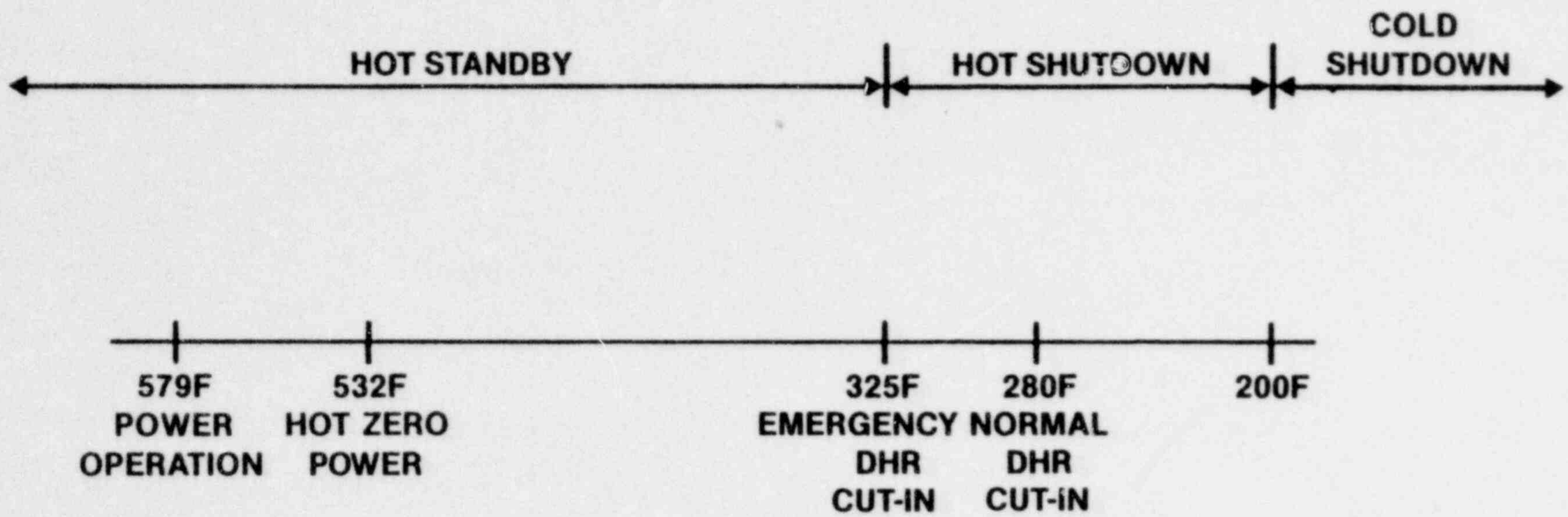
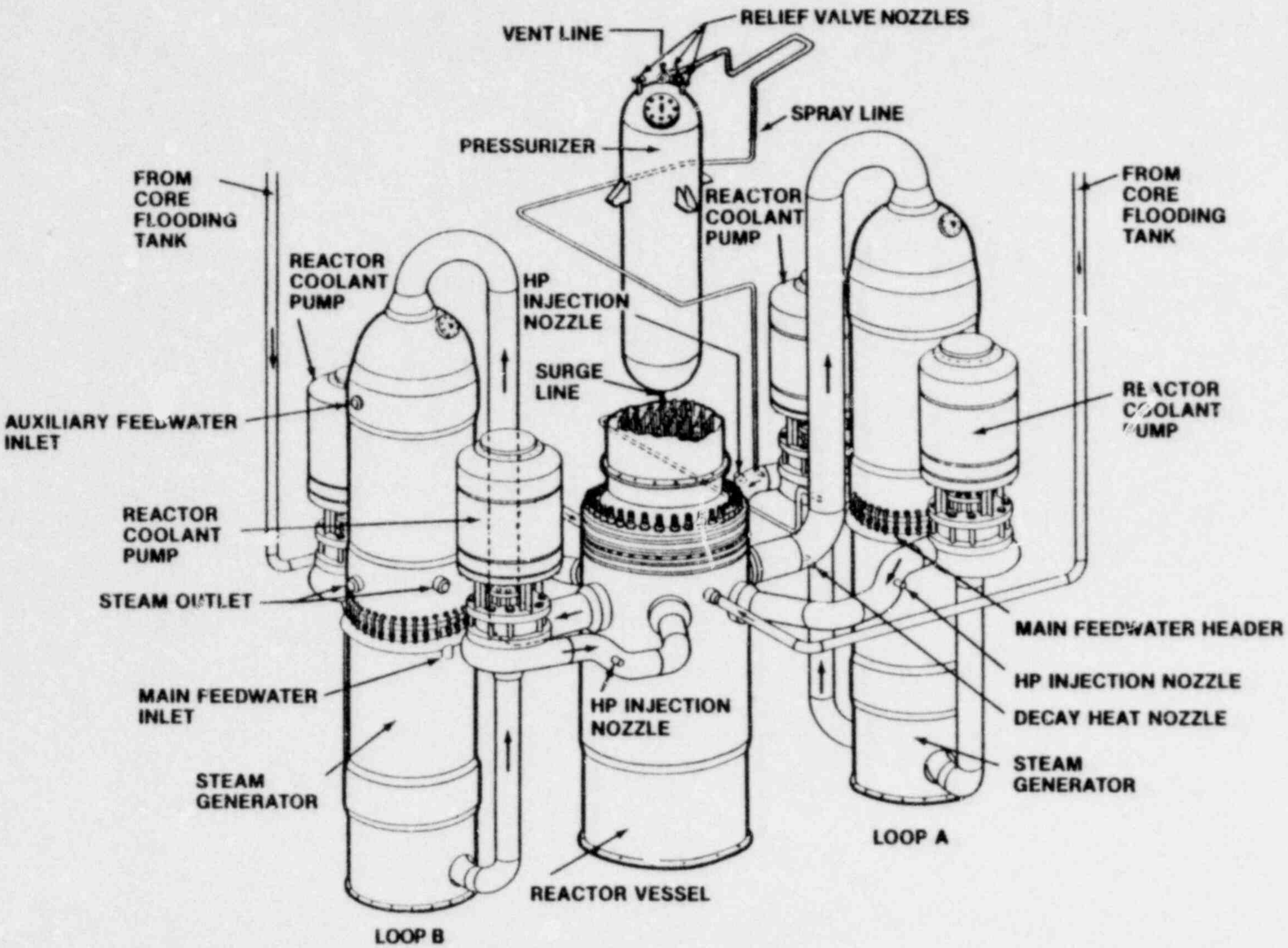
FIGURES



