	120	AC/2	DCRM1B	EP	EP-120AC-PNL B	PNL	UNKNOWN
EP-INV-1C	120	AC/3	ESFC	EP	EP-120AC-PNL C	PNL	UNKNOWN
EP-INV-1D	120	AC/4	DCRM1D	EP	EP-120AC-PNL D	PNL	UNKNOWN
EP-MCC-1A1	480	AC/A	ESFA	EP	EP-BC-1A	BC	ESFA
EP-MCC-1B1	480	AC/B	ESFB	EP	EP-BC-1B	BC	ESFB
EP-MCC-1F	480	AC/A	ABMCC1F	RCS	RCS-001	MOV	DW
EP-MCC-1G	480	AC/B	ABMCC1G	RCS	RCS-002	MOV	DW
EP-SWMCC-1A	480	AC/A	SXPPA	SSW	SSW-03A	MOV	SXPPA
EP-SWMCC-1A	480	AC/A	SXPPA	SSW	SSW-04A	MOV	SXPPA
EP-SWMCC-1A	480	AC/A	SXPPA	SSW	SSW-08A	MOV	SXPPA
EP-SWMCC-1A	480	AC/A	SXPPA	SSW	SSW-11A	MOV	SXPTNL
EP-SWMCC-1A	480	AC/A	SXPPA	SSW	SSW-14A	MOV	SXPPA
EP-SWMCC-1B	480	AC/B	SXPPB	SSW	SSW-03B	MOV	SXPPB
EP-SWMCC-1B	480	AC/B	SXPPB	SSW	SSW-04B	MOV	SXPPB

Table 3.5-2. Partial Listing of Electrical Sources and Loads at Clinton 1 (Continued)

POWER SOURCE	VOLTAGE	EMERG LOAD GRP	POWER SOURCE LOCATION	LOAD SYSTEM	LOAD COMPONENT ID	COMP TYPE	COMPONENT LOCATION
EP-SWMCC-1B	480	AC/B	SXPPB	SSW	SSW-08B	MOV	SXPPB
EP-SWMCC-1B	480	AC/B	SXPPB	SSW	SSW-11B	MOV	SXPTNL
EP-SWMCC-1B	480	AC/B	SXPPB	SSW	SSW-14B	MOV	SXPPB
EP-SWMCC-1C	480	AC/C	SXPPC	SSW	SSW-03C	MOV	SXPPC
EP-SWMCC-1C	480	AC/C	SXPPC	SSW	SSW-04C	MOV	SXPPC
EP-SWMCC-1C	480	AC/C	SXPPC	SSW	SSW-04C	MOV	SXPPC
EP-SWMCC-1C	480	AC/C	SXPPC	SSW	SSW-08C	MOV	SXPPC
EP-SWMCC-1C	480	AC/C	SXPPC	SSW	SSW-14C	MOV	SXPPC
EP-TRAN-1A	480	AC/A	ESFA	EP	EP-BS-1A	BUS	ESFA
EP-TRAN-1B	480	AC/B	ESFB	EP	EP-BS-1B	BUS	ESFB
EP-TRAN-HPCS	480	AC/C	ESFC	EP	EP-BS-1C	MCC	ESFC
OFFSITE		AC/A		EP	EP-BS-1A1	BUS	ESFA
OFFSITE		AC/B		[illegible]	EP-BS-1B1	BUS	ESFC
OFFSITE		AC/C		EP	EP-BS-1C1	BUS	ESFC

3.6 CONTROL ROD DRIVE HYDRAULIC SYSTEM (CRDHS)

3.6.1 System Function

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

3.6.2 System Definition

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

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

3.6.3 System Operation

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

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

The control rod drive accumulators are necessary to scram the control rods within the required time. It should be noted that each drive has an internal ball check valve which allows reactor pressure to be admitted under the drive piston. If reactor pressure is above 600 psi, the ball check valve ensures rod insertion in the event that the scram accumulator is not charged or the inlet scram valve fails to open. The insertion time, however, will be slower than the scram time with a properly functioning scram system.

Although not intended as a makeup system, the CRDHS can provide a source of cooling water to the RCS during vessel isolation. In BWR/6 plants, RCS makeup at high pressure is performed by the RCIC (see Section 3.2) and HPCS (see Section 3.3) systems. The maximum RCS makeup rate of the CRDHS is about 200 gpm with both pumps operating (Ref. 1).

3.6.4 System Success Criteria

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

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

- A specified number of control rods must responds and insert into the reactor core (specific number needed is not known).

3.6.5 Component Information

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

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

C. Scram Accumulator
  1. Normal pressure: 1750 psig

D. Scram Discharge Volume
  1. Normal pressure: Atmospheric

3.6.6 Support Systems and Interfaces

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

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

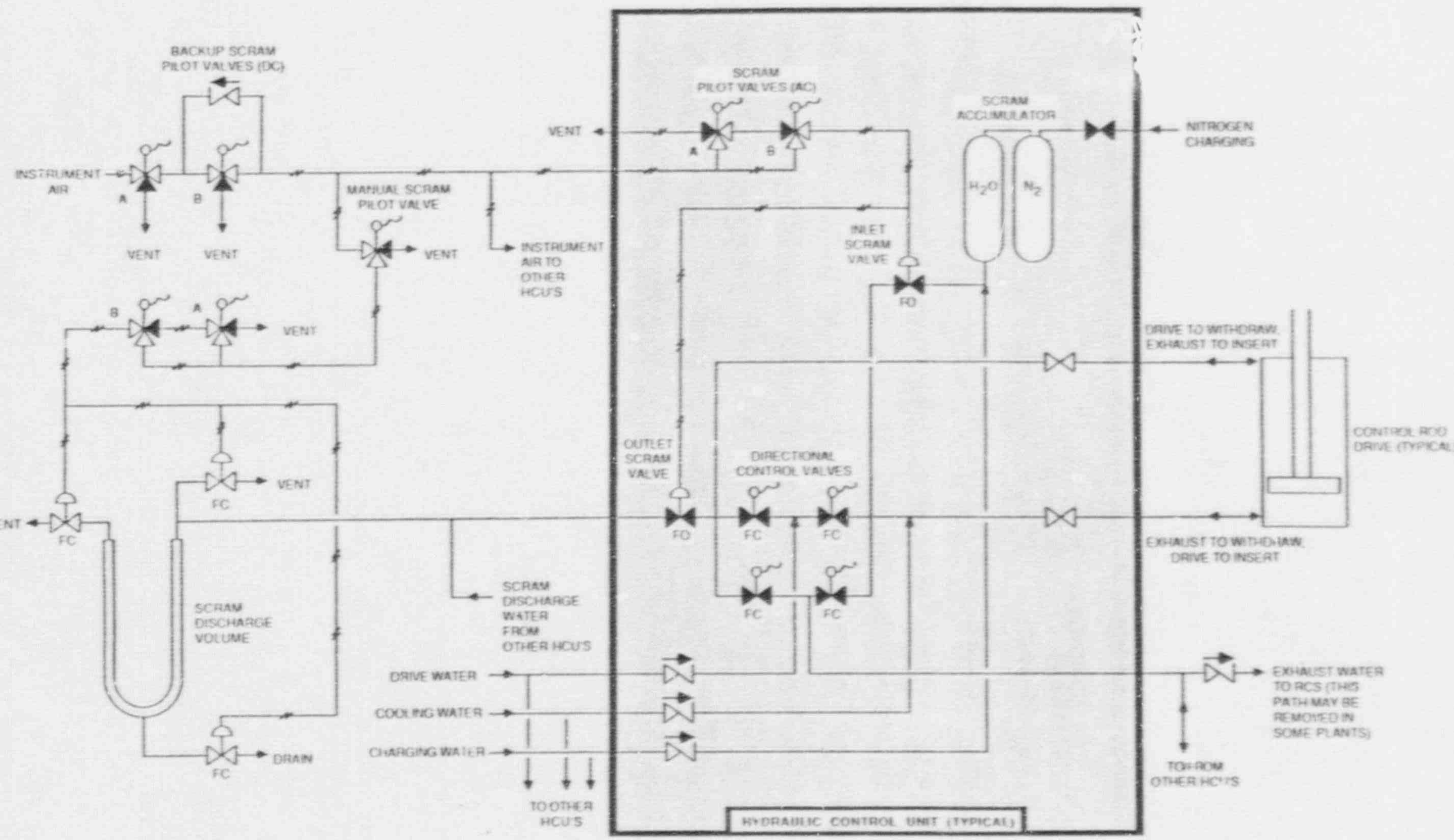


Figure 3.6-1. Simplified Diagram Of Portions Of The Control Rod Drive Hydraulic System That Are Related To The Scram Function

3.7 SHUTDOWN SERVICE WATER SYSTEM (SSWS)

3.7.1 System Function

The Shutdown Service Water System provides cooling water from the ultimate heat sink to various heat loads in the plant required for safe shutdown. The SSWS completes the decay heat transfer path from the RHR system to the ultimate heat sink. Train B of the SSWS also can be aligned to supply water to the RHR system for low pressure core flooding if needed.

3.7.2 System Definition

The SSW system consists of three separate trains which each contain one motor driven pump and distribution piping serving the heat loads assigned to that train.

Simplified drawings of the three SSWS trains are shown in Figures 3.7-1 to 3.7-6. A summary of the data on selected SSW system components is presented in Table 3.7-1.

3.7.3 System Operation

The SSWS pumps normally are shut down, and heat loads in the SSWS are supplied with cooling water via interties with the plant service water system (PSWS, see Section 3.8). The SSWS pumps are automatically started and the intertie line is isolated upon loss of offsite power, which causes a loss of power to the PSW pumps. The SSW pumps also start automatically upon receipt of a LOCA signal.

The SSWS supplies cooling water to the heat loads listed in Table 3.7-2. The SSWS also serves as a backup supply of cooling water for the reactor recirculation pump motors, bearings, and seals, when the pumps are operating. They draw water from Lake Clinton, which serves as the ultimate heat sink.

SSWS trains A and B can be cross-connected to each other. SSWS train C is dedicated to serving heat loads associated with the HPCS, and is not cross-connected with the other SSWS trains.

3.7.4 System Success Criteria

The SSWS success criteria are described on a per train basis. If the equipment in a particular train requires cooling the SSW pump in that train must operate and an intact flow path must exist from the pump to the heat loads. It should be noted that SSWS trains A and B can be cross-connected. It is unclear whether a single pump (either A or B) can supply the heat loads of two trains simultaneously.

3.7.5 Component Information

A. Shutdown Service Water, Divisions I and II
   1. Rated flow: 16,500 gpm @ 275 ft. head (119 psid)
   2. Rated capacity: 100%
   3. Type: vertical centrifugal

B. Shutdown Service Water Pump, Division III
   1. Rated flow: 1,100 gpm @ 175 ft head (76 psid)
   2. Rated capacity: 100%
   3. Type: vertical centrifugal

3.7.6 Support Systems and Interfaces

A. Control Signals

1. Automatic

   Upon receipt of a LOCA or loss of offsite power signal, all SSWS pumps are started and isolation valves 14A, 14B, and 14C in the intertie lines with the PSWS are automatically closed.

2. Remote manual

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

B. Motive Power

The SSW pumps are Class 1E AC loads that can be supplied from the standby diesel generators as described in Section 3.5.

C. Pump Cooling and Pump Room Cooling

Cooling water is diverted from the SSWS supply header to provide cooling water for the bearings of the respective SSWS pump, and for the SSWS room cooler.