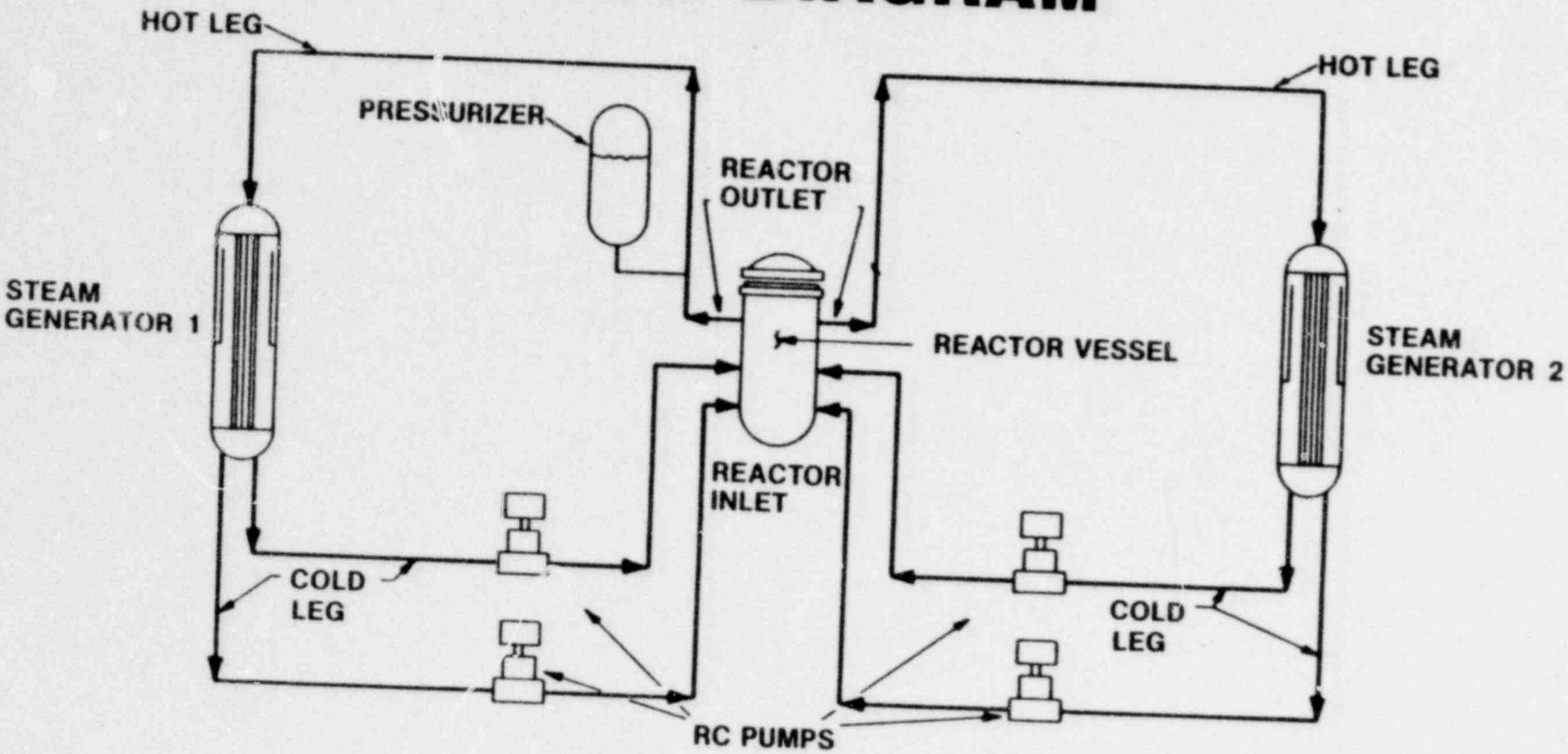

# REACTOR OPERATIONAL MODES

G-1508-11

# REACTOR COOLANT SYSTEM

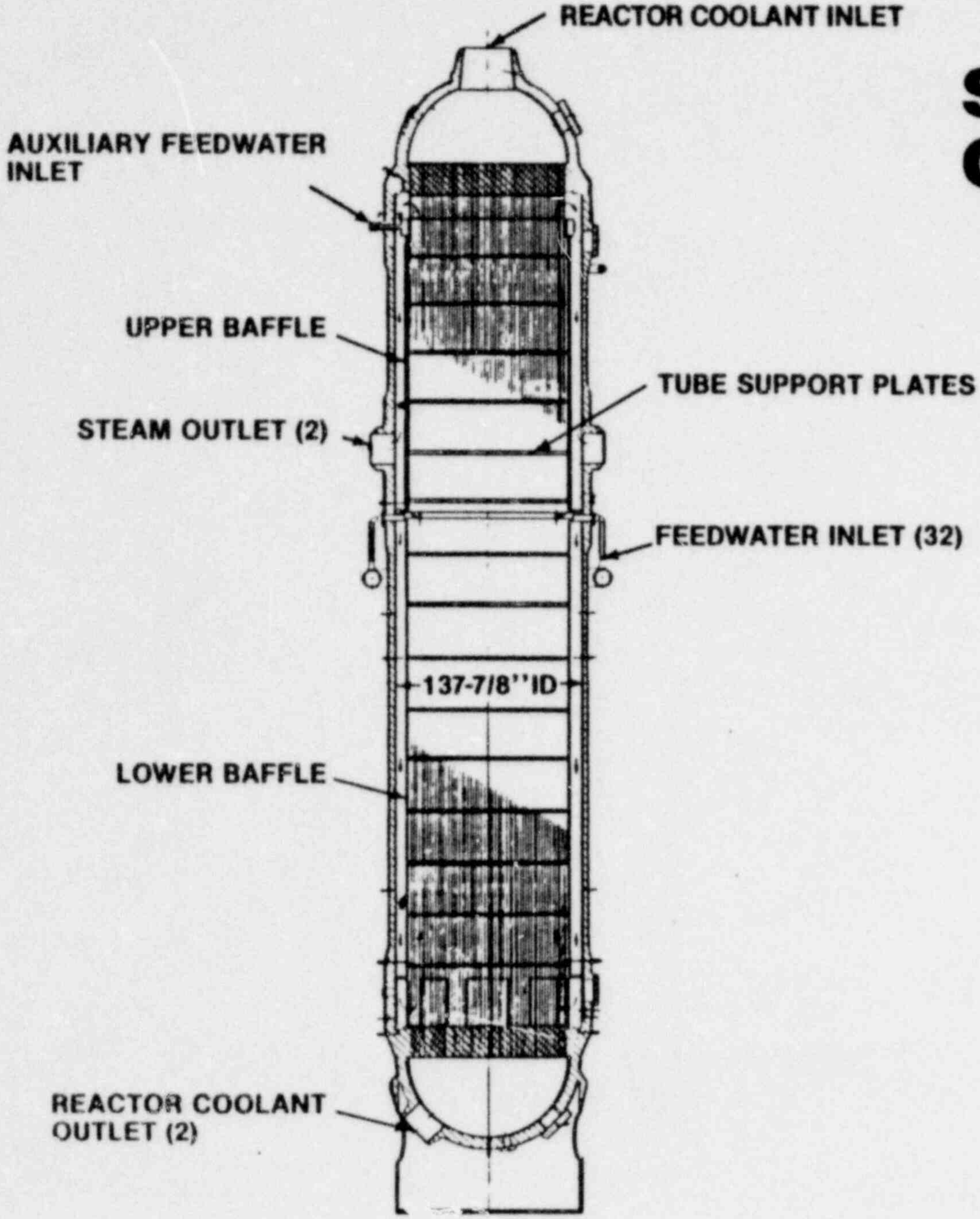


# REACTOR COOLANT SYSTEM FLOW DIAGRAM




G-1508-02

# STEAM GENERATOR

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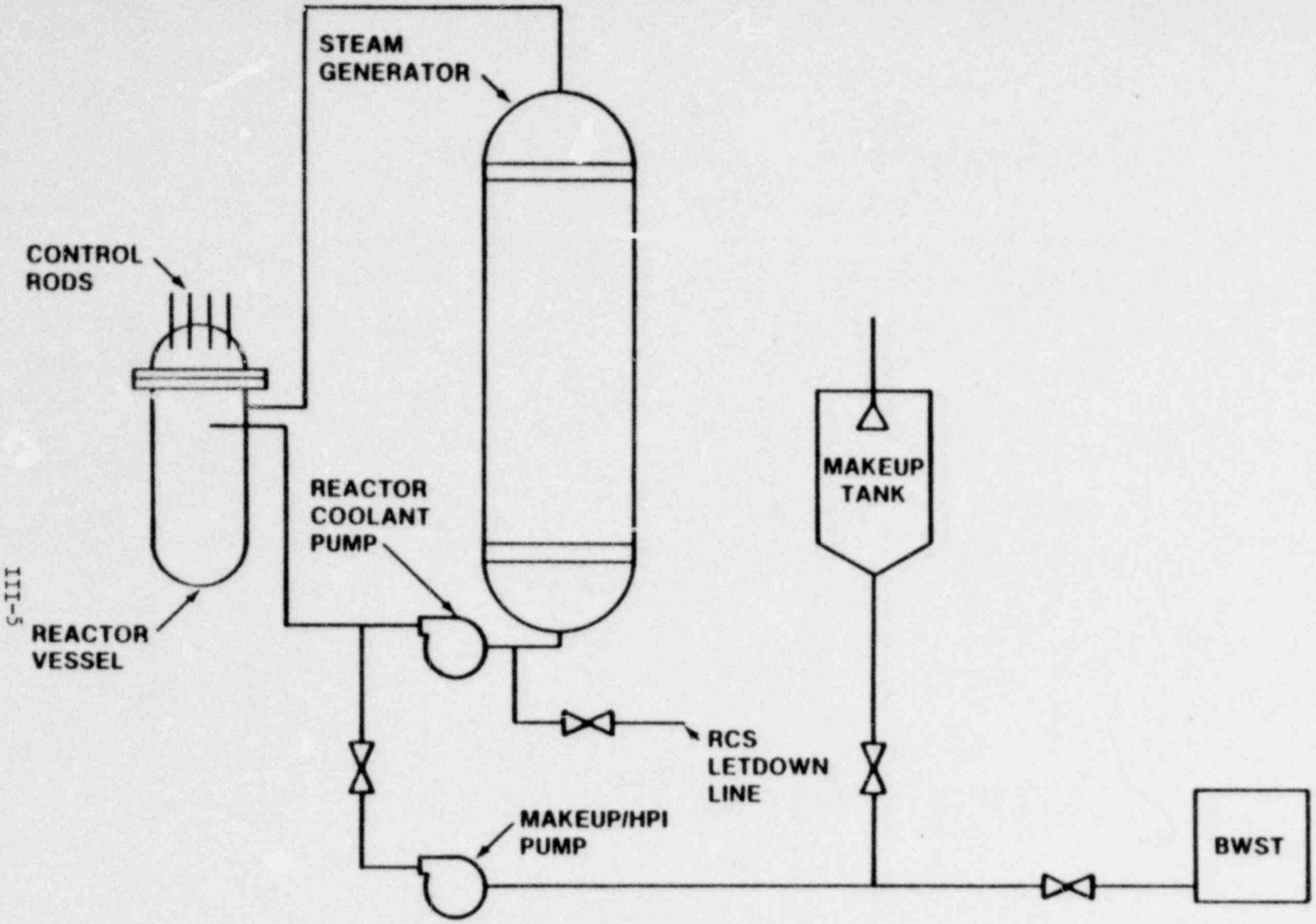
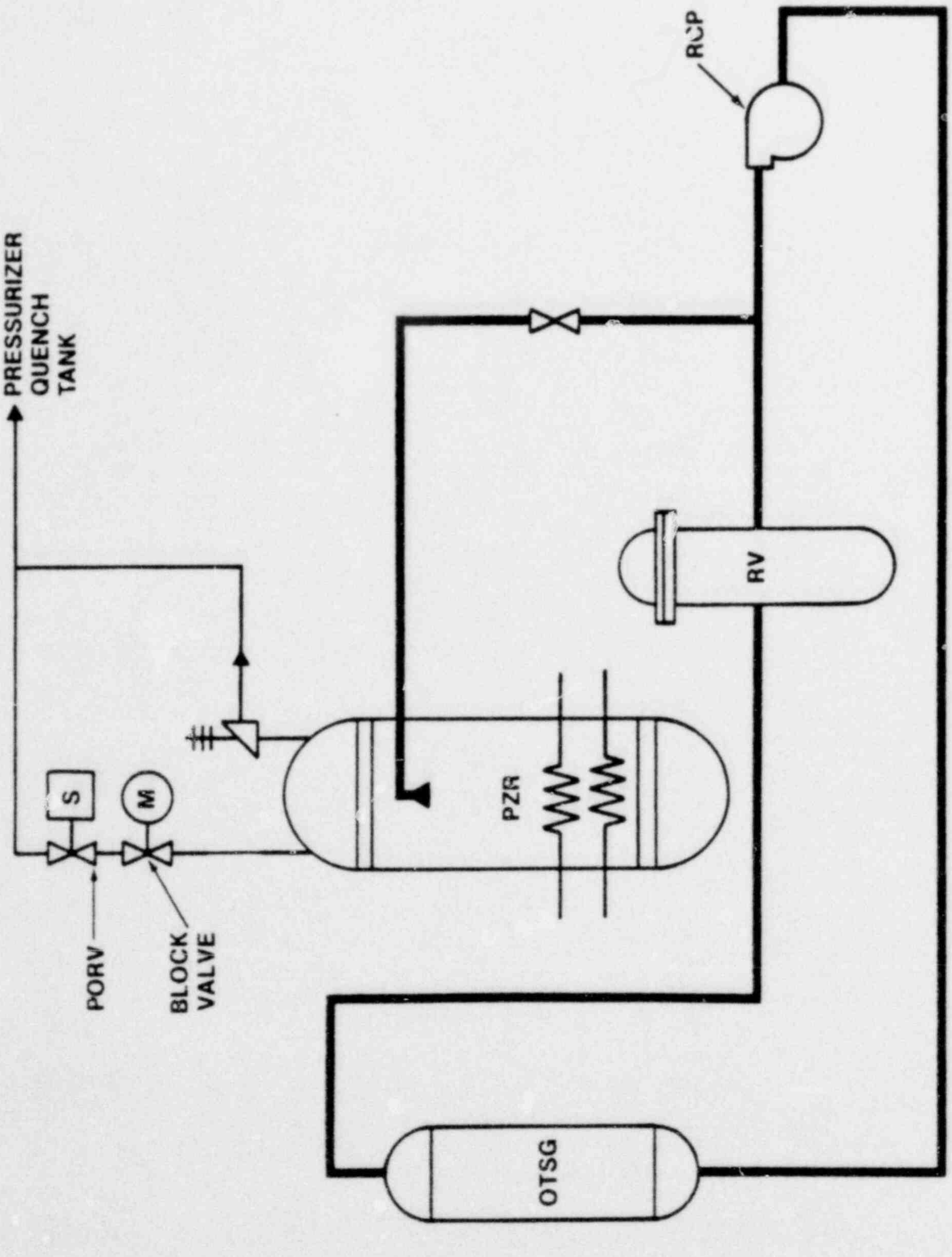