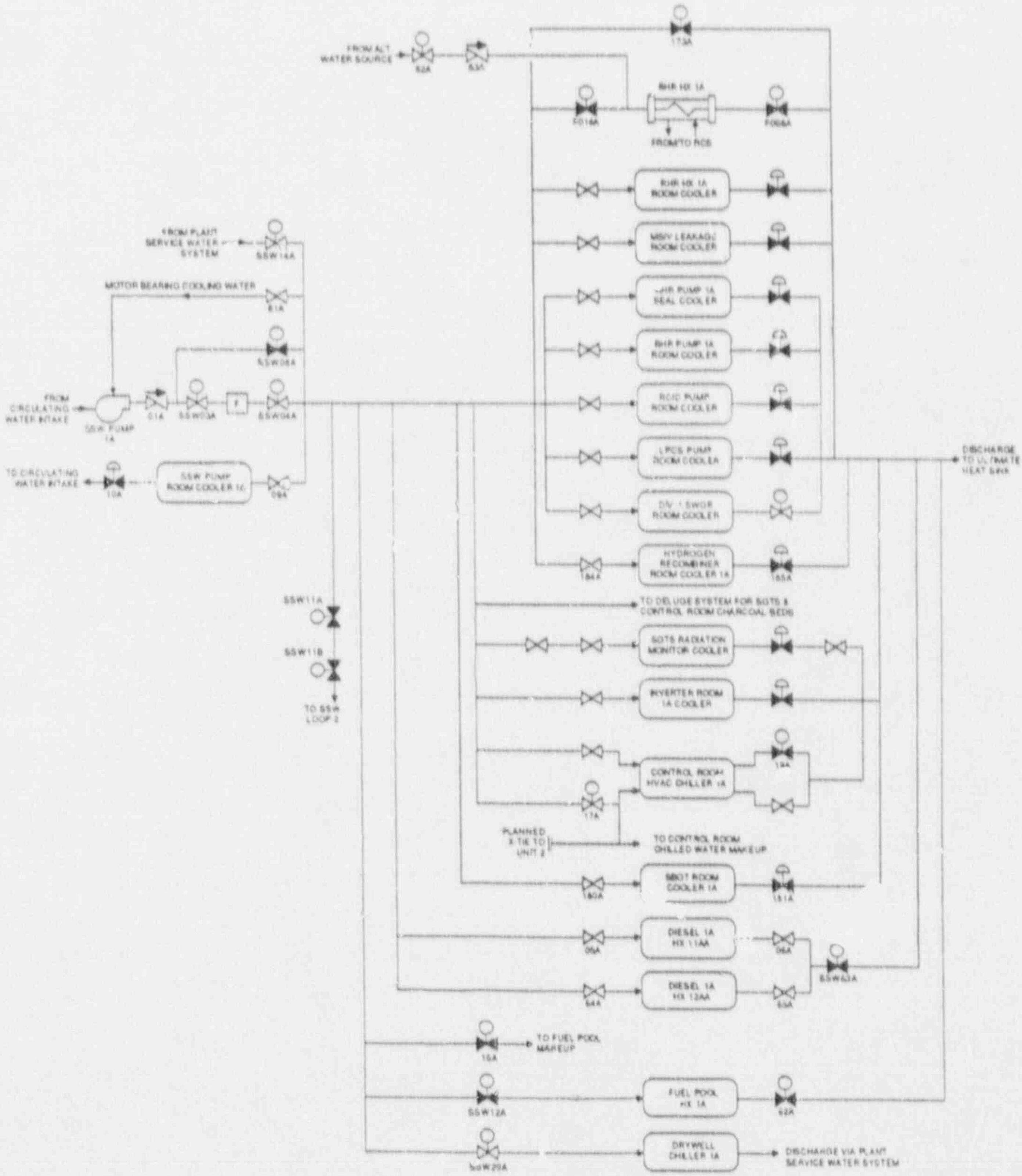


Figure 3.7-1. Clinton 1 Shutdown Service Water System, Train A

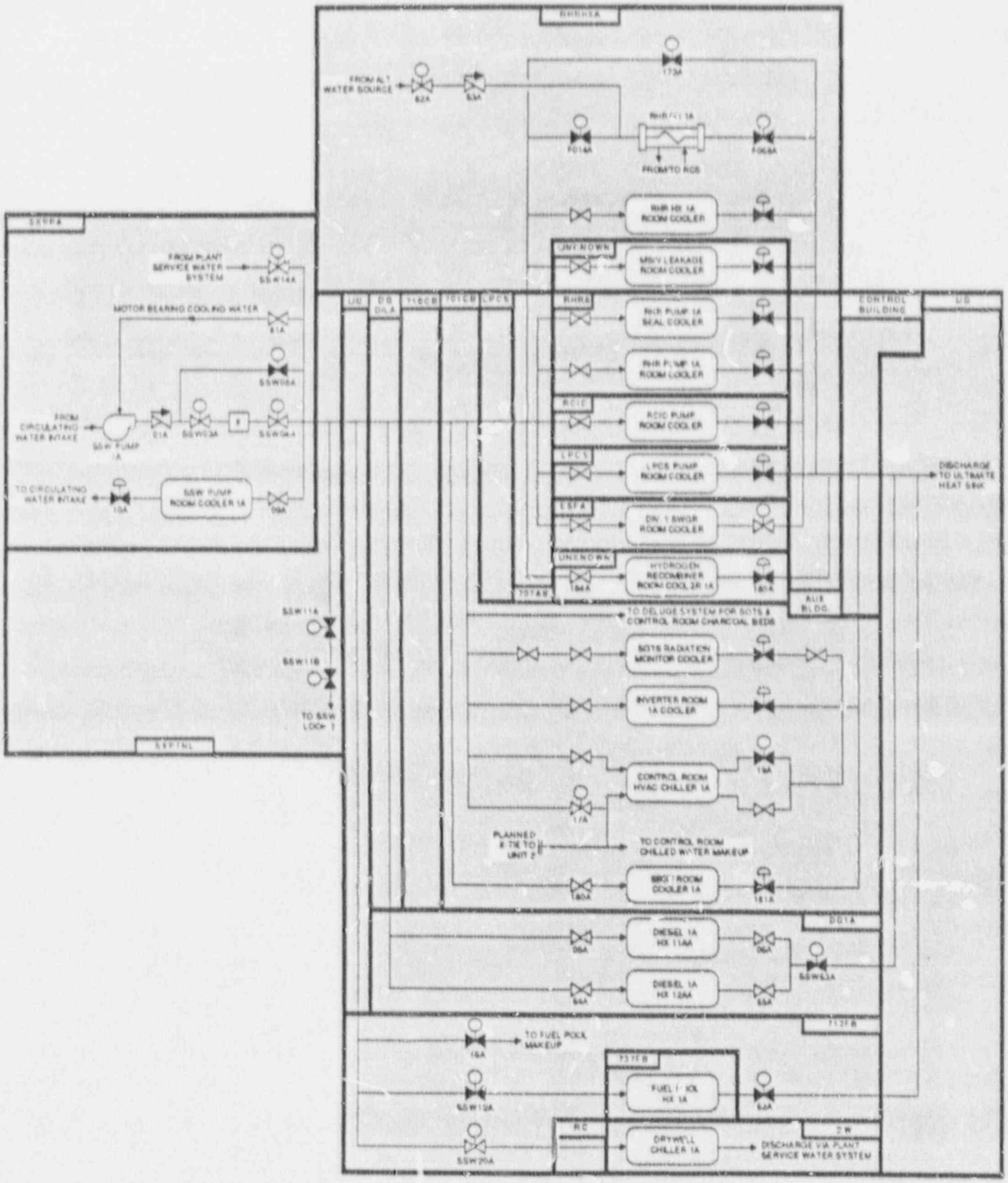


Figure 3.7-2. Clinton 1 Shutdown Service Water System, Train A, Showing Component Locations

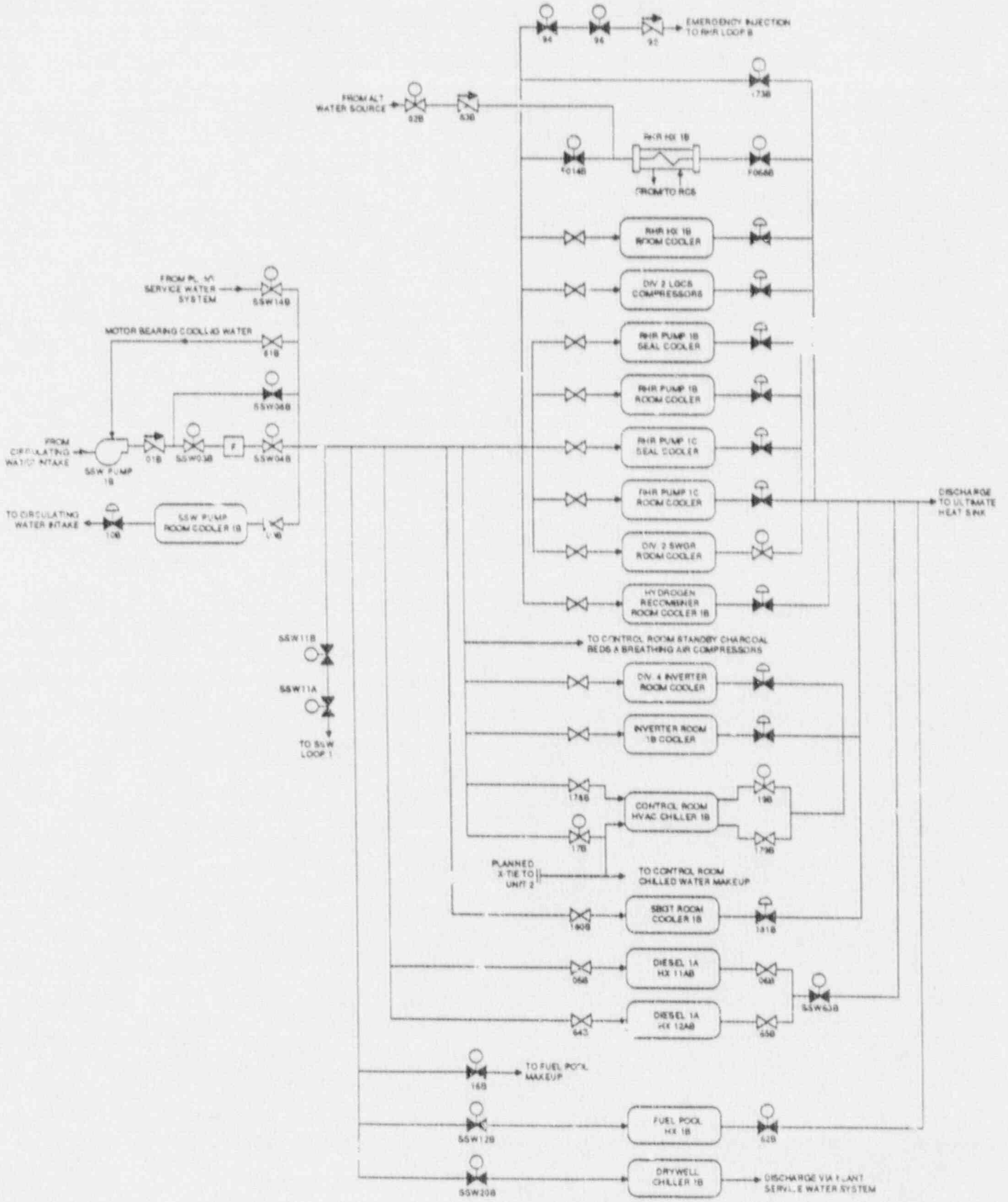


Figure 3.7-3. Clinton 1 Shutdown Service Water System, Train B

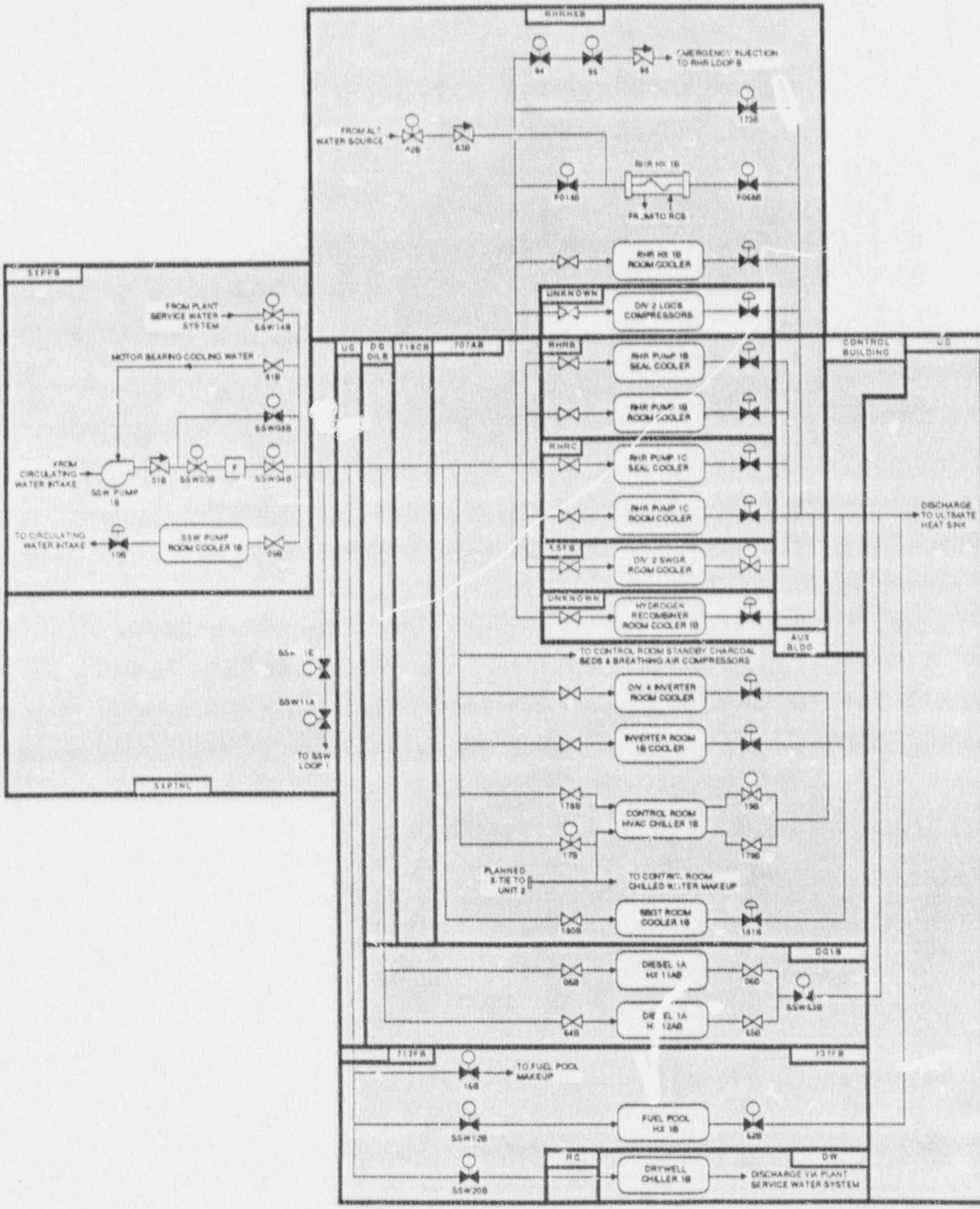


Figure 3.7-4. Clinton 1 Shutdown Service Water System, Train B, Showing Component Locations

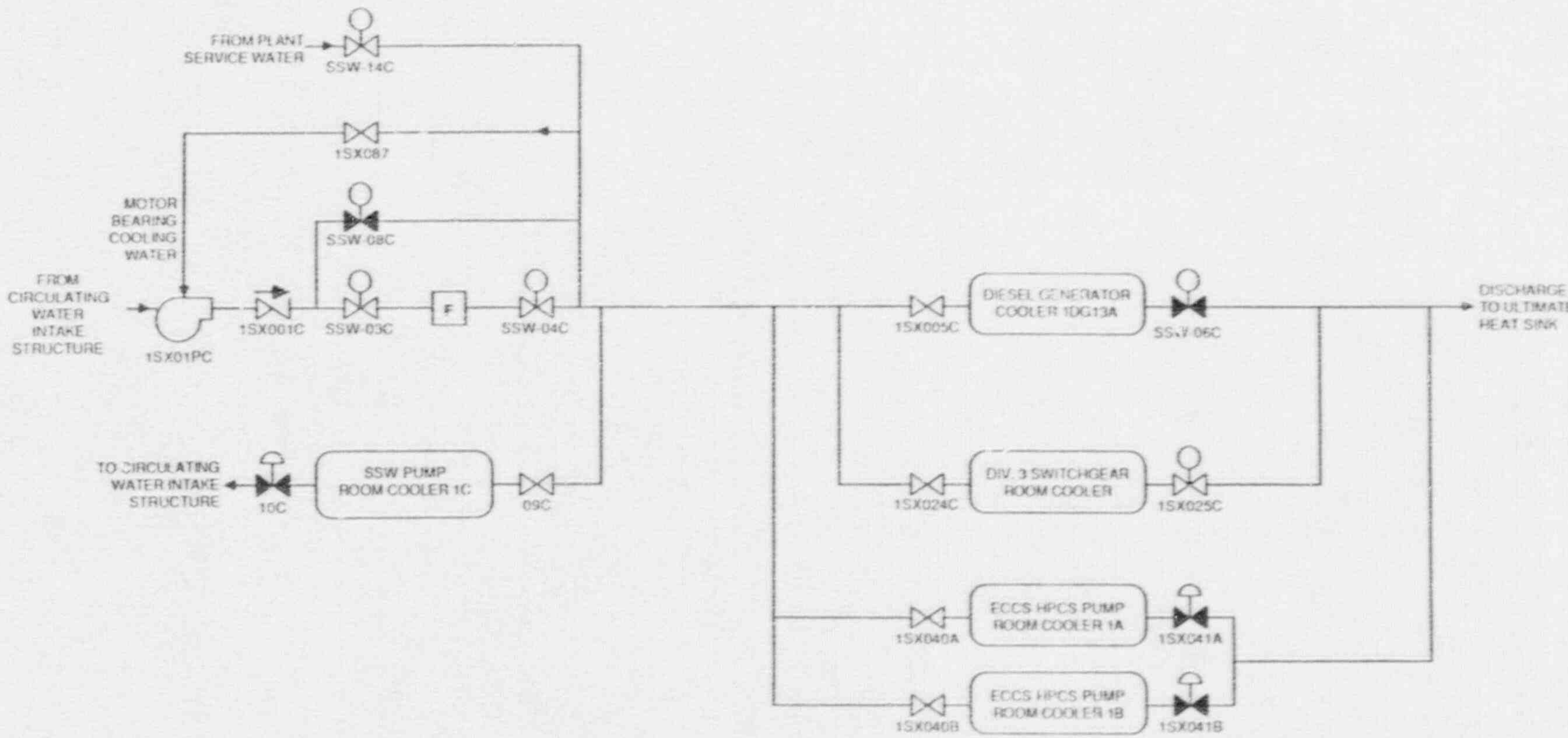


Figure 3.7-5. Clinton 1 Shutdown Service Water System, Train C

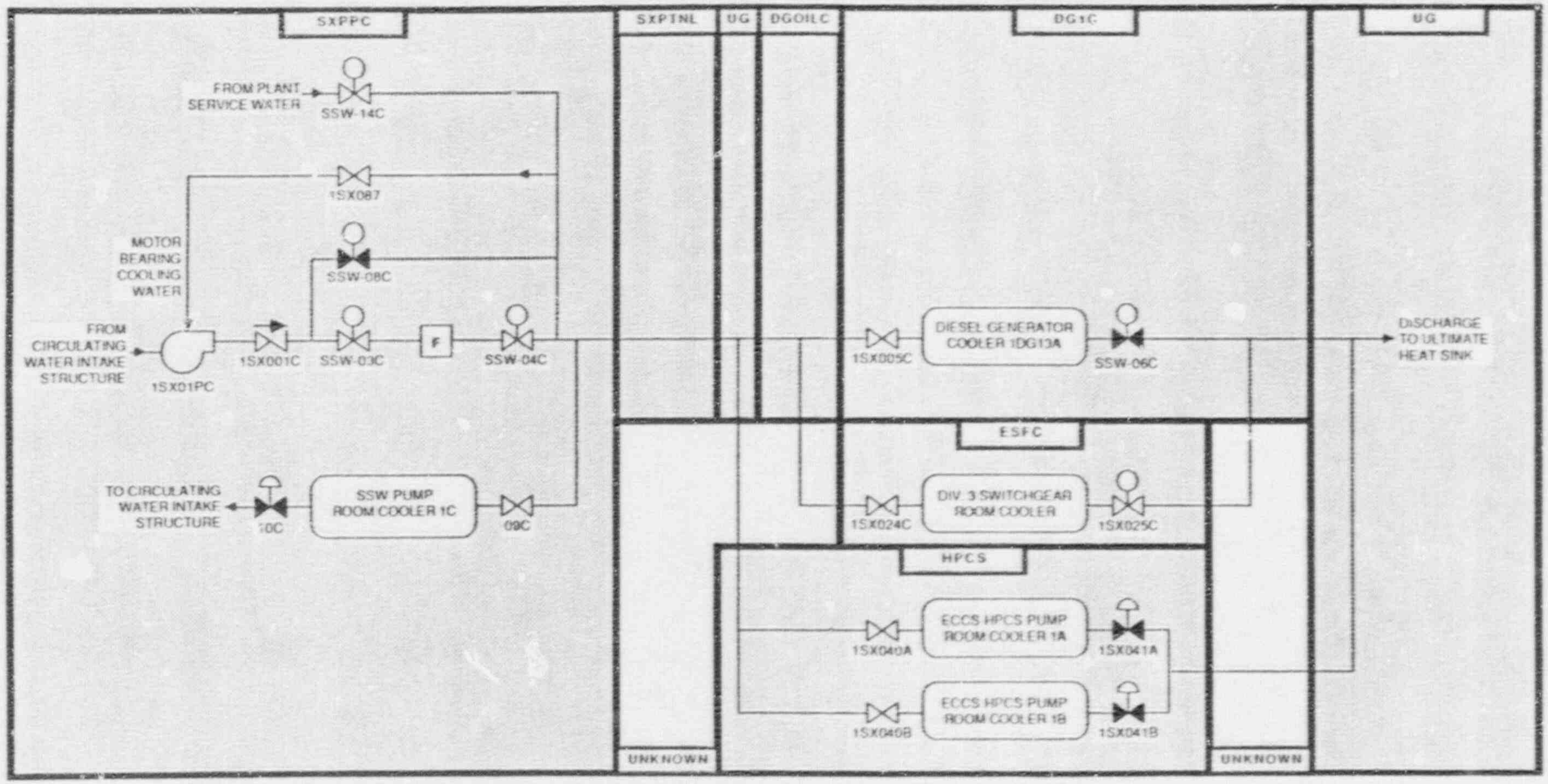


Figure 3.7-6. Clinton 1 Shutdown Service Water System, Train C Showing Component Locations