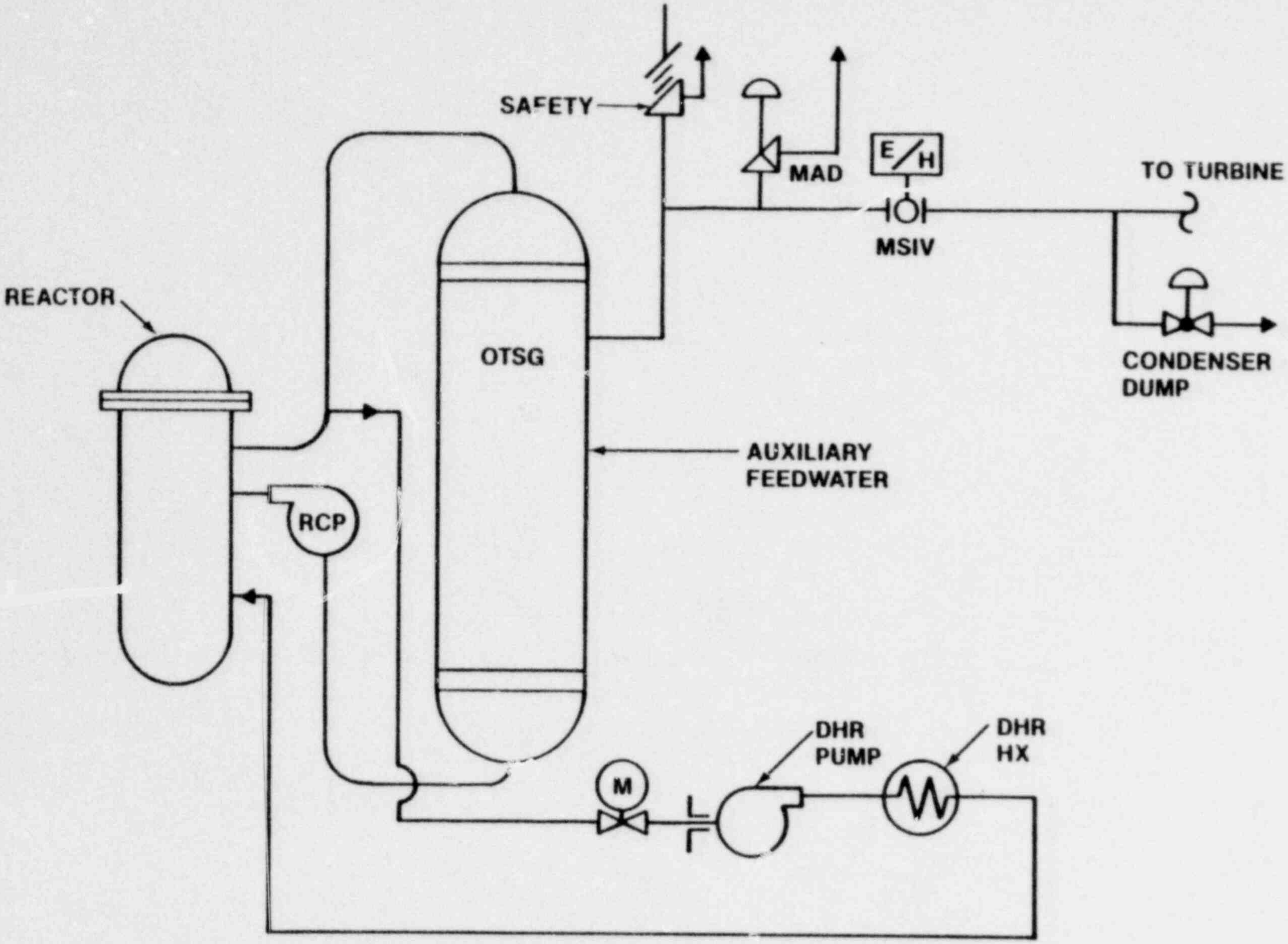

# REACTIVITY CONTROL/ INVENTORY CONTROL

G 1508 05




PRESSURE CONTROL

G 1508-04



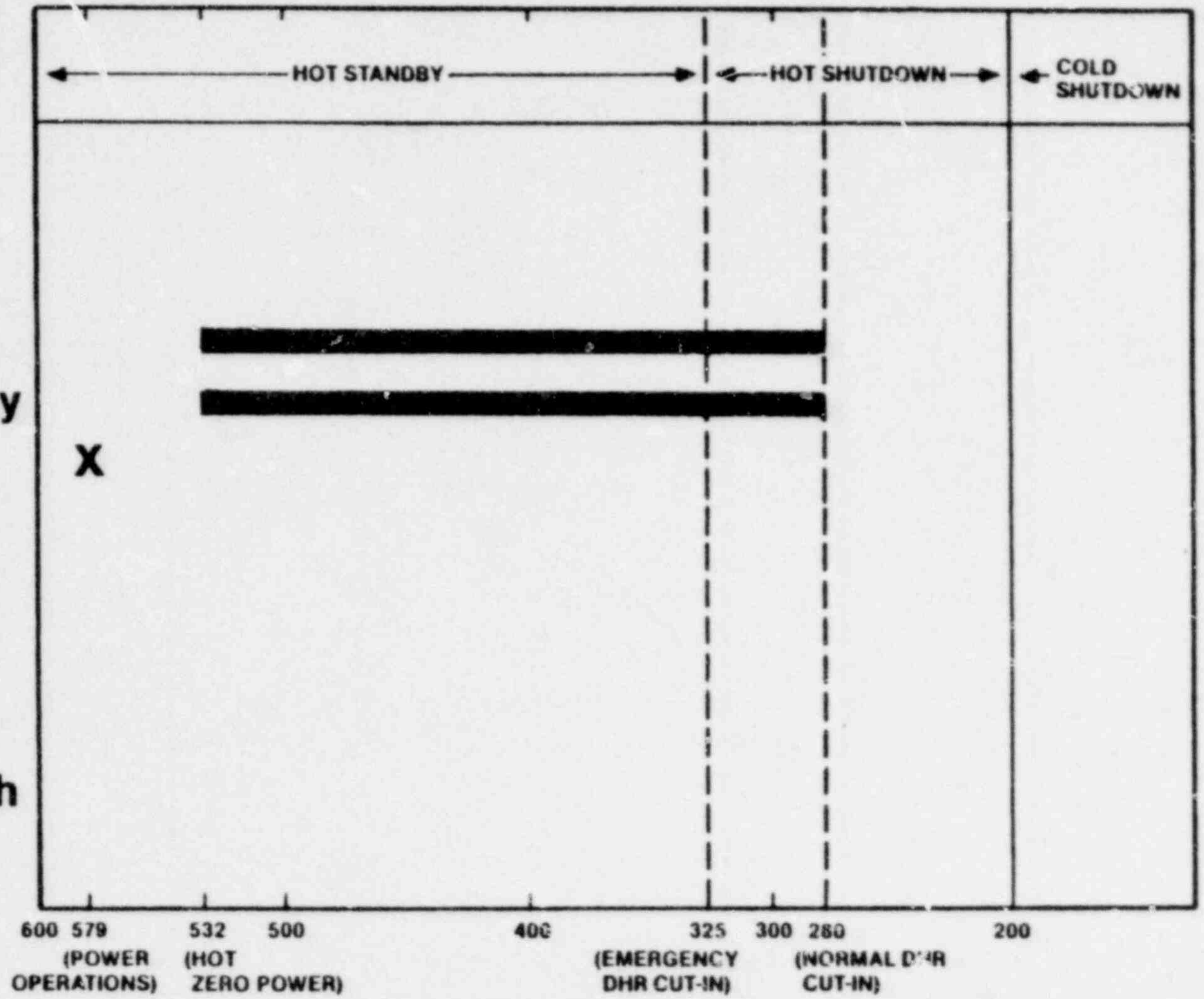

# HEAT REJECTION (TEMPERATURE CONTROL)

G-1508-06

# SHUTDOWN SYSTEMS OPERATIONAL RANGE

SHUTDOWN FUNCTIONS AND SYSTEMS

SHUTDOWN STAGE




PRESSURE CONTROL

Pressurizer Heaters (5&6)

Auxiliary Pressurizer Spray

Letdown Isolation Valves

Pressurizer Safety Valves (Set at 2,500 psig)

PORV (Set at 2,260 psig)

PORV Block Valve (Set at 2,100 psig Coincident With PORV not Shut)

RCS TEMPERATURE (°F)

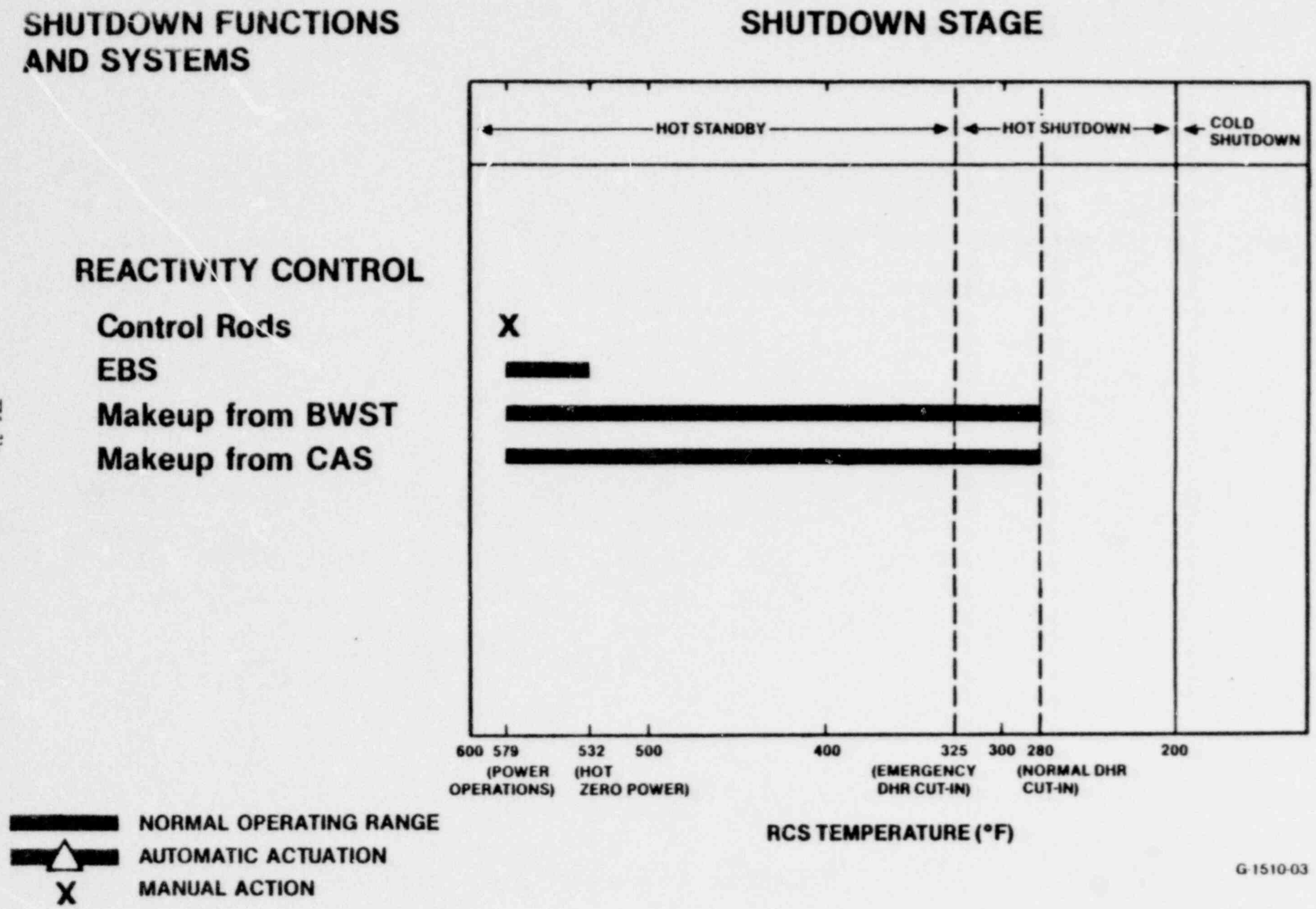
NORMAL OPERATING RANGE

AUTOMATIC ACTUATION

X MANUAL ACTION

G-1510-03

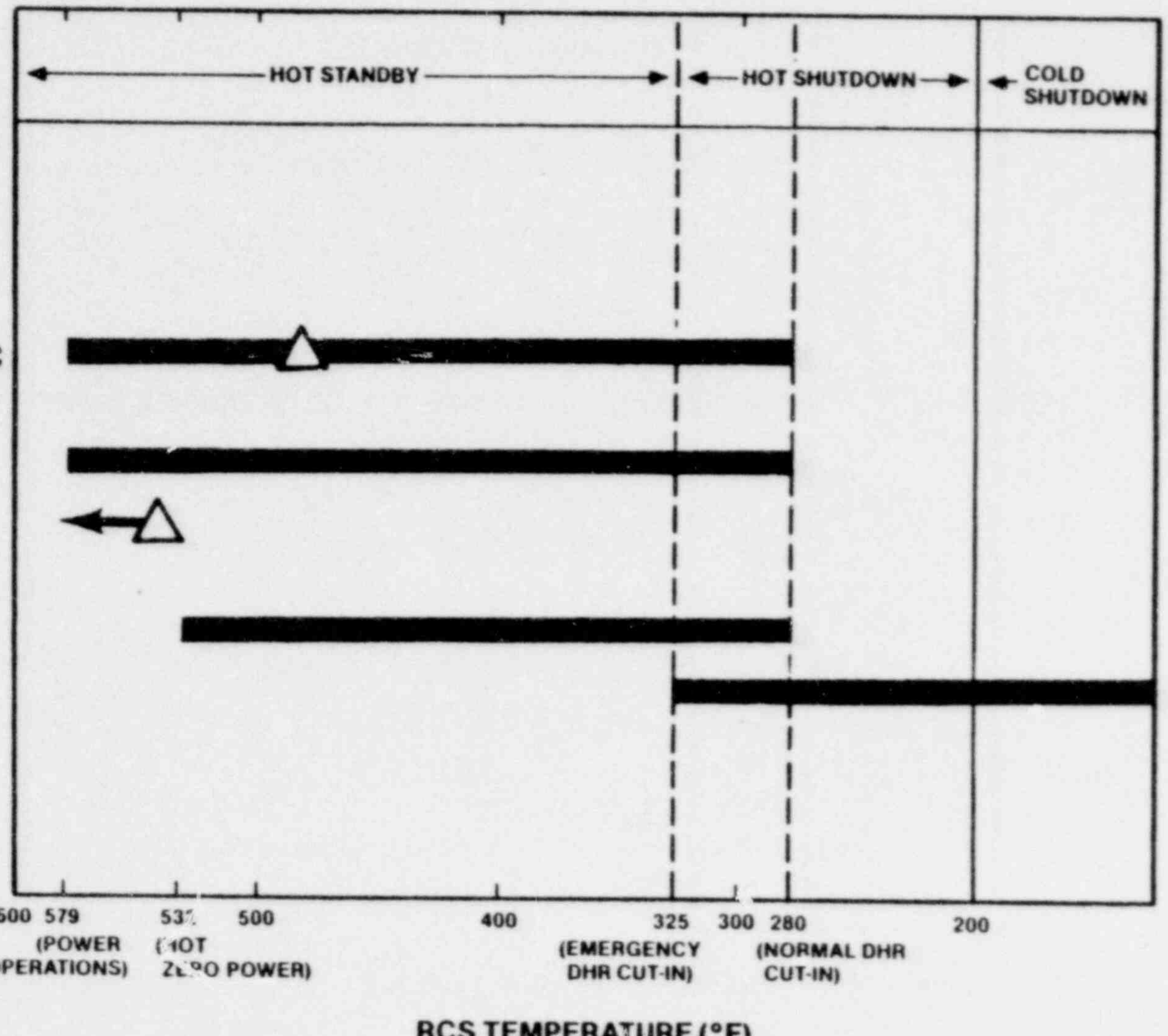
# SHUTDOWN SYSTEMS OPERATIONAL RANGE



# SHUTDOWN SYSTEMS OPERATIONAL RANGE

**SHUTDOWN FUNCTIONS AND SYSTEMS**

**SHUTDOWN STAGE**




**HEAT REJECTION**

**Steam Generator**

**MSIV & MFWIV (Automatic Isolation at 585 psig)**

**AFW**

**Main Steam Relief Valves (Set at 1,050 psig)**

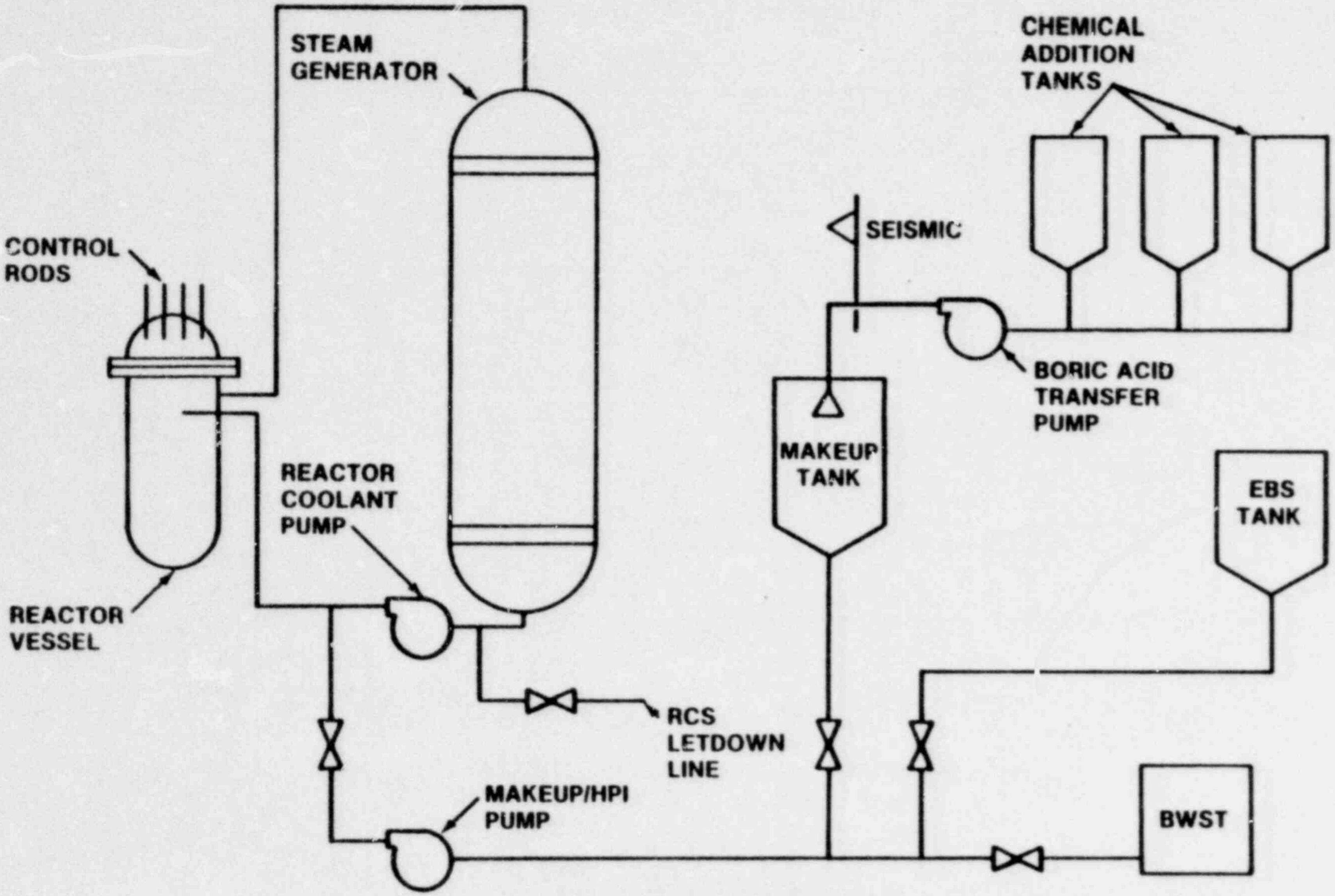
**POAV**

**Decay Heat Removal System**

NORMAL OPERATING RANGE

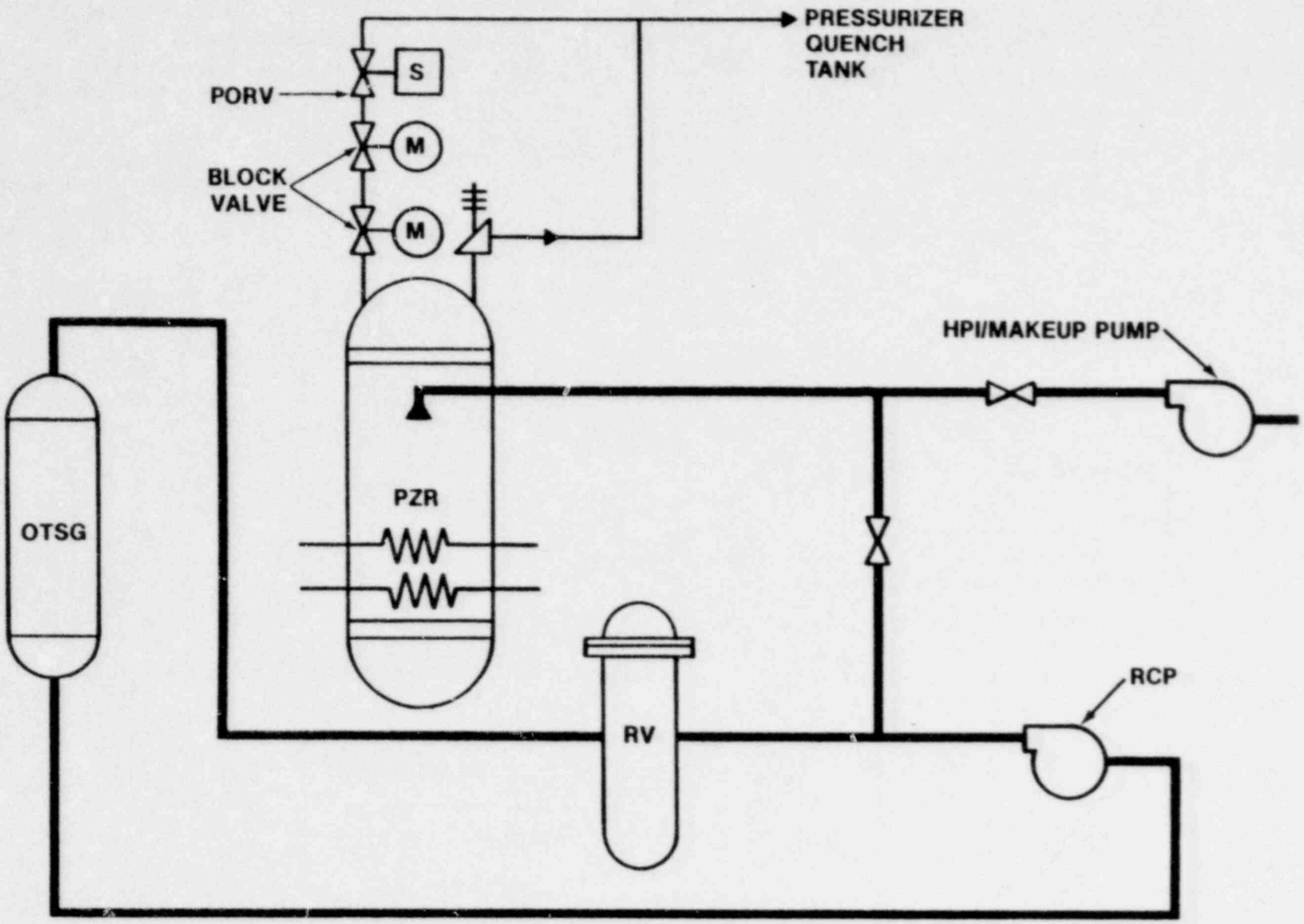
AUTOMATIC ACTUATION

X MANUAL ACTION



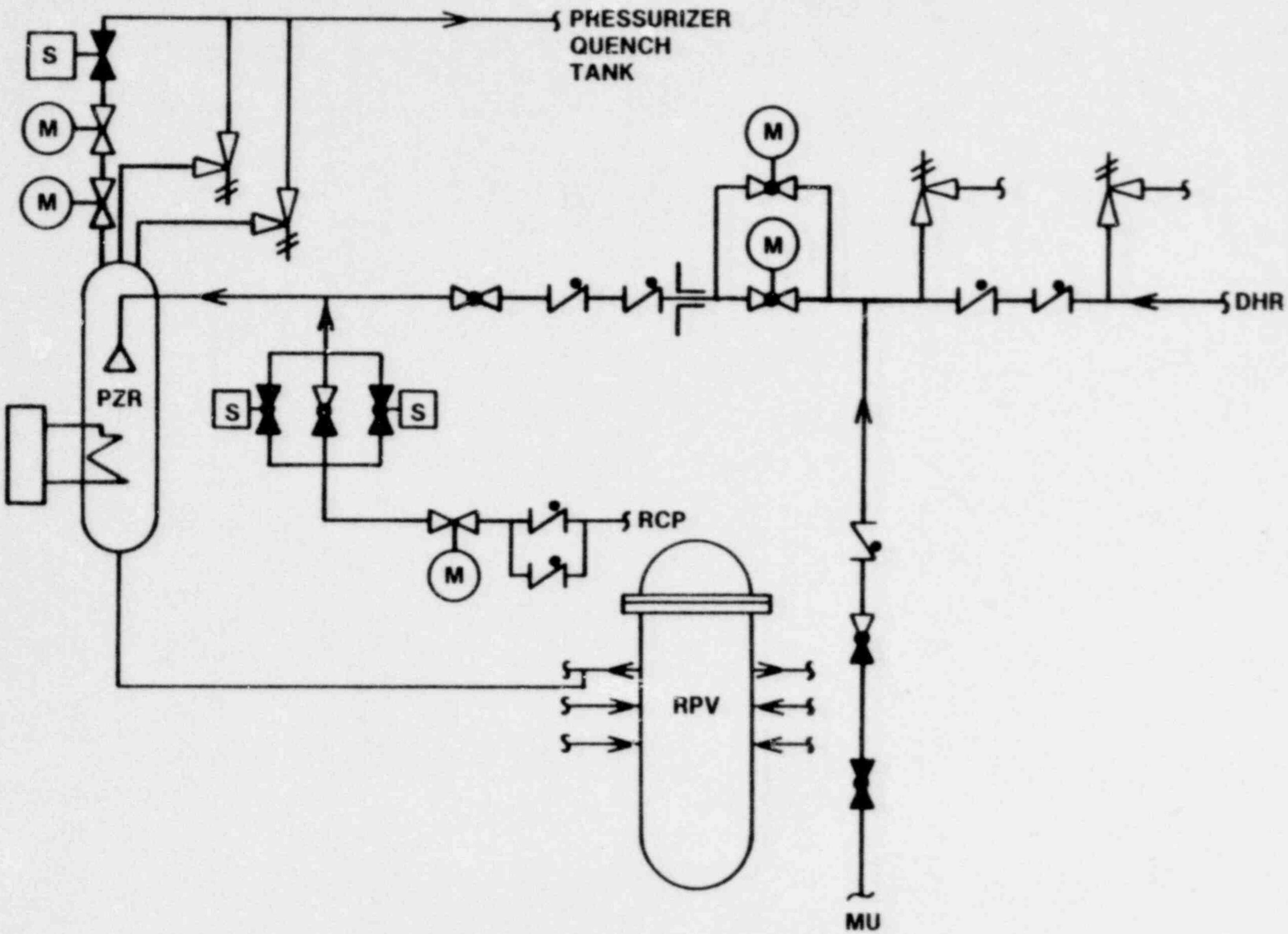

# REACTIVITY CONTROL/ INVENTORY CONTROL

G-1508 05



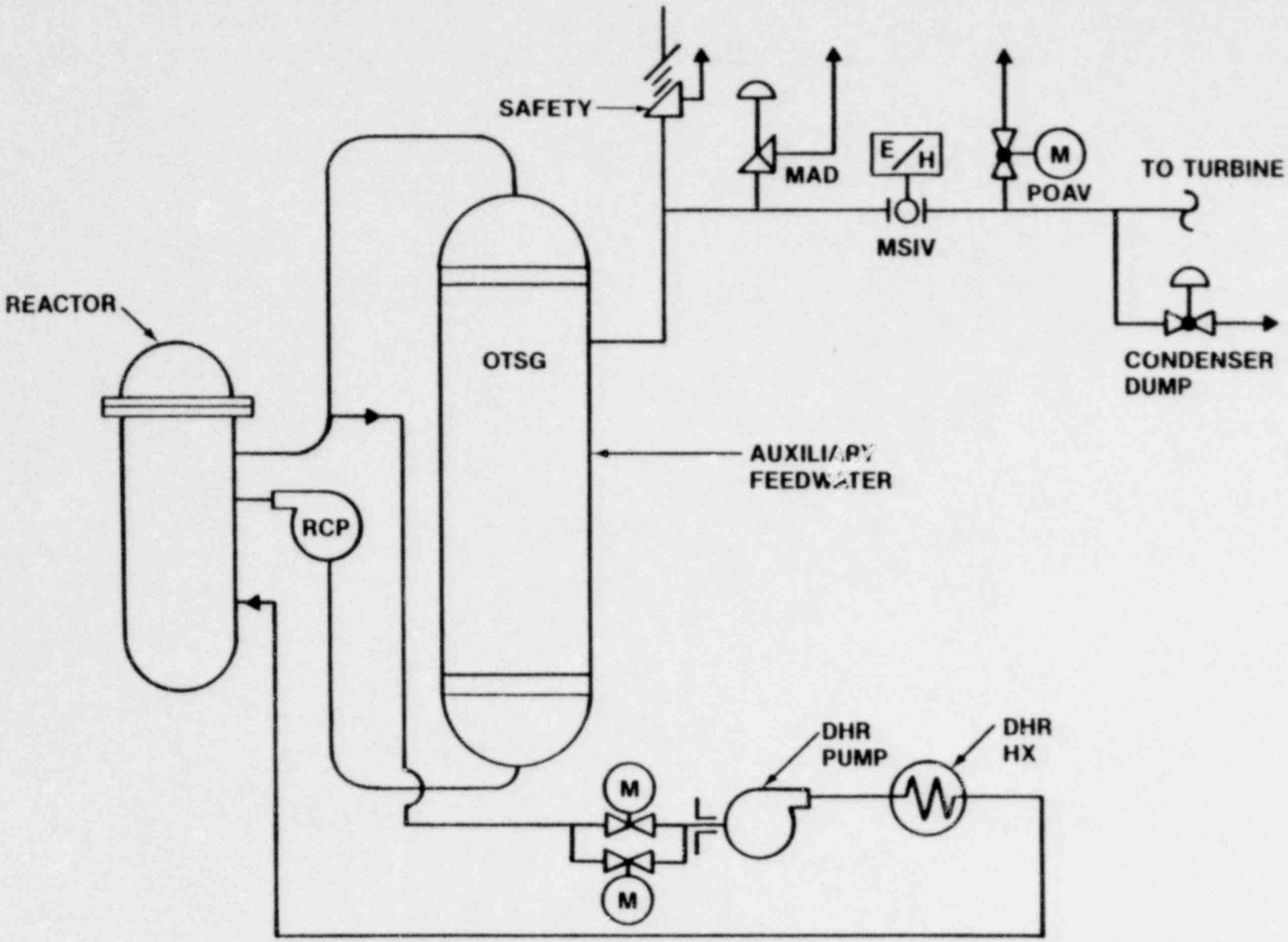

# PRESSURE CONTROL

G-1508-04



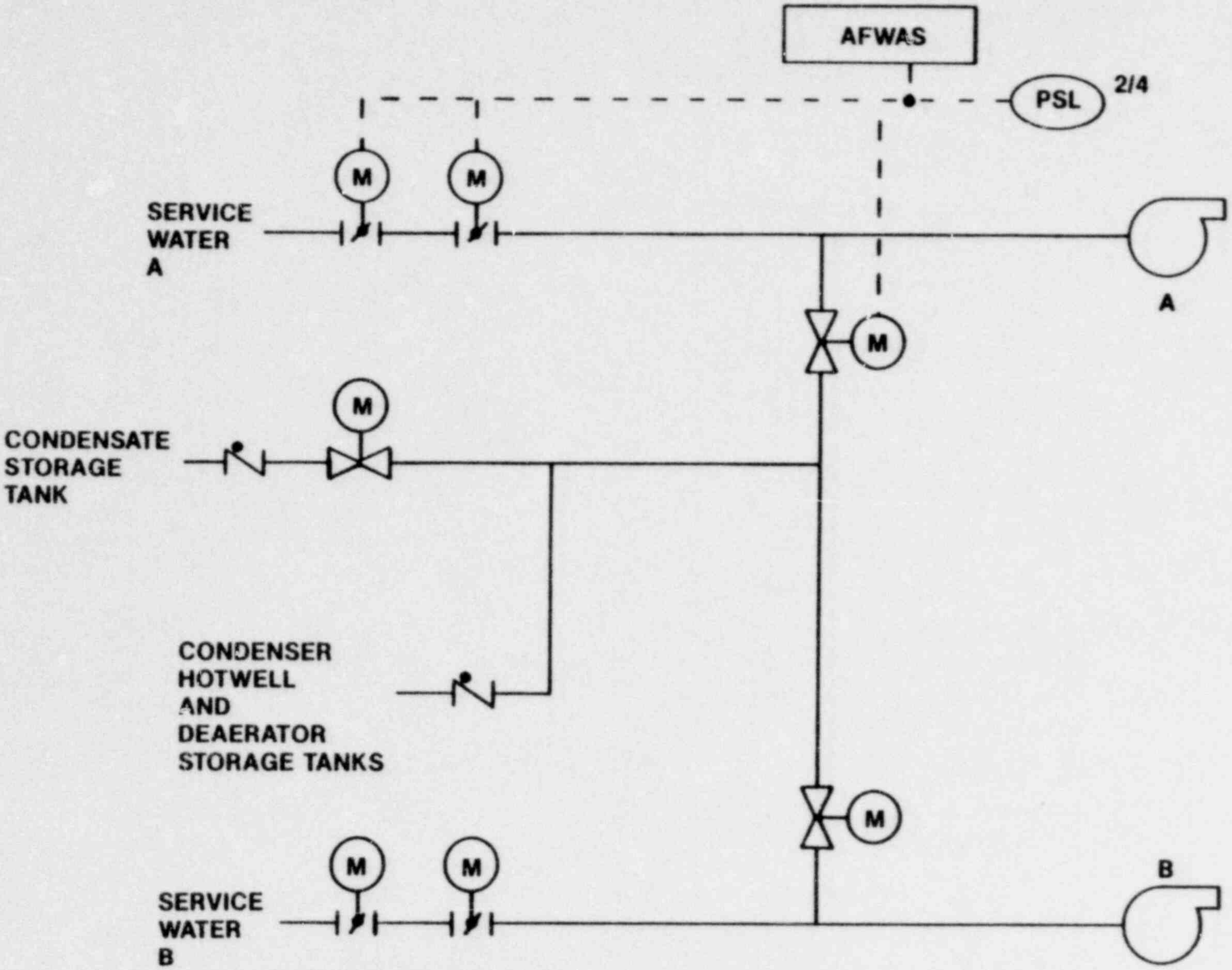

# RCS PRESSURE CONTROL

G-1508-07



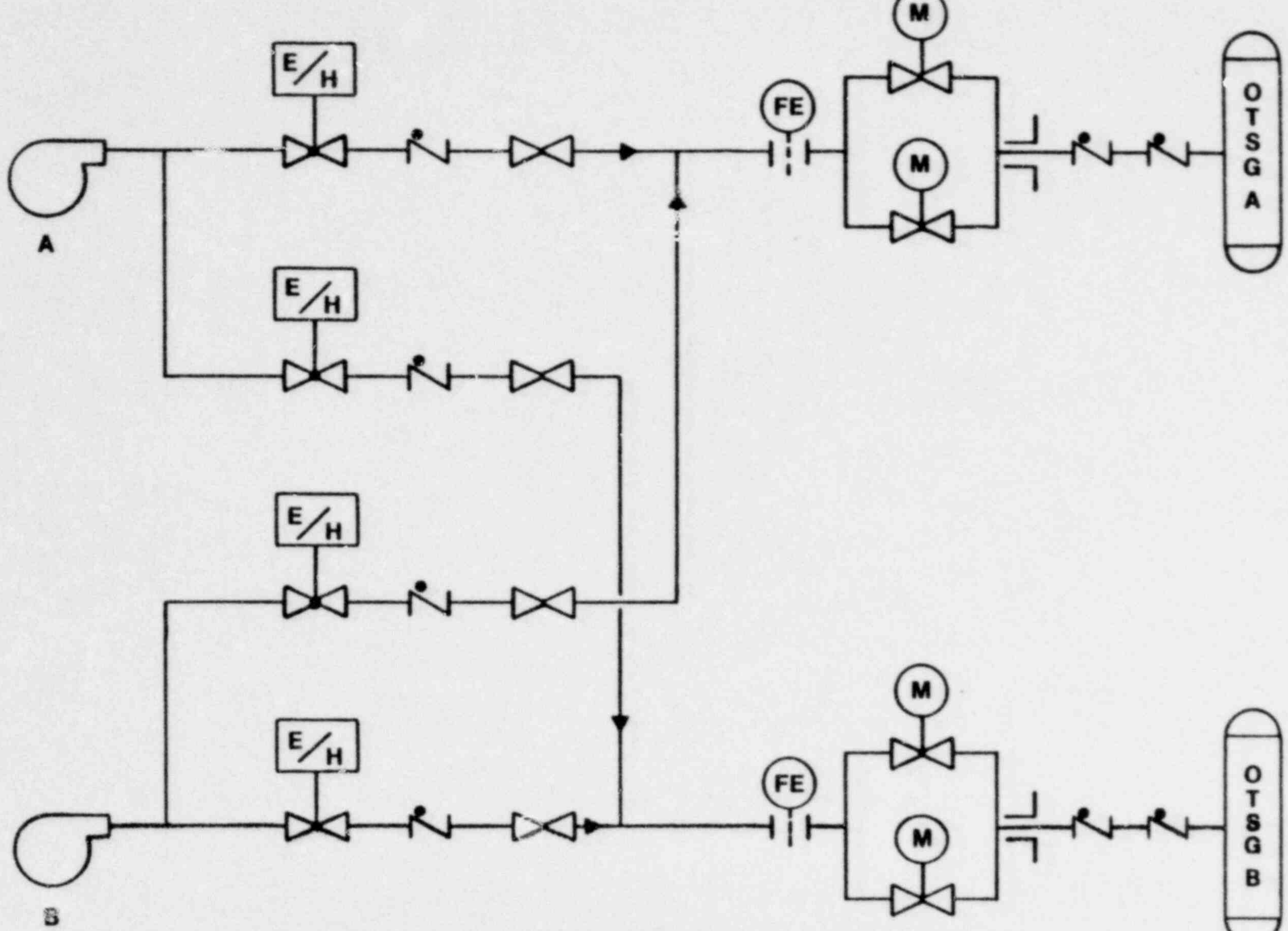

# HEAT REJECTION (TEMPERATURE CONTROL)

G 1508 06



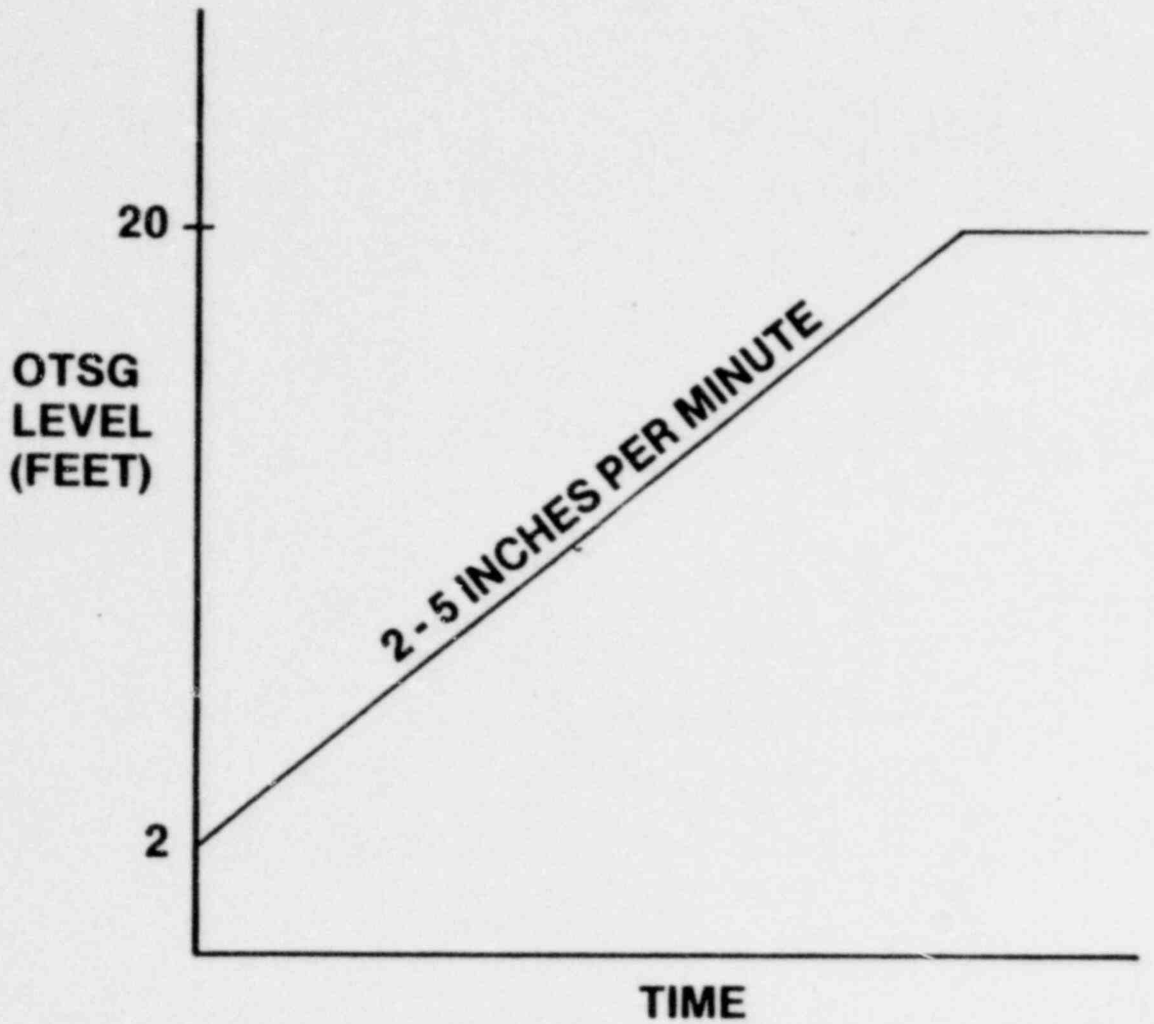

# AUXILIARY FEEDWATER SUCTION CONFIGURATION

G-1508-10




# AUXILIARY FEEDWATER DISCHARGE CONFIGURATION

G-1508-09




# STEAM GENERATOR WATER LEVEL CONTROL

G-1508-08

- **NRC POSITION**
  Provide DHR Dropline Design to Accommodate a Single Failure

- **REFERENCES**
  BTP RSB 5-1, Q211.35, PSB-11, RSB-20

- **MIDLAND DESIGN**
  Complies: Parallel/Series Motor-Operated Valves Provided Inside Containment