Table 3.7-1. Clinton 1 Shutdown Service Water System Data Summary for Selected Components

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SSW-03A	MOV	SXPPA	EP-SWMCC-1A	480	SXPPA	AC/A
SSW-03B	MOV	SXPPB	EP-SWMCC-1B	480	SXPPB	AC/B
SSW-03C	MOV	SXPPC	EP-SWMCC-1C	480	SXPPC	AC/C
SSW-04A	MOV	SXPPA	EP-SWMCC-1A	480	SXPPA	AC/A
SSW-04B	MOV	SXPPB	EP-SWMCC-1B	480	SXPPB	AC/B
SSW-04C	MOV	SXPPC	EP-SWMCC-1C	480	SXPPC	AC/C
SSW-04C	MOV	SXPPC	EP-SWMCC-1C	480	SXPPC	AC/C
SSW-06C	MOV	DG1C	EP-BS-1C	480	ESFC	AC/C
SSW-08A	MOV	SXPPA	EP-SWMCC-1A	480	SXPPA	AC/A
SSW-08B	MOV	SXPPB	EP-SWMCC-1B	480	SXPPB	AC/B
SSW-08C	MOV	SXPPC	EP-SWMCC-1C	480	SXPPC	AC/C
SSW-11A	MOV	SXPTNL	EP-SWMCC-1A	480	SXPPA	AC/A
SSW-11B	MOV	SXPTNL	EP-SWMCC-1B	480	SXP[illegible]	AC/B
SSW-12A	MOV	712FB	EP-BS-1A	480	ESF[illegible]	AC/A
SSW-12B	MOV	737FB	EP-BS-1B	480	ESFB	AC/B
SSW-14A	MOV	SXPPA	EP-SWMCC-1A	480	SXPPA	AC/A
SSW-14A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
SSW-14B	MOV	SXPPB	EP-SWMCC-1B	480	SXPPB	AC/B
SSW-14B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
SSW-14C	MOV	SXPPC	EP-SWMCC-1C	480	SXPPC	AC/C
SSW-20A	MOV	712FB	EP-BS-1A	480	ESFA	AC/A
SSW-20B	MOV	737FB	EP-DGMCC-1B	480	737CB	AC/B
SSW-63A	MOV	DG1A	EP-DGMCC-1A	480	737CB	AC/A
SSW-63B	MOV	DG1B	EP-DGMCC1B	480	737CB	AC/B
SSW-68A	MOV	RHRHXA	EP-BS-1A	480	ESFA	AC/A
SSW-68B	MOV	RHRHXB	EP-BS-1B	480	ESFB	AC/B
SSW-P1A	MDP	SXPPA	EP-BS-1A1	4160	ESFA	AC/A

Table 3.7-1. Clinton 1 Shutdown Service Water System Data Summary for Selected Components (Continued)

COMPONENT ID	COMP. TYPE	LOCATION	POWER SOURCE	VOLTAGE	POWER SOURCE LOCATION	EMERG. LOAD GRP.
SSW-P1B	MDP	SXPPB	EP-BS-1B1	4160	ESFB	AC/B
SSW-P1C	MDP	SXPPC	EP-BS-1C1	4160	ESFC	AC/C

Table 3.7-2. Summary of Shutdown Service Water System Heat Loads

Equipment	Heat Load ($x 10^6$ Btu/hr)
RHR Heat Exchangers (2)	116.70*
Fuel Pool Cooling and Cleanup Heat Exchangers (2)	33.20
Division 1 and 2 Diesel Generator Heat Exchangers	23.34
Division 3 Diesel Generator Heat Exchanger	6.93
Control Room Chillers (2)	3.12
Diesel Switchgear Heat Removal Units	1.71
RHR Pump Room Coolers	0.83
Shutdown Service Water Pump Room Coil Cabinets (3)	0.66
RHR Heat Exchanger Room Coolers (2)	0.64
HPCS Pump Room Coolers	0.60
LPCS Pump Room Cooler	0.47
Hydrogen Recombiner Room Cooler	0.44
SBGT Room Coolers	0.42
RR Pump Seal and Bearing Coolers	0.24
RHR Pump Seal Coolers	0.20
MSIV Leakage Room Coolers	0.13
RCIC Pump Room Cooler	0.11
HG Room Cooling Coil Cabinet	0.10
Inverter Room Coolers	0.05
SBGT Exhaust Radiation Monitor Cooler	-0.00

* Assuming 95°F service water and 185°F suppression pool temperature

3.8 PLANT SERVICE WATER SYSTEM (PSWS)

3.8.1 System Function

The PSWS is the source of cooling for station auxiliaries during normal station operation and shutdown. The PSWS also is the normal source of supply to the heat loads in the three shutdown service water system (SSWS) divisions (see Section 3.7).

3.8.2 System Definition

The PSWS consists of three parallel pumps located in the intake structure, and distribution piping to the various heat loads served by the system. An intertie between each SSWS division and the PSWS is provided.

A simplified drawing of the PSWS, focusing on the intertie with the SSWS, is shown in Figure 3.8-1.

3.8.3 System Operation

The PSWS draws water from Lake Clinton with three pumps located in the intake structure. Water is supplied to plant auxiliaries and the SSWS, and is then returned to the lake, which functions as the ultimate heat sink. Two of the three PSWS pumps are normally operating to supply station auxiliaries with cooling water. The third pump is in standby.

3.8.4 System Success Criteria

The PSWS is not required to ensure safe shutdown of the plant and is not designed to Seismic Category I standards. When the PSWS is not available, the SSWS pumps automatically start and supply cooling water to equipment and systems needed for safe shutdown (see Section 3.7).

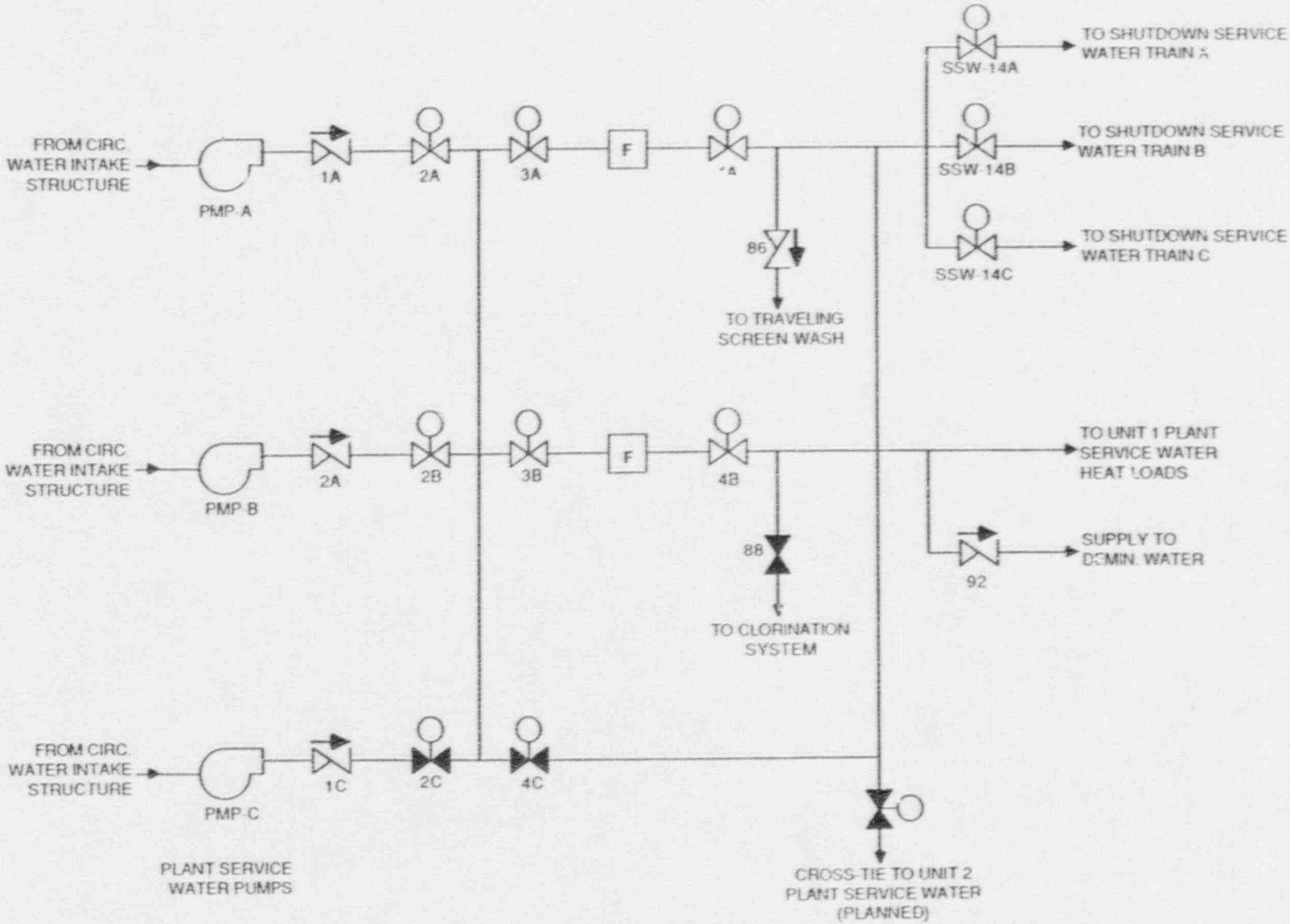
3.8.5 Component Information

A. Plant Service Water Pumps (3)
   1. Rated flow: 22,000 gpm @ 265 ft head (115 psid)
   2. Rated capacity: 50%
   3. Type: vertical turbine, 2-stage

3.8.6 Support Systems and Interfaces

A. Control Signals
   The PSWS pumps are normally operating. Each pump can be manually controlled from the main control room or the pumphouse.

B. Motive power
   The PSWS pumps are supplied from non-Class 1E power.



NOTE: EACH PLANT SERVICE WATER PUMP IS SUPPLIED WITH MOTOR & PUMP BEARING COOLING WATER BY SEPERATE SEAL WATER PUMPS

Figure 3.8-1. Clinton 1 Plant Service Water System

4. PLANT INFORMATION

4.1 SITE AND BUILDING SUMMARY

The Clinton site is located in DeWitt County in East-Central Illinois about 6 miles east of the city of Clinton. The station is near the confluence of Salt Creek and the North Fork of Salt Creek about 56 miles east of where Salt Creek joins the Sangamon River. The site contains a single BWR/6 plant. The second unit planned for the site has been cancelled. A general view of the site is shown in Figure 4-1 (from Ref. 1) and a more detailed site plan is shown in Figure 4-2.

The containment building is surrounded by the fuel building and the auxiliary building. The spent fuel storage pool and the HPCS system are located in the fuel building. The RCIC, LPCS, LPCI (RHR), and reactor water cleanup systems are located on various elevations of the auxiliary building along with electric power distribution equipment in AC divisions A and B and DC divisions 1 and 2 (including 125 VDC batteries 1A and 1B). A personnel airlock for entering the containment is on the 737 ft. elevation of the auxiliary building, and a large containment equipment hatch is on the same elevation of the fuel building.

To the east of the auxiliary and fuel buildings are the control building and the diesel generator and HVAC building. Diesel generators 1A, 1B, and 1C are located in separate rooms on the 737 ft. elevation of the diesel generator building, with long-term fuel tanks below the diesel generators (in separate rooms on the 712 ft. elevation) and air intakes above (in separate rooms on the 762 ft. elevation).

The control room is located on the 801 ft. elevation of the control building, above two cable spreading rooms on the 781 ft. elevation. Also on the 781 ft. elevation of the control building is the electric power distribution equipment for AC division C and DC divisions 3 and 4 (including 125 VDC batteries 1C and 1D). On the upper level of the control building (825 ft. elevation) is an access way to a personnel airlock for entering the containment building.

The turbine building and the radwaste building are located on the north side of the auxiliary and control buildings. The switchyard is located further to the north, outside of the protected area fence.

Note that Clinton was originally planned as a two unit plant, with some shared facilities in the control, diesel generator/HVAC, and radwaste buildings. The detailed layouts of these buildings in areas that would have been used Unit 2 equipment and systems are not known.

A screenhouse to the west of the reactor building includes the shutdown service water pumps. These pumps draw water from the North Fork of Salt Creek. A makeup water pumphouse is located between the screenhouse and the reactor building.

The RCIC storage tank is located just south of the reactor building, and a 200,000 gallon storage tank is just south of the makeup water pumphouse.

4.2 FACILITY LAYOUT DRAWINGS

Six elevation views of Clinton 1 are shown in Figures 4-3 and 4-4. Simplified layout drawings are presented in Figures 4-5 to 4-11. An elevation view of the circulating water screenhouse is shown in Figure 4-12 and a simplified layout drawing of the screenhouse is presented in Figure 4-13. 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 4, Oak Ridge National Laboratory, Nuclear Safety Information Center, March 1975.