- **NRC POSITION**
  Provide Safety-Grade Steam Dump Valves

- **REFERENCE**
  BTP RSB 5-1, Q211.35, ASB-8, RG 1.139

- **MIDLAND DESIGN**
  Complies: Two POAV Valves Provided per Steam Generator

- **NRC POSITION**
  Provide Auxiliary Pressurizer Spray or Show Acceptable Manual Actions

VI-3

- **REFERENCES**
  BTP RSP 5-1, Q211.35

- **MIDLAND DESIGN**
  Complies: Auxiliary Pressurizer Spray Provided

- **NRC POSITION**
  Provide Safety-Grade Boration Capability or Show Acceptable Manual Actions

- **REFERENCES**
  BTP RSB 5-1, Q211.35, RG 1.139

- **MIDLAND DESIGN**
  Complies: EBS and Other Safety-Grade Borated Water Sources Provide Sufficient Boration

- **NRC POSITION**
  Provide Adequate DHR Isolation

- **REFERENCES**
  BTP RSB 5-1, RG 1.139

- **MIDLAND DESIGN**
  Complies: Suction Isolation by Two Series Motor-Operated Valves; Discharge Isolation by Two Series Check Valves

- **NRC POSITION**
  **Collect and Contain DHRS Pressure Relief Valve Discharge**

- **REFERENCES**
  **BTP RSB 5-1, Q211.35, RG 1.139**

- **MIDLAND DESIGN**
  **Complies: Discharge Routed to Containment Sump**

- **NRC POSITION**
  Conduct Natural Circulation Cooldown and Borated Water Mixing Test

- **REFERENCES**
  BTP RSB 5-1, Q211.35, RG 1.139

- **MIDLAND DESIGN**
  Partial Compliance: 50F Natural Circulation Cooldown Test Will Be Conducted or Referenced; No Separate Boron Mixing Test Planned; Safe Boron Mixing Test Infeasible