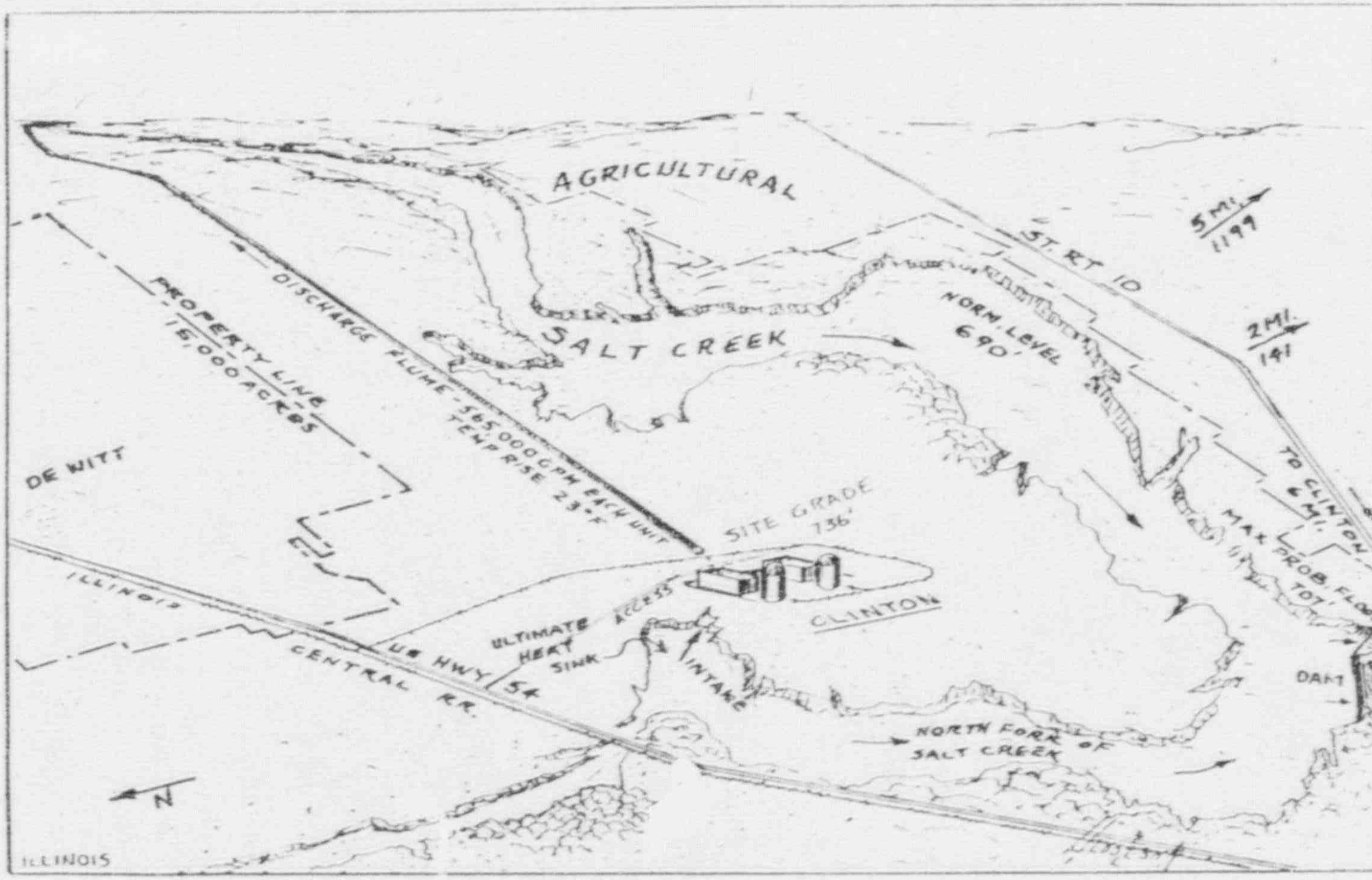


Figure 4-1. General View of the Clinton Site and Vicinity

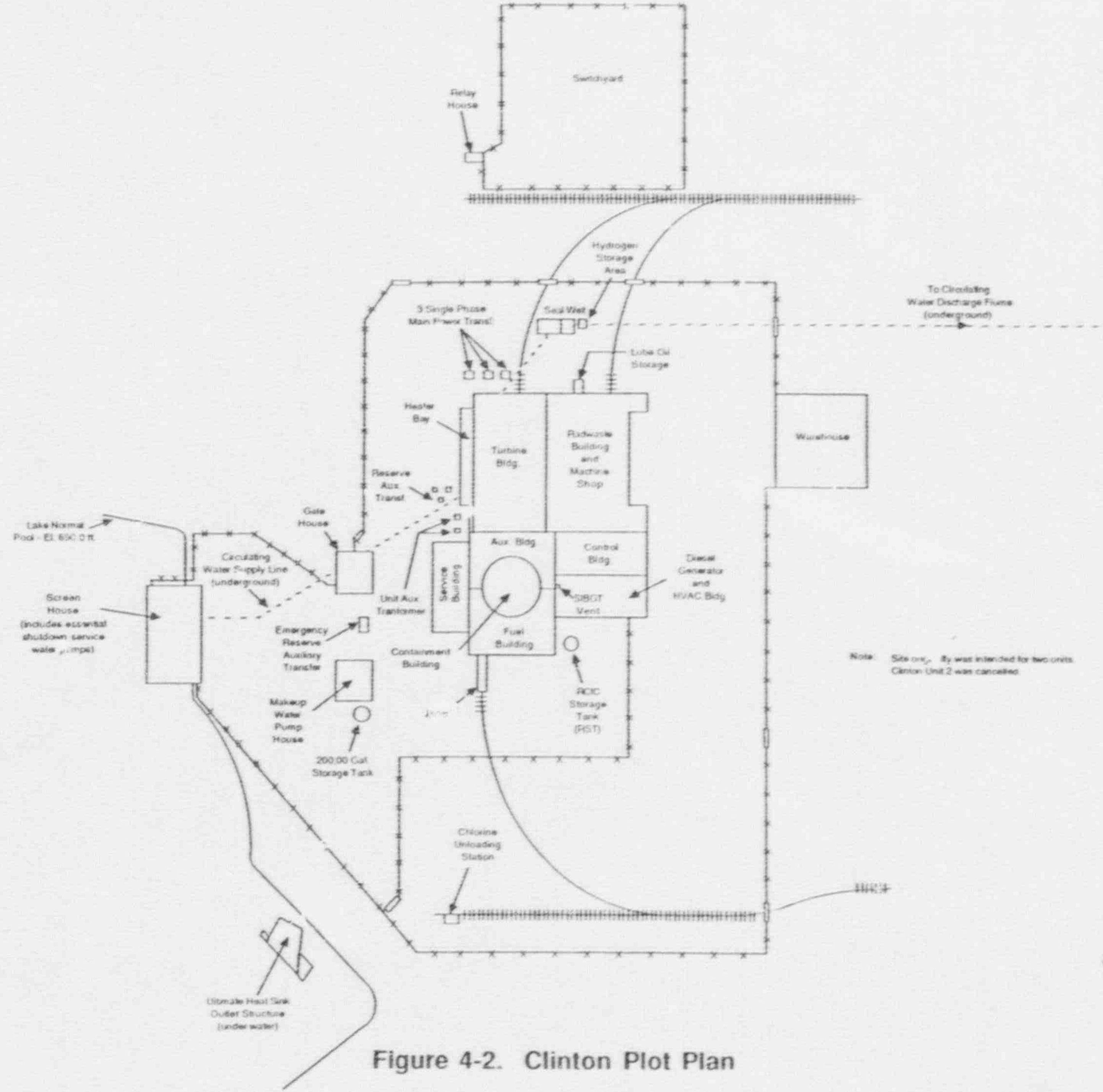


Figure 4-2. Clinton Plot Plan

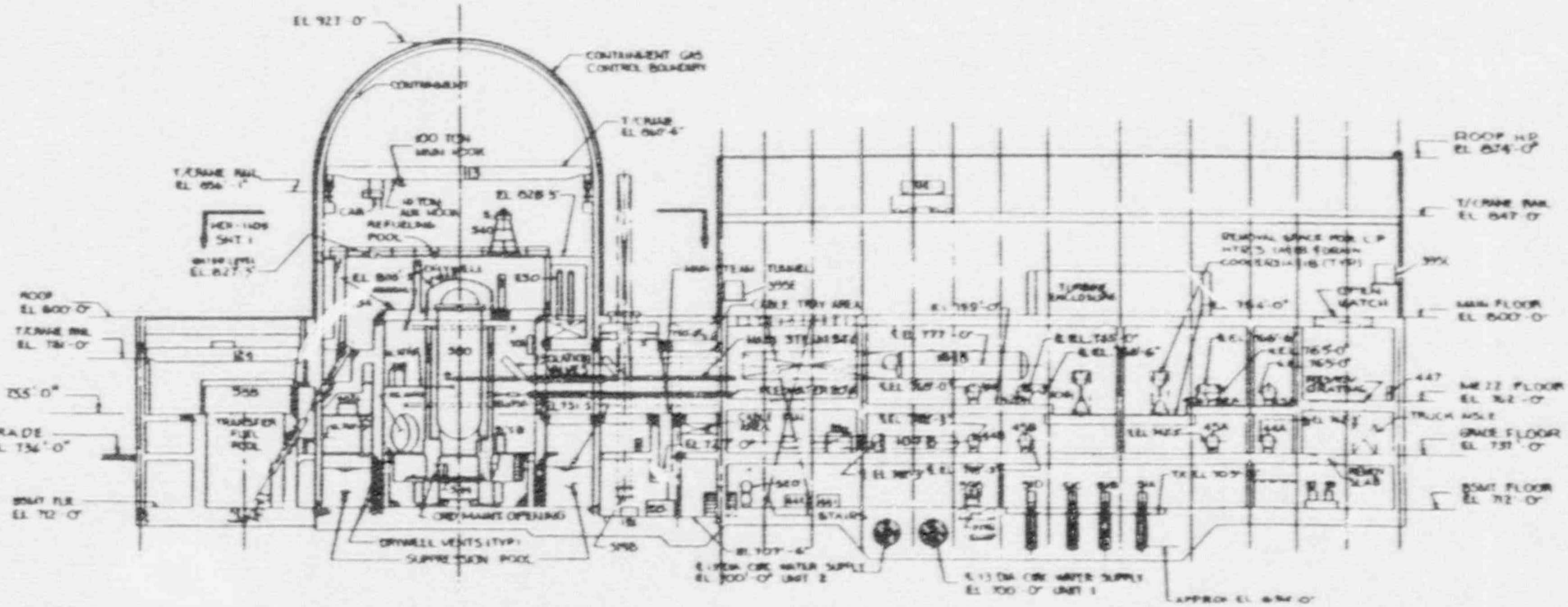


Figure 4-3. Longitudinal Elevation Views of Clinton 1 Showing Containment, Fuel, Auxiliary and Turbine Buildings (Page 1 of 3)

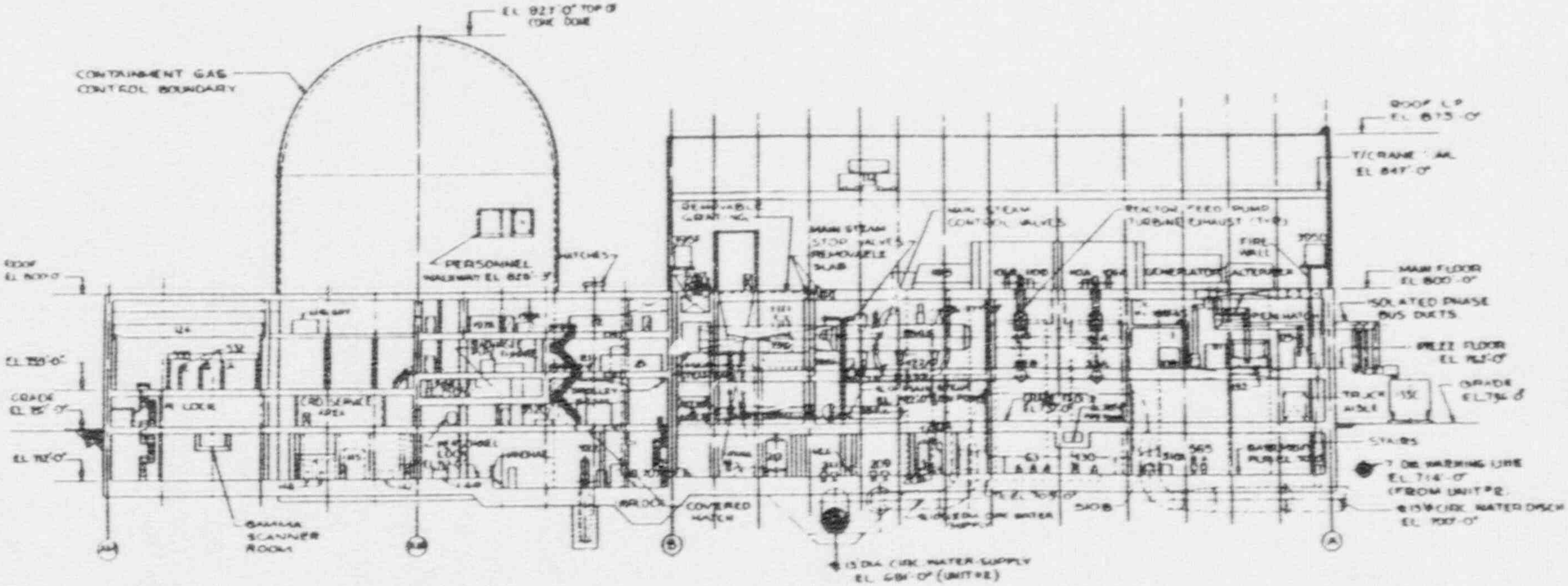


Figure 4-3. Longitudinal Elevation Views of Clinton 1 Showing Containment, Fuel, Auxiliary and Turbine Buildings (Page 2 of 3)

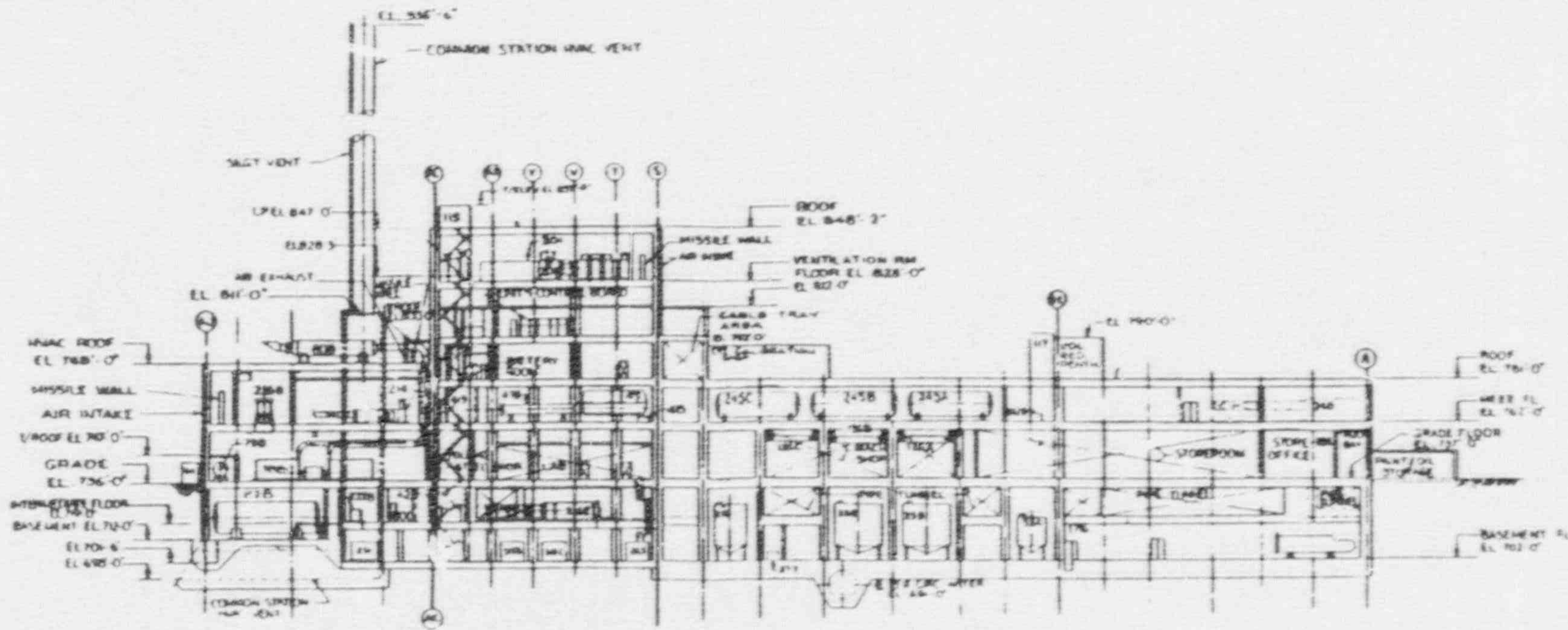


Figure 4-3. Longitudinal Elevation Views of Clinton 1 Showing Containment, Fuel, Auxiliary and Turbine Buildings (Page 3 of 3)

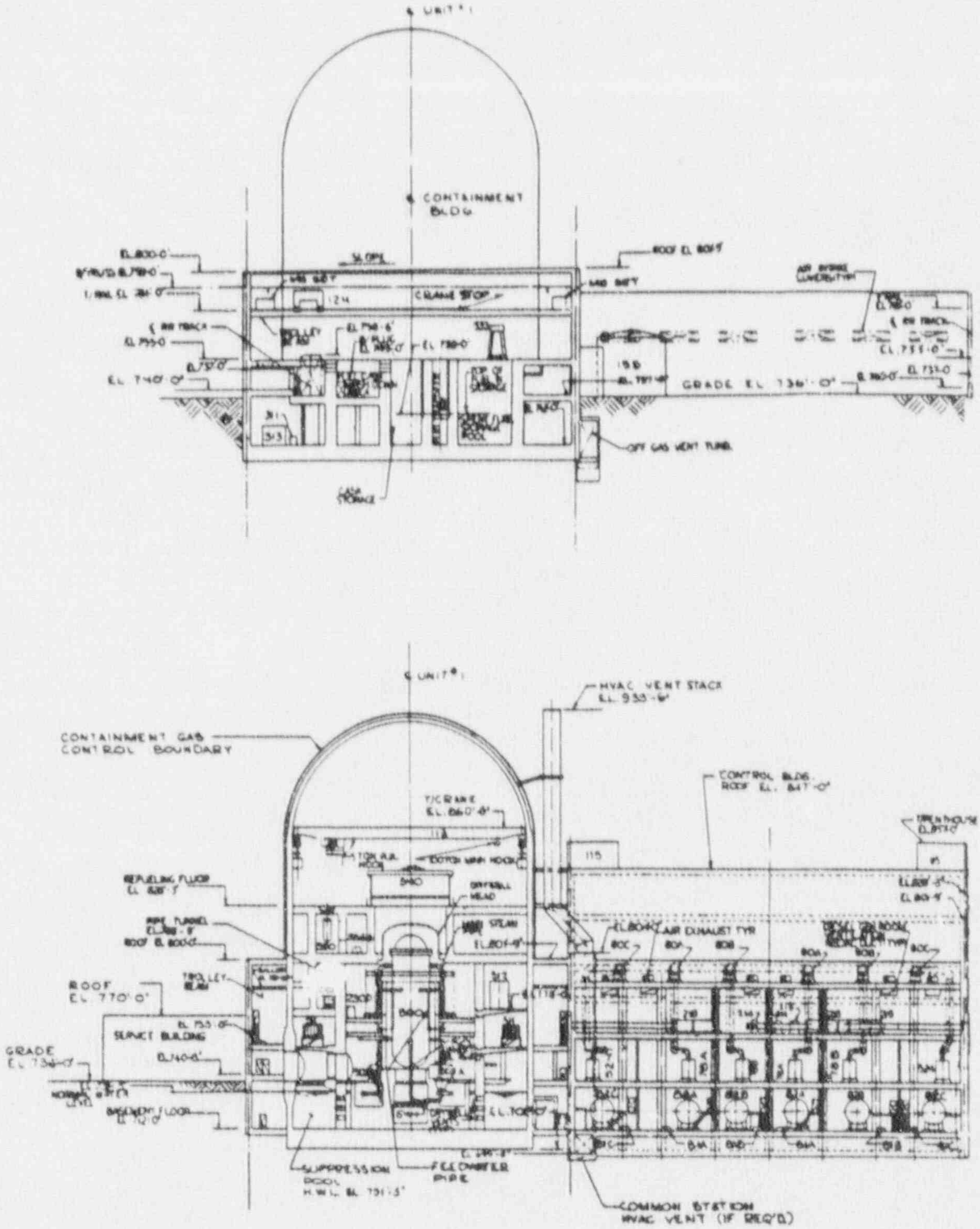


Figure 4-4. Transverse Elevation Views of Clinton 1 Showing Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings (Page 1 of 2)

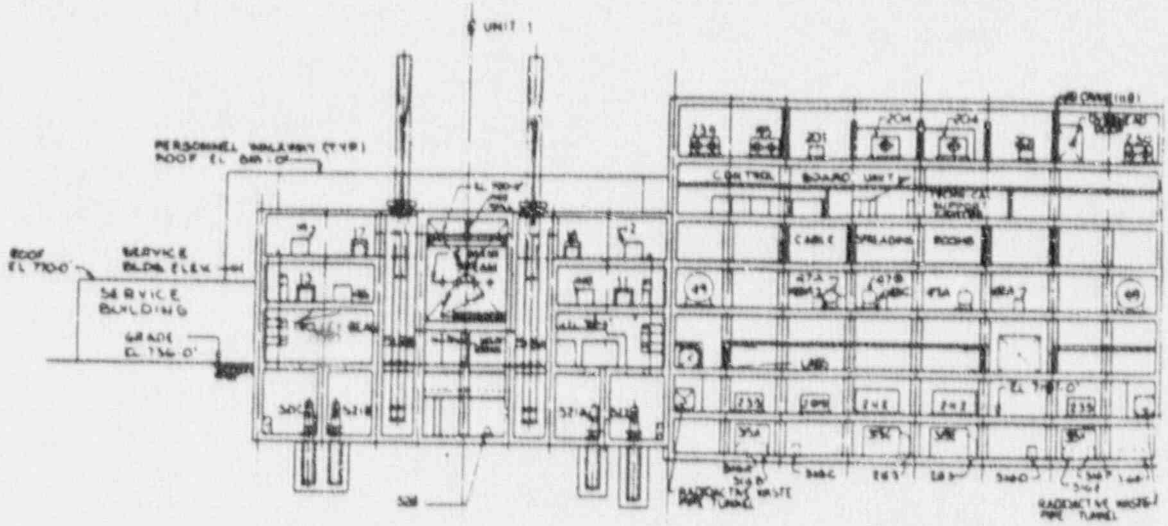


Figure 4-4. Transverse Elevation Views of Clinton 1 Showing Containment, Fuel, Auxilary, Diesel Generator and Control Buildings (Page 2 of 2)

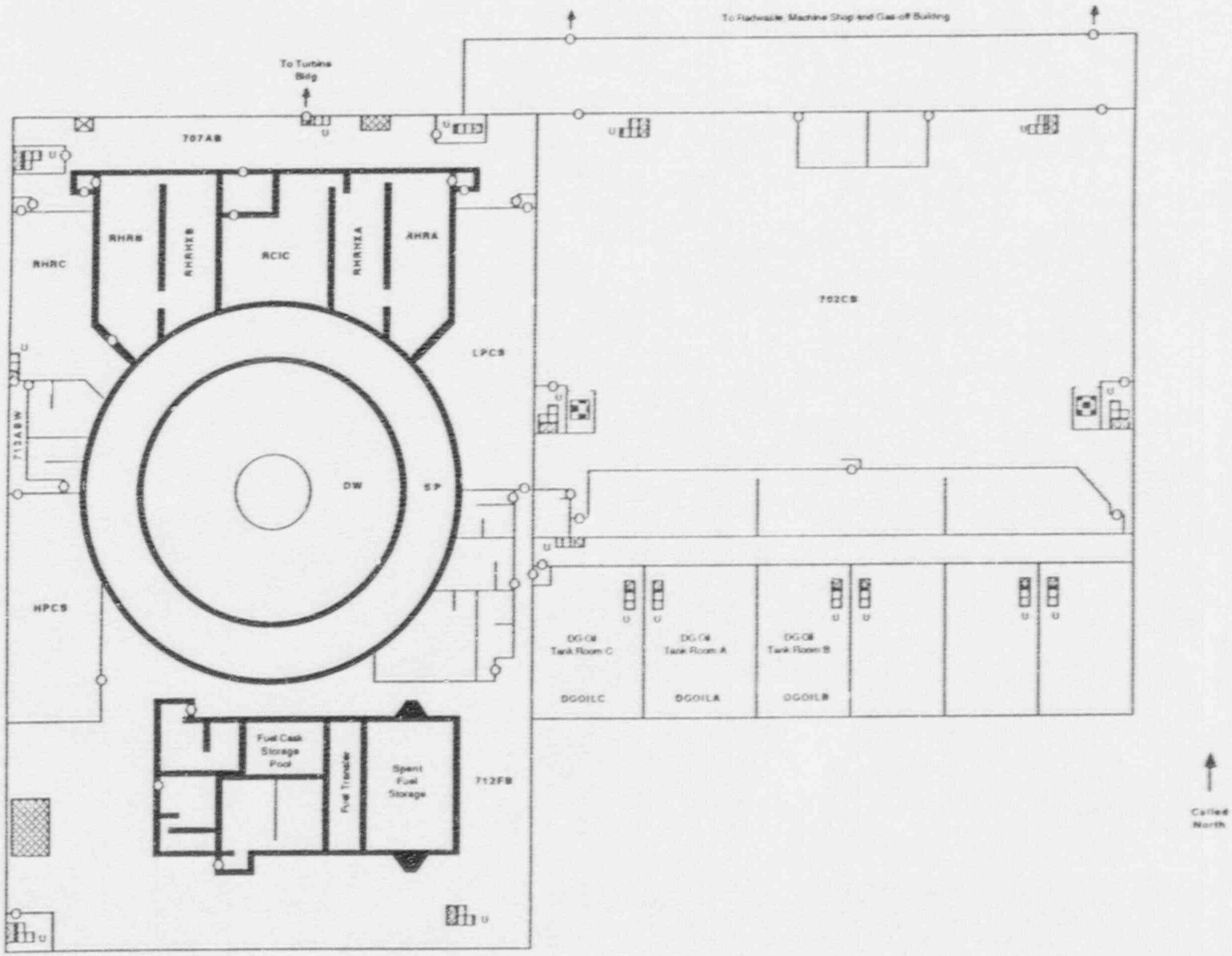


Figure 4-5. Clinton 1 Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings, Elevation 712'-0" (Basement Floor)

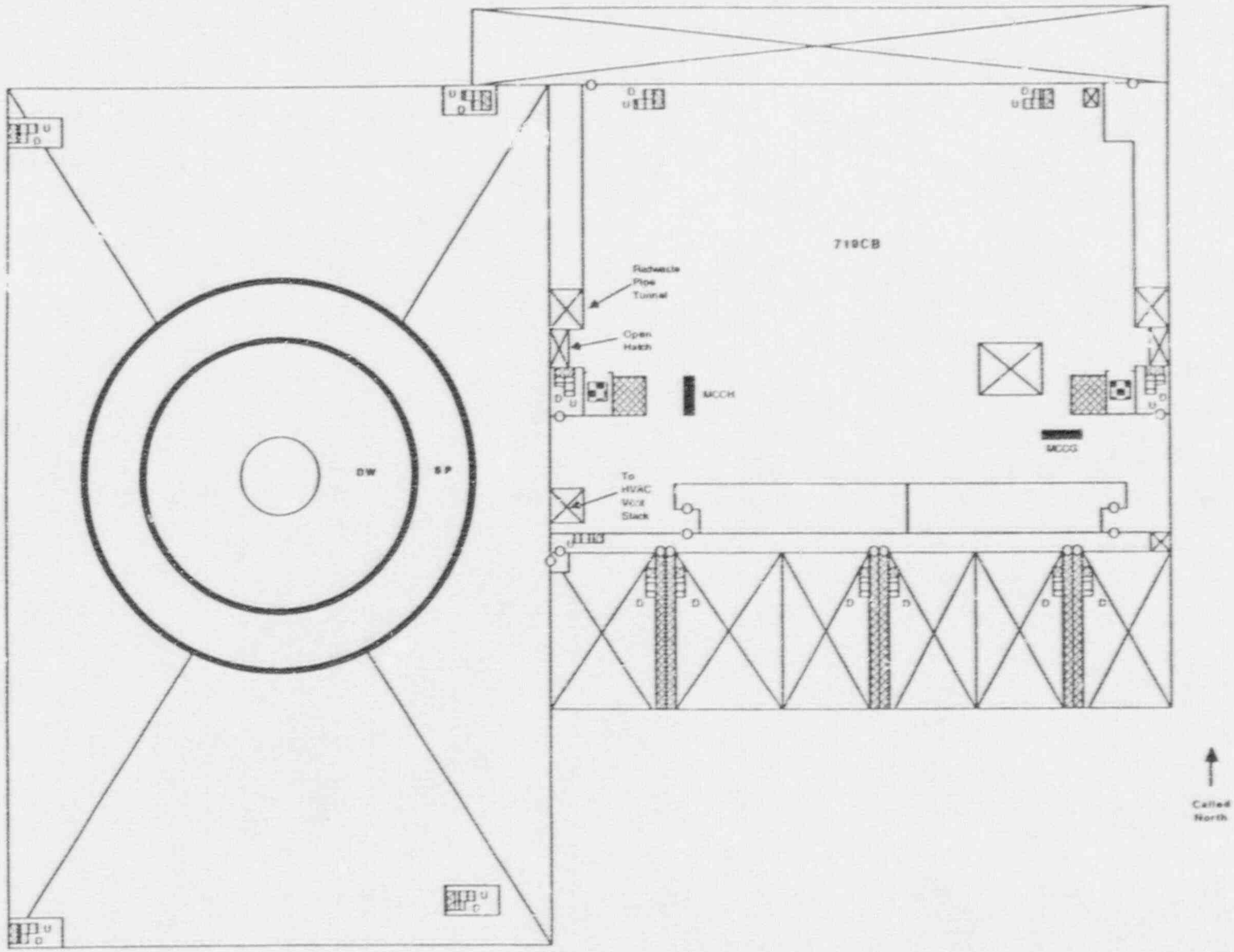


Figure 4-6. Clinton 1 Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings, Elevation 719'-0"

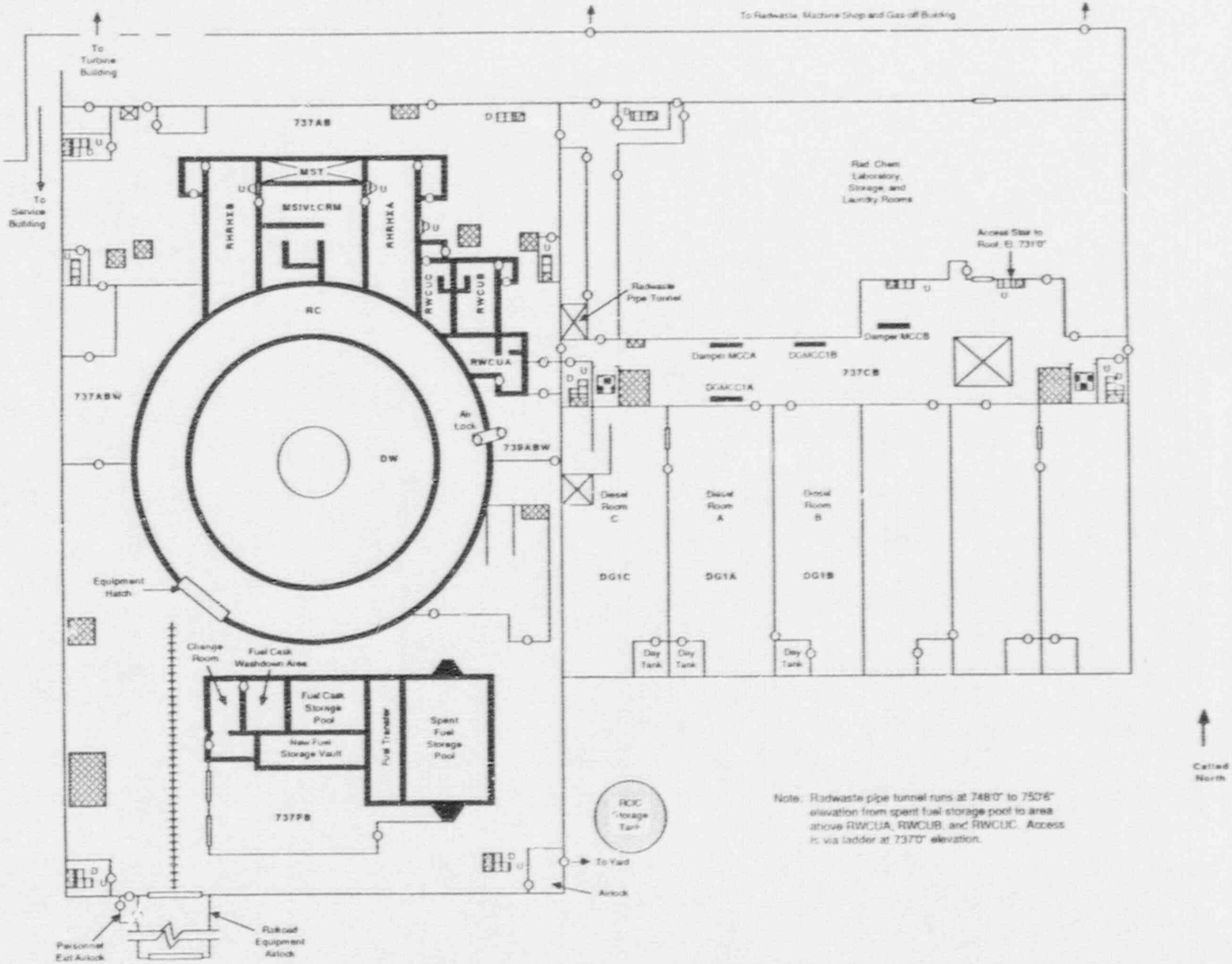


Figure 4-7. Clinton 1 Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings, Elevation 737'-0" (Grade Level)