- **NRC POSITION**
  Provide Procedures for Natural Circulation Cooldown

- **REFERENCES**
  BTP RSB 5-1, Q211.35, RG 1.139

- **MIDLAND DESIGN**
  Complies: Appropriate Procedures to Be Provided

- **NRC POSITION**
  Provide Adequate Seismic Category I AFW Supply

- **REFERENCES**
  BTP RSB 5-1, Q211.35, RG 1.139

- **MIDLAND DESIGN**
  Complies: Normal Supply is Nonsafety-Grade Condensate; Automatic Switchover Provided to Safety-Grade Service Water

- **NRC POSITION**
  **Provide Boron Monitoring Capability with Safety-Grade System**

- **REFERENCES**
  **BTP RSB 5-1, RG 1.139**

- **MIDLAND DESIGN**
  - **Nonsafety-Grade Boron Monitoring Provided**
    - **Continuous monitoring by boronometer on letdown**
    - **Periodic monitoring by manual sampling**

- **NRC POSITION**
  Provide Safety-Grade Steam Generator Water Level Indication and Alarm

- **REFERENCES**
  RG 1.139

- **MIDLAND DESIGN**
  Complies with Clarification: Safety-Grade Water Level Indication and Nonsafety-Grade Alarms Provided

- **NRC POSITION**
  Provide Safety-Grade Makeup and Letdown to Accommodate Cooldown Shrinkage and Boration

- **REFERENCES**
  RG 1.139

- **MIDLAND DESIGN**
  Complies with Clarification: Boration and Cooldown Shrinkage Accommodated Using Only Safety-Grade Systems Without Letdown

- **NRC POSITION**
  **Address Pressurizer Heaters Required to Maintain Natural Circulation Conditions**

- **REFERENCES**