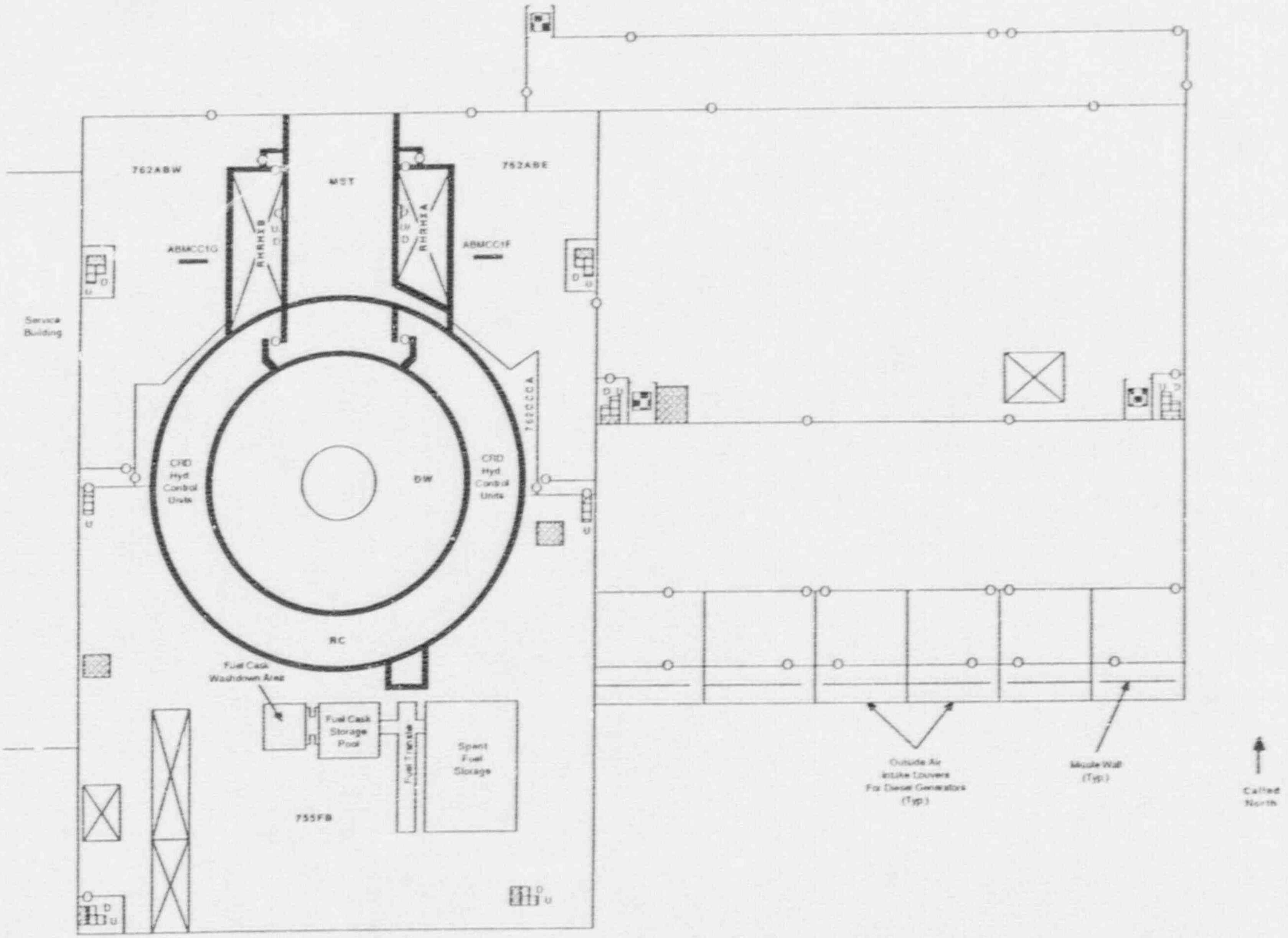


Figure 4-8. Clinton 1 Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings, Elevation 762'-0" (Mezzanine Floor)

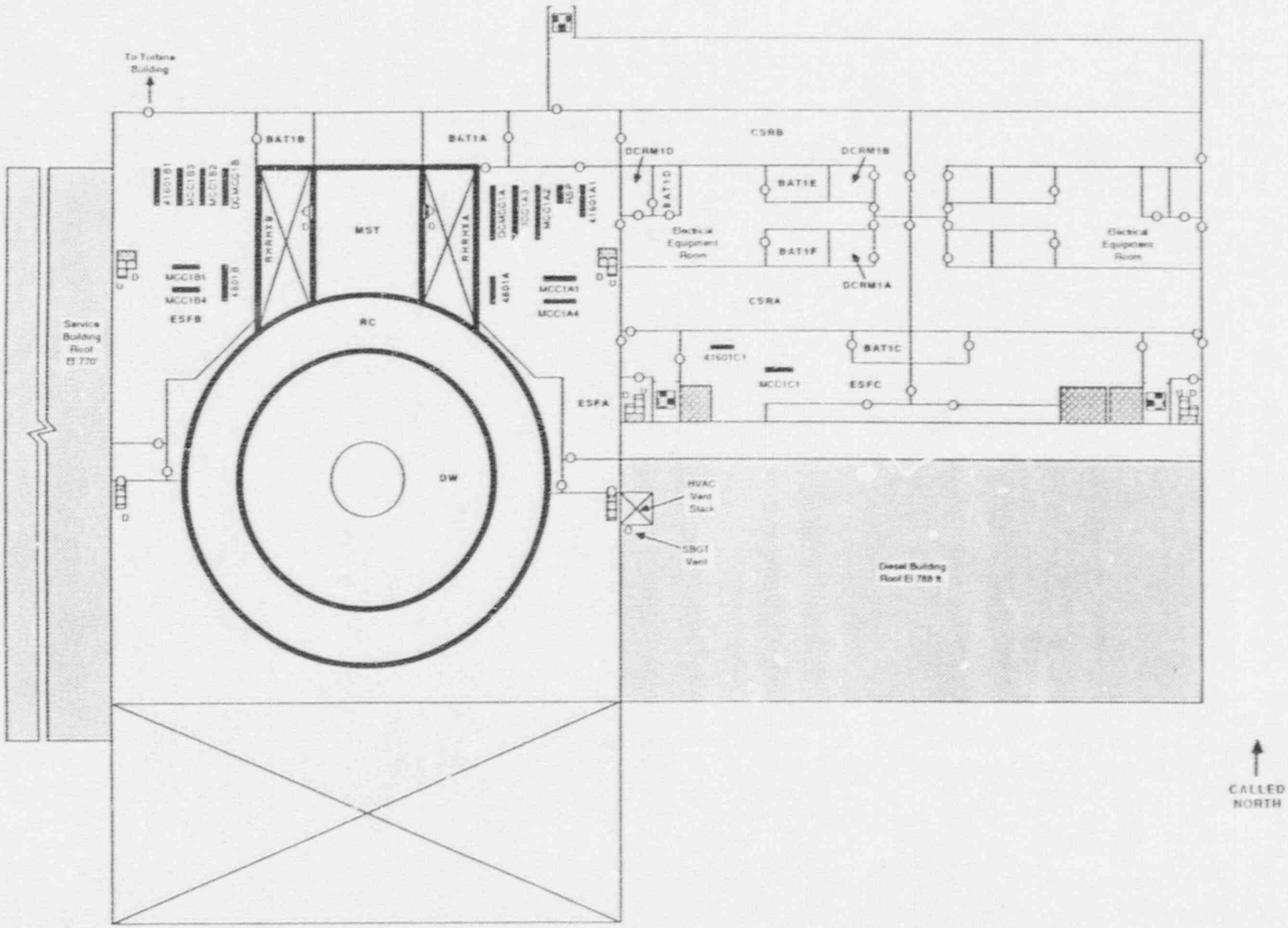


Figure 4-9. Clinton 1 Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings, Elevation 781'-0"

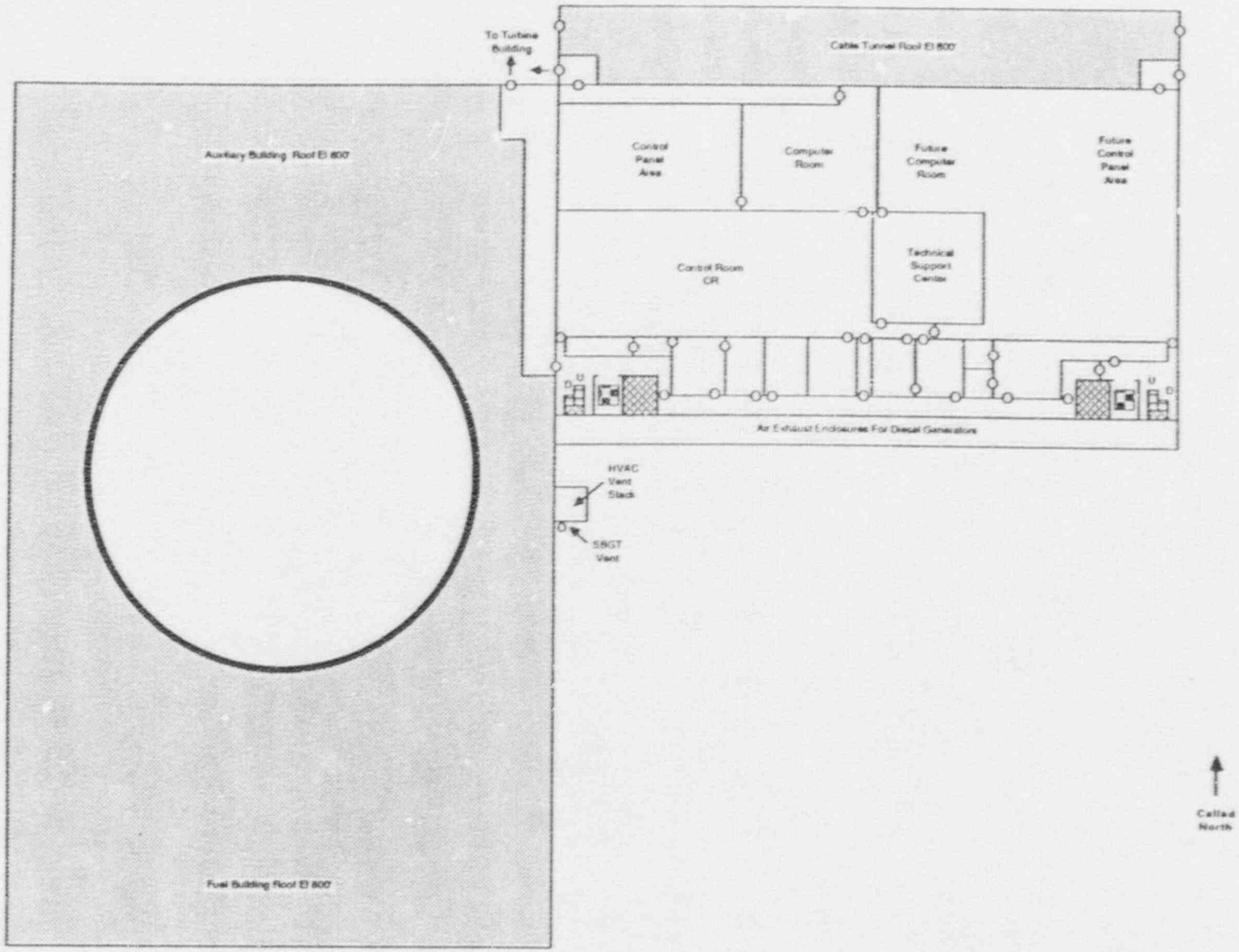


Figure 4-10. Clinton 1 Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings, Elevation 801'-0"

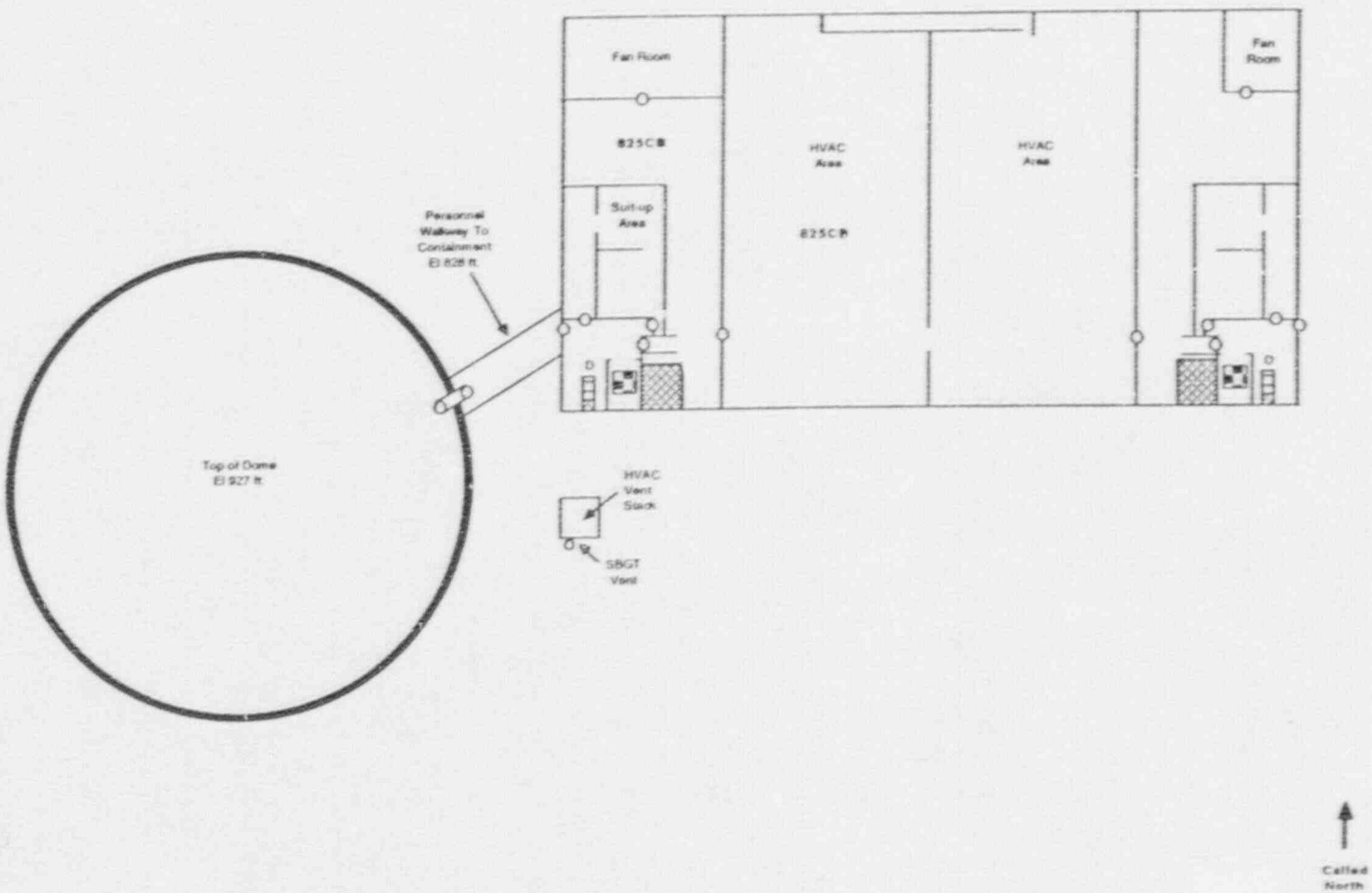


Figure 4-11. Clinton 1 Containment, Fuel, Auxiliary, Diesel Generator and Control Buildings, Elevation 825'-0"

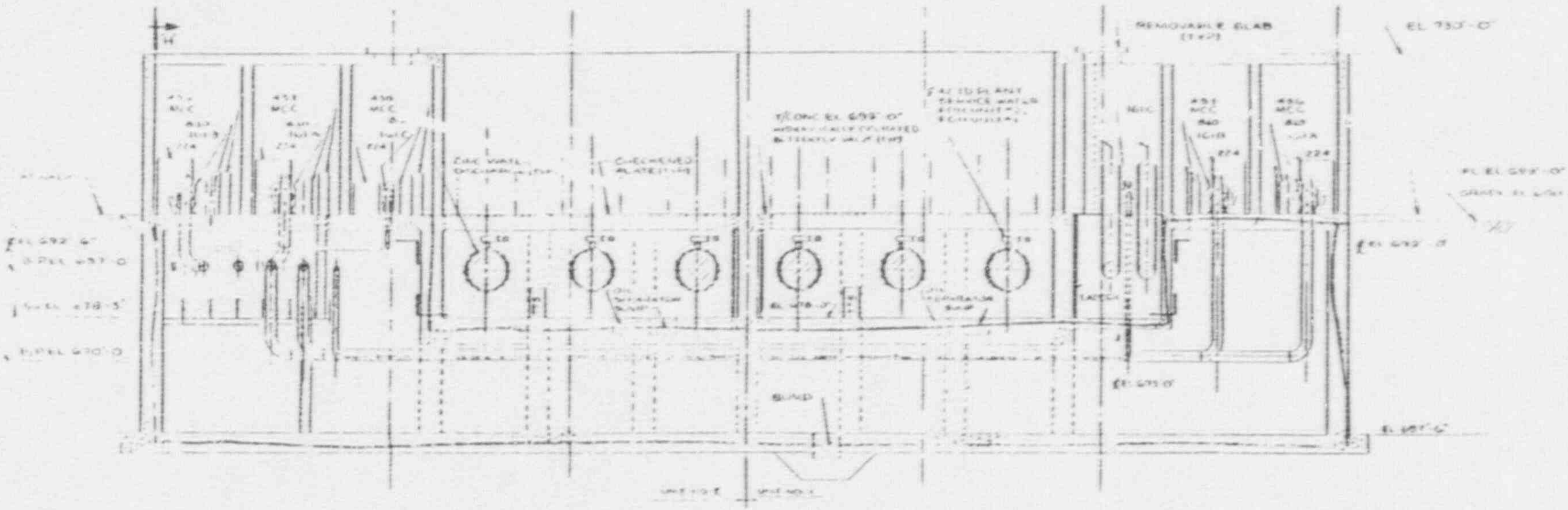


Figure 4-12. Elevation View of Clinton 1 Circulating Water Screen House

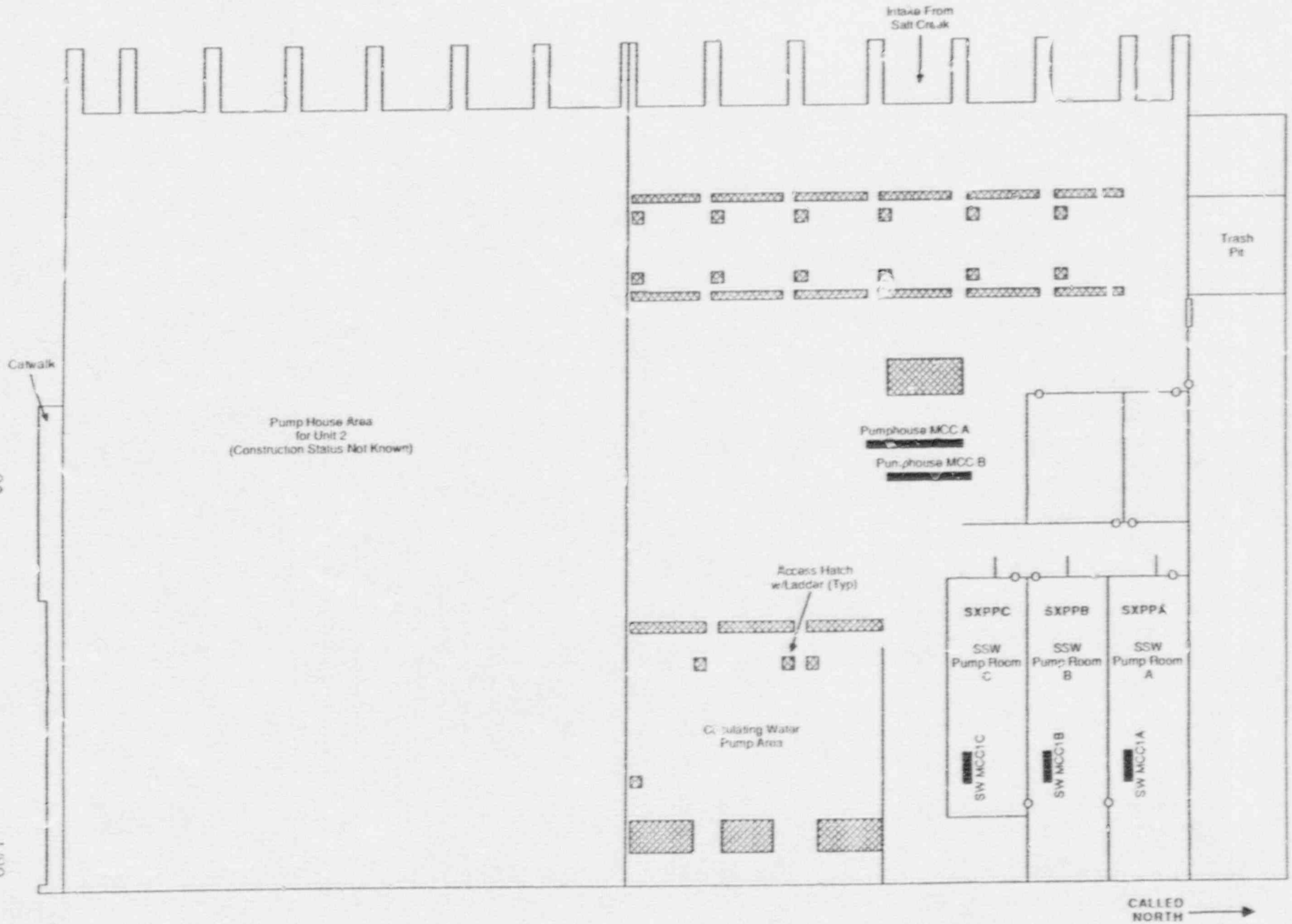


Figure 4-13. Clinton 1 Circulating Water Screen House, Main Floor

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

	Codes	Descriptions
1.	701CB	701' elevation of the Control Building
2.	707AB	707' elevation of the Auxiliary Building
3.	712ABW	712' elevation of the Auxiliary Building - west side
4.	712FB	712' elevation of the Fuel Building
5.	719CB	719' elevation of the Control Building
6.	737ABW	737' elevation of the Auxiliary Building - west side
7.	737CB	737' elevation of the Control Building
8.	737FB	737' elevation of the Fuel Building
9.	755FB	755' elevation of the Fuel Building
10.	762CGCA	Combustible Gas Control Area, located on the 762' elevation of the Auxiliary Building - east side
11.	ABMCC1F	Auxiliary Building Motor Control Center 1F, located on the 762' elevation of the Auxiliary Building
12.	ABMCC1G	Auxiliary Building Motor Control Center 1G, located on the 762' elevation of the Auxiliary Building
13.	BAT1A, BAT1B	Battery Rooms 1A and 1B, located on the 790' elevation of Reactor Containment of the Auxiliary Building - north side
14.	BAT1C, BAT1D, BAT1E, BAT1F	Battery Rooms 1C, 1D, 1E and 1F located on the 781' elevation of the Control Building
15.	CR	Control Room, located on the 800' elevation of the Control Building
16.	CSRMA	Cable Spreading Room A, located on the 781' elevation of the Control Building
17.	CSRMB	Cable Spreading Room B, located on the 781' elevation of the Control Building
18.	DCRM1A, DCRM1B, DCRM1D	DC Equipment Rooms 1A, 1B and 1D located on the 781' elevation of the Control Building

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

Codes	Descriptions
19. DG1A	Diesel Generator 1A Room, located on the 737' elevation of the Control and Diesel Generator Building
20. DG1B	Diesel Generator 1B Room, located on the 737' elevation of the Control and Diesel Generator Building
21. DG1C	Diesel Generator 1C Room, located on the 737' elevation of the Control and Diesel Generator Building
22. DGMCC1A	Diesel Generator Motor Control Center 1A, located on the 737' elevation - just outside DG1A Room of the Control and Diesel Generator Building
23. DGMCC1B	Diesel Generator Motor Control Center 1B, located on the 737' elevation - just outside DG1A Room of the Control and Diesel Generator Building
24. DGOILA	Diesel Generator Oil Storage Tank A, located on the 719' elevation of the Control and Diesel Generator Building
25. DGOILB	Diesel Generator Oil Storage Tank B, located on the 719' elevation of the Control and Diesel Generator Building
26. DGOILC	Diesel Generator Oil Storage Tank C, located on the 719' elevation of the Control and Diesel Generator Building
27. DW	Drywell - area surrounding the core
28. ESFA	Engineering Safeguard Feature Room A, located on the 781' elevation of the Auxiliary Building
29. ESFB	Engineering Safeguard Feature Room B, located on the 781' elevation of the Auxiliary Building
30. ESFC	Engineering Safeguard Feature Room C, located on the 781' elevation of the Auxiliary Building
31. HPCS	High Pressure Core Spray Pump Room, located west of the Reactor Containment on the 712' elevation of the Auxiliary Building
32. LPCS	Low Pressure Core Spray Pump Room, located east of the Reactor Containment on the 712' elevation of the Auxiliary Building

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

Codes	Descriptions
33. MSIVLCRM	Main Steam Isolation Valve Leakage Control Room, located just north of the Reactor Containment on the 737' elevation of the Auxiliary Building
34. MST	Main Steam Tunnel, located north of Reactor Containment on the 737' elevation of the Auxiliary Building
35. RC	Reactor Containment - surrounds the Drywell
36. RCIC	Reactor Core Isolation Cooling Pump Room, located on the 707' elevation of the Auxiliary Building
37. RHRA	Residual Heat Removal Pump Room A, located on the 707' elevation of the Auxiliary Building
38. RHRB	Residual Heat Removal Pump Room B, located on the 707' elevation of the Auxiliary Building
39. RHRC	Residual Heat Removal Pump Room C, located on the 707' elevation of the Auxiliary Building
40. RHRHXA	Residual Heat Removal Heat Exchanger Room A, located on the 707' to 755' elevation of the Auxiliary Building
41. RHRHXB	Residual Heat Removal Heat Exchanger Room B, located on the 707' to 755' elevation of the Auxiliary Building
42. RST	RCIC Storage Tank, located near the southeast corner of the Fuel Building
43. RWCUPMRM	Reactor Water Clean Up Pump Room, located adjacent to Reactor Containment on the 737' elevation of the Auxiliary Building
44. SP	Suppression Pool, located below the Reactor Containment at 721' elevation
45. SXPPA	Shutdown Service Water Pump Room A, located on the 669' elevation of the Screen House
46. SXPPB	Shutdown Service Water Pump Room B, located on the 669' elevation of the Screen House
47. SXPPC	Shutdown Service Water Pump Room C, located on the 669' elevation of the Screen House

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

Codes	Descriptions
48. SXPTNL	Shutdown Service Water Pipe Tunnel, located on the 657'-6" elevation of the Screen House

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

LOCATION	SYSTEM	COMPONTENT ID	COMP TYPE
712FB	SSW	SSW-12A	MOV
712FB	SSW	SSW-20A	MOV
737ABW	ECCS	RHR-27B	MOV
737ABW	ECCS	RHR-27B	MOV
737ABW	ECCS	RHR-21C	MOV
737ABW	ECCS	RHR-42C	MOV
737CB	EP	EP-DGMCC-1B	MCC
737CB	EP	EP-DGMCC-1A	MCC
737FB	SSW	SSW-12B	MOV
737FB	SSW	SSW-20B	MOV
755FB	ECCS	HPCS-F004	MOV
755FB	ECCS	LPCS-F005	MOV
762CGCA	ECCS	RHR-27A	MOV
762CGCA	ECCS	RHR-27A	MOV
BAT1A	EP	EP-B5-1A	BATT
BAT1B	EP	EP-BT- B	BATT
BAT1C	EP	EP-BT-1C	BATT
BAT1D	EP	EP-BT-1D	BATT
DCRM1A	EP	EP-INV-1A	INV
DCRM1B	EP	EP-INV-1B	INV
DCRM1D	EP	EP-INV-1D	INV
DCRM1D	EP	EP-BC-1D	BC
DCRM1D	EP	EP-DCMCC-1D	MCC
DCRM1D	EP	EP-DCMCC-1D	MCC
DG1A	EP	EP-DG-1A	DG
DG1A	SSW	SSW- [illegible]A	MOV
DG1B	EP	EP-DG-1B	DG
DG1B	SSW	SSW-63B	MOV
DG1C	EP	EP-DG-1C	DG
DG1C	SSW	SSW-06C	MOV

Table 4-2. Partial Listing of Components by Location at Clinton 1 (Continued)

LOCATION	SYSTEM	COMPONTENT ID	COMP TYPE
DW	RCIC	RCIC-63	MOV
DW	RCIC	RCIC-63	MOV
DW	RCS	RCS-16	MOV
DW	RCS	RCS-001	MOV
DW	RCS	RCS-002	MOV
DW	RCS	RCS-9	MOV
DW	RCS	RWCU-1	MOV
ESFA	EP	EP-CB-1A1	CB
ESFA	EP	EP-BC-1A	BC
ESFA	EP	EP-BS-1A1	BUS
ESFA	EP	EP-DCMCC-1A	MCC
ESFA	EP	EP-BS-1A	BUS
ESFA	EP	EP-TRAN-1A	TRAN
ESFA	EP	EP-MCC-1A1	MCC
ESFA	EP	EP-DCMCC-1A	MCC
ESFA	EP	EP-BS-1A1	BUS
ESFB	EP	EP-CB-1B1	CB
ESFB	EP	EP-BC-1B	BC
ESFB	EP	EP-BS-1B1	BUS
ESFB	EP	EP-DCMCC-1B	MCC
ESFB	EP	EP-BS-1B	BUS
ESFB	EP	EP-TRAN-1B	TRAN
ESFB	EP	EP-MCC-1B1	MCC
ESFB	EP	EP-DCMCC-1B	MCC
ESFC	EP	EP-CB-1C1	CB
ESFC	EP	EP-BS-1C1	BUS
ESFC	EP	EP-DCMCC-1C	MCC
ESFC	EP	EP-BS-1C	MCC
ESFC	EP	EP-TRAN-HPCS	TRAN
ESFC	EP	EP-DCMCC-1C	MCC

Table 4-2. Partial Listing of Components by Location at Clinton 1 (Continued)

LOCATION	SYSTEM	COMPONTENT ID	COMP TYPE
ESFC	EP	EP-INV-1C	INV
ESFC	EP	EP-HPMCC-1C	MCC
ESFC	EP	EP-BS-1B1	BUS
ESFC	EP	EP-BC-1C	BC
ESFC	EP	EP-BS-1C1	BUS
HPCS	ECCS	HPCS-P1	MDP
HPCS	ECCS	HPCS-F001	MOV
HPCS	ECCS	HPCS-F011	MOV
HPCS	ECCS	HPCS-F010	MOV
HPCS	ECCS	HPCS-F015	MOV
HPCS	ECCS	HPCS-F023	MOV
LPCS	ECCS	RHR-24A	MOV
LPCS	ECCS	RHR-53A	MOV
LPCS	ECCS	LPCS-P1	MDP
LPCS	ECCS	LPCS-F001	MOV
LPCS	ECCS	LPCS-F012	MOV
LPCS	ECCS	RHR-24A	MOV
MSIVLCRM	RCIC	RCIC-68	MOV
MST	RCIC	RCIC-64	MOV
MST	RCIC	RCIC-13	MOV
MST	RCIC	RCIC-64	MOV
MST	RCS	RWCU-4	MOV
RC	ECCS	RHR-28A	MOV
RC	ECCS	RHR-42A	MOV
RC	ECCS	RHR-28B	MOV
RC	ECCS	RHR-37B	MOV
RC	ECCS	RHR-42B	MOV
RC	ECCS	RHR-37A	MOV
RC	ECCS	RHR-28A	MOV
RC	ECCS	RHR-28B	MOV

Table 4-2. Partial Listing of Components by Location at Clinton 1 (Continued)

LOCATION	SYSTEM	COMPONTENT ID	COMP TYPE
RCIC	RCIC	RCIC-P1	TDP
RCIC	RCIC	RCIC-TTV	HV
RCIC	RCIC	RCIC-10	MOV
RCIC	RCIC	RCIC-31	MOV
RCIC	RCIC	RCIC-45	MOV
RHRA	ECCS	LPCI-P1A	MDP
RHRA	ECCS	RHR-4A	MOV
RHRA	ECCS	RHR-6A	MOV
RHRA	RCS	RCS-8	MOV
RHRB	ECCS	LPCI-P1B	MDP
RHRB	ECCS	RHR4B	MOV
RHRB	ECCS	RHR-6B	MOV
RHRC	ECCS	LPCI-P1C	MDP
RHRC	ECCS	RHR-105C	MOV
RHRHXA	ECCS	RHR-3A	MOV
RHRHXA	ECCS	RHR-47A	MOV
RHRHXA	ECCS	RHR-48A	MOV
RHRHXA	ECCS	RHR-52A	MOV
RHRHXA	ECCS	RHR-87A	MOV
RHRHXA	ECCS	RHR-HXA	HX
RHRHXA	ECCS	RHR-48A	MOV
RHRHXA	RCIC	RCIC-22	MOV
RHRHXA	RCIC	RCIC-59	MOV
RHRHXA	SSW	SSW-14A	MOV
RHRHXA	SSW	SSW-68A	MOV
RHRHXB	ECCS	RHR-3B	MOV
RHRHXB	ECCS	RHR-24B	MOV
RHRHXB	ECCS	RHR-47B	MOV
RHRHXB	ECCS	RHR-48B	MOV
RHRHXB	ECCS	RHR-53B	MOV

Table 4-2. Partial Listing of Components by Location at Clinton 1 (Continued)

LOCATION	SYSTEM	COMPONTENT ID	COMP TYPE
RHRHXB	ECCS	RHR-52B	MOV
RHRHXB	ECCS	RHR-87B	MOV
RHRHXB	ECCS	RHR-HXB	HX
RHRHXB	ECCS	RHR-48B	MOV
RHRHXB	ECCS	RHR-24B	MOV
RHRHXB	SSW	SSW-14B	MOV
RHRHXB	SSW	SSW-68B	MOV
RST	ECCS	RST	TANK
RST	RCIC	RST	TANK
SP	ECCS	SUPP. POOL	TANK
SP	RCIC	SUPP. POOL	TANK
SXPPA	EP	EP-SWMCC-1A	MCC
SXPPA	SSW	SSW-08A	MOV
SXPPA	SSW	SSW-03A	MOV
SXPPA	SSW	SSW-04A	MOV
SXPPA	SSW	SSW-14A	MOV
SXPPA	SSW	SSW-P1A	MDP
SXPPB	EP	EP-SWMCC-1B	MCC
SXPPB	SSW	SSW-08B	MOV
SXPPB	SSW	SSW-03B	MOV
SXPPB	SSW	SSW-04B	MOV
SXPPB	SSW	SSW-14B	MOV
SXPPB	SSW	SSW-P1B	MDP
SXPPC	EP	EP-SWMCC-1C	MCC
SXPPC	SSW	SSW-P1C	MDP
SXPPC	SSW	SSW-08C	MOV
SXPPC	SSW	SSW-03C	MOV
SXPPC	SSW	SSW-04C	MOV
SXPPC	SSW	SSW-04C	MOV
SXPPC	SSW	SSW-14C	MOV

Table 4-2. Partial Listing of Components by Location at Clinton 1 (Continued)

LOCATION	SYSTEM	COMPONTENT ID	COMP TYPE
SXPTNL	SSW	SSW-11A	MOV
SXPTNL	SSW	SSW-11B	MOV
UNKNOWN	EP	EP-120AC-PNLA	PNL
UNKNOWN	EP	EP-120AC-PNLB	PNL
UNKNOWN	EP	EP-120AC-PNLC	PNL
UNKNOWN	EP	EP-120AC-PNLD	PNL

5. BIBLIOGRAPHY FOR CLINTON 1

1. NUREG-75/013, "Safety Evaluation of the Clinton Power Station, Units 1 and 2," USNRC, March 1975.
2. NUREG-0853, "Safety Evaluation Report Related to the Operation of Clinton Power Station, Unit No. 1," USNRC, February 1982.
3. NUREG-0854, "Final Environmental Statement Related to the Operation of Clinton Power Station, Unit No. 1," USNRC, May 1982.
4. NUREG-1235, "Technical Specifications for Clinton Power Station, Unit 1," USNRC.

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

A1. SYSTEM DRAWINGS

A1.1 Fluid System Drawings

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

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

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

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

A1.3 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)

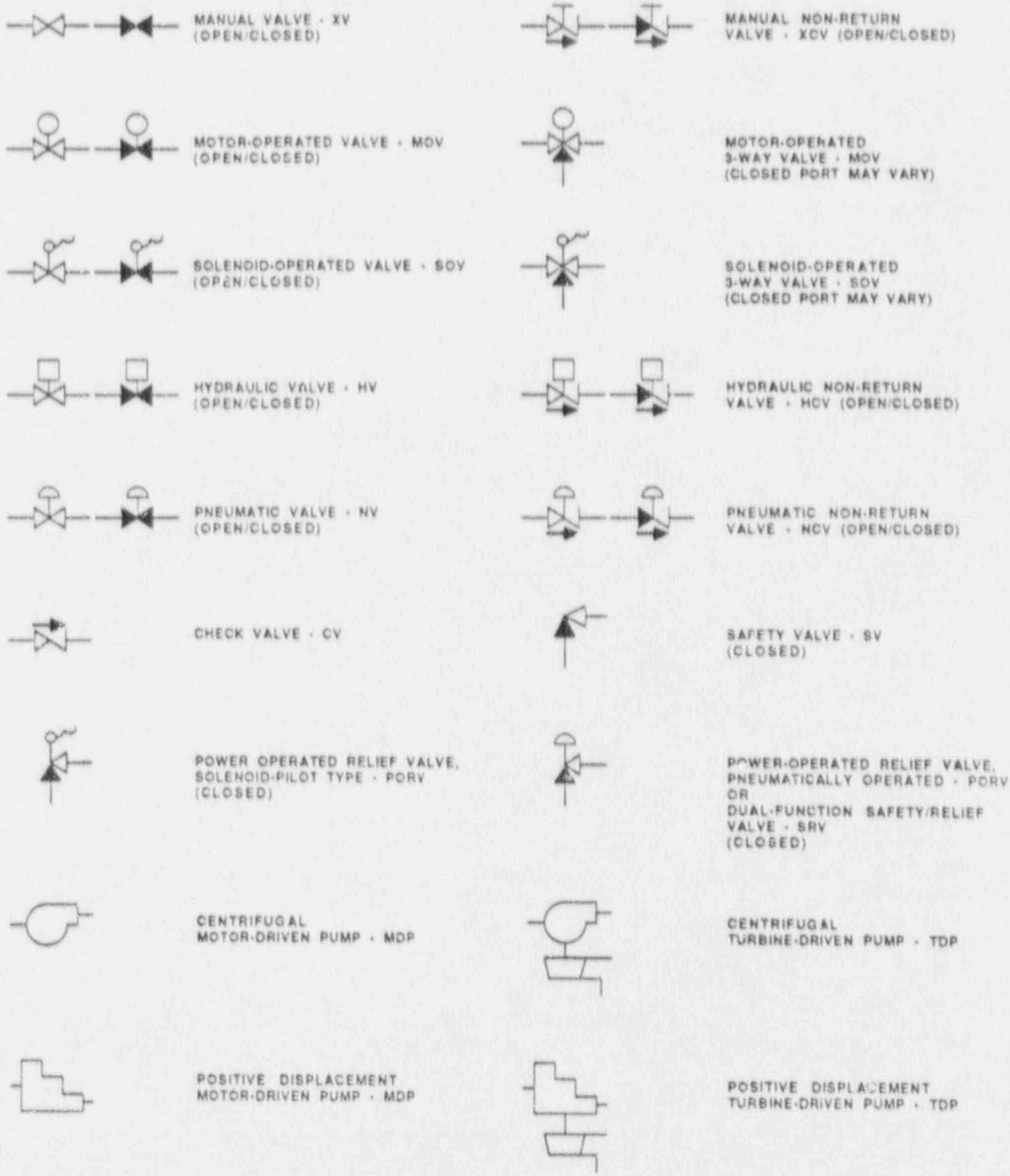


Figure A-1. Key To Symbols In Fluid System Drawings

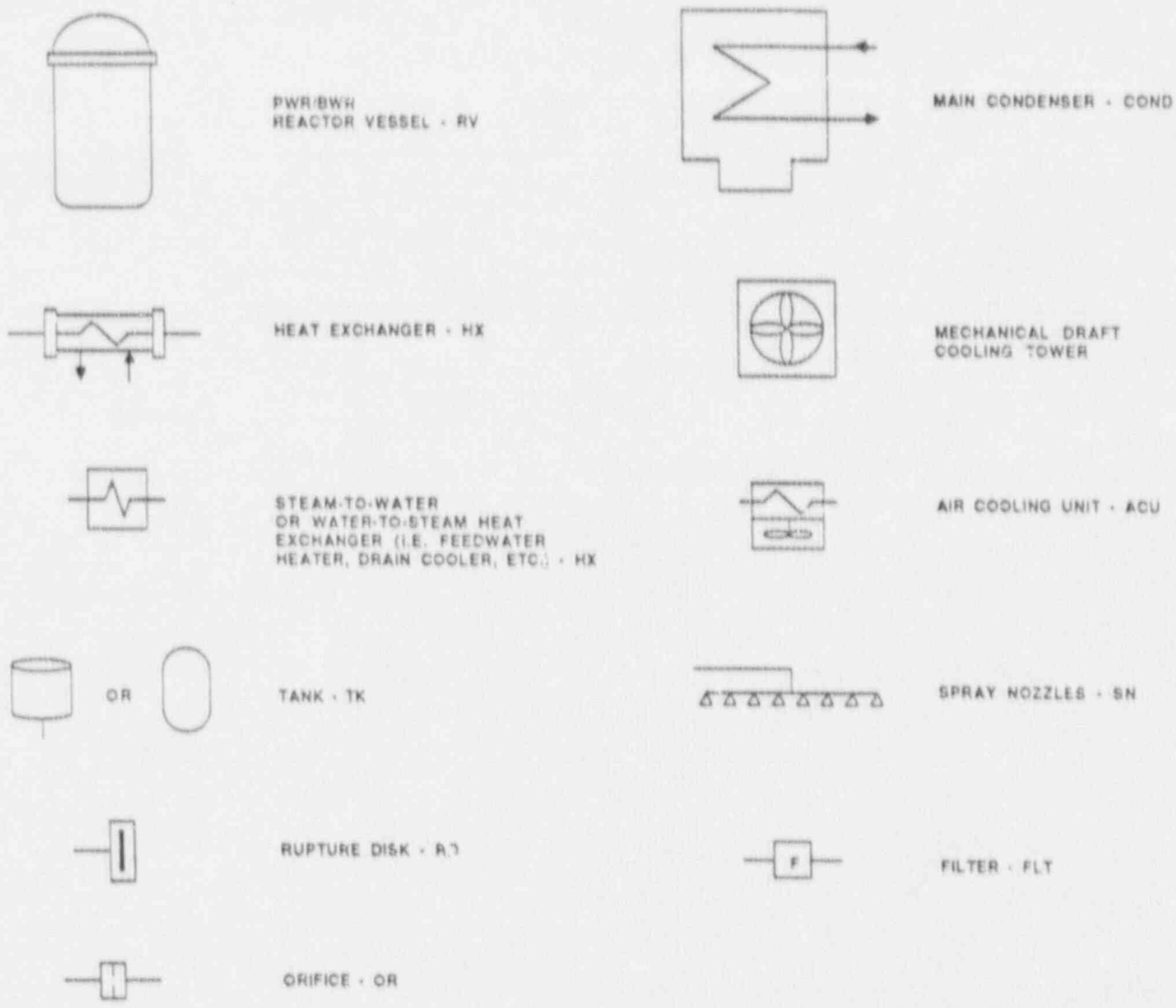


Figure A-1. Key To Symbols In Fluid System Drawings
(Continued)

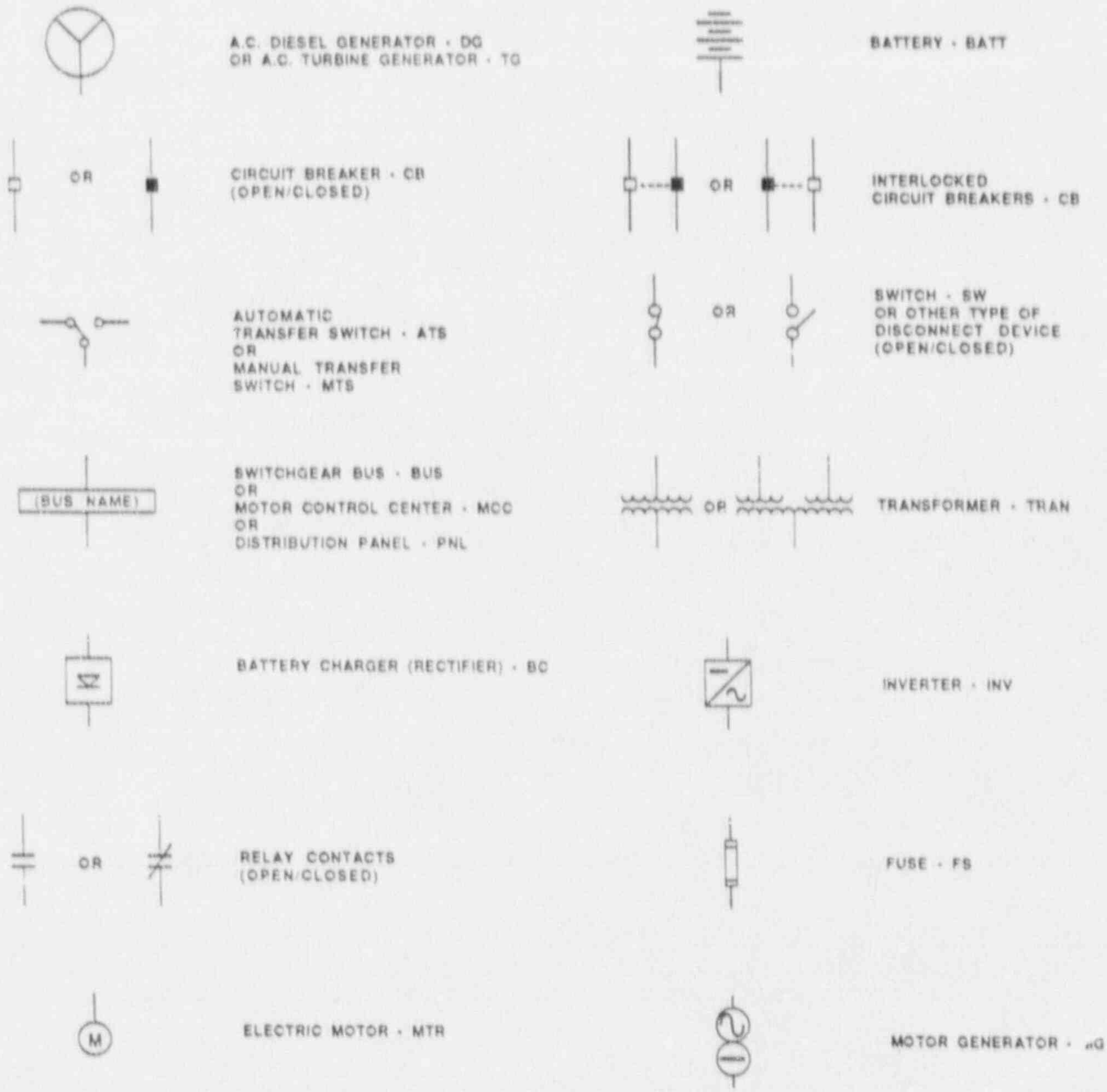


Figure A-2. Key To Symbols In Electrical System Drawings

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, LPCI, LPCS and ADS)
EP	Electric Power System
SSW	Shutdown Service Water System

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

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

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

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

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

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

TABLE B-1. COMPONENT TYPE CODES

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

TABLE B-1. COMPONENT TYPE CODES (Continued)

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