  **Open Item RSB-10, RG 1.139**

- **MIDLAND DESIGN**
  **Complies: Two Banks of Pressurizer Heaters Backed by Safety-Grade Power and Controls**

- NRC POSITION
  Achieve Cold Shutdown with Safety-Grade Systems
- REFERENCES
  BTP RSB 5-1, [illegible]211.35, RG 1.139
  Open Items [illegible]SB-11, RSB-10, ASB-8, RSB-7
- MIDLAND DESIGN
  Complies with Clarifications:
  - Boration accomplished without letdown
  - Boration monitored and sampled by nonsafety-grade systems
  - No separate boron mixing test planned
  - Steam generator water level alarms are nonsafety-grade
  - One steam generator cooldown will take longer than 36 hours
  - Upgraded nonseismic CAS can provide contraction volume after tornado

# CONTROL CAPABILITIES OUTSIDE THE CONTROL ROOM

**AUXILIARY SHUTDOWN PANEL**

**MONITORS**
- EBS Tank Level
- Pressurizer Level
- T-Hot, T-Cold
- AFW Flow
- OTSG Pressure & Level
- RCS Flow & Pressure
- POAV Position

**CONTROLS**
- Pressurizer Heaters
- Portions of MU&PS
- CCW Pumps
- POAV Valves
- Pressurizer PORV
- Auxiliary Feedwater

**LOCAL CONTROL PANELS, MCC, & SWGR**

**SYSTEMS**
- Diesel Generator
- Service Water
- Component Cooling Water
- Chilled Water
- Plant HVAC
- Auxiliary Pressurizer Spray

VARIOUS ACTIONS INDICATED IN DISCUSSION (e.g., EBS, DHR)

LOCAL AT EQUIPMENT

HOT STANDBY

HOT SHUTDOWN

COLD SHUTDOWN

# STANDARD REVIEW PLAN
# SECTION 7.4 ACCEPTANCE CRITERIA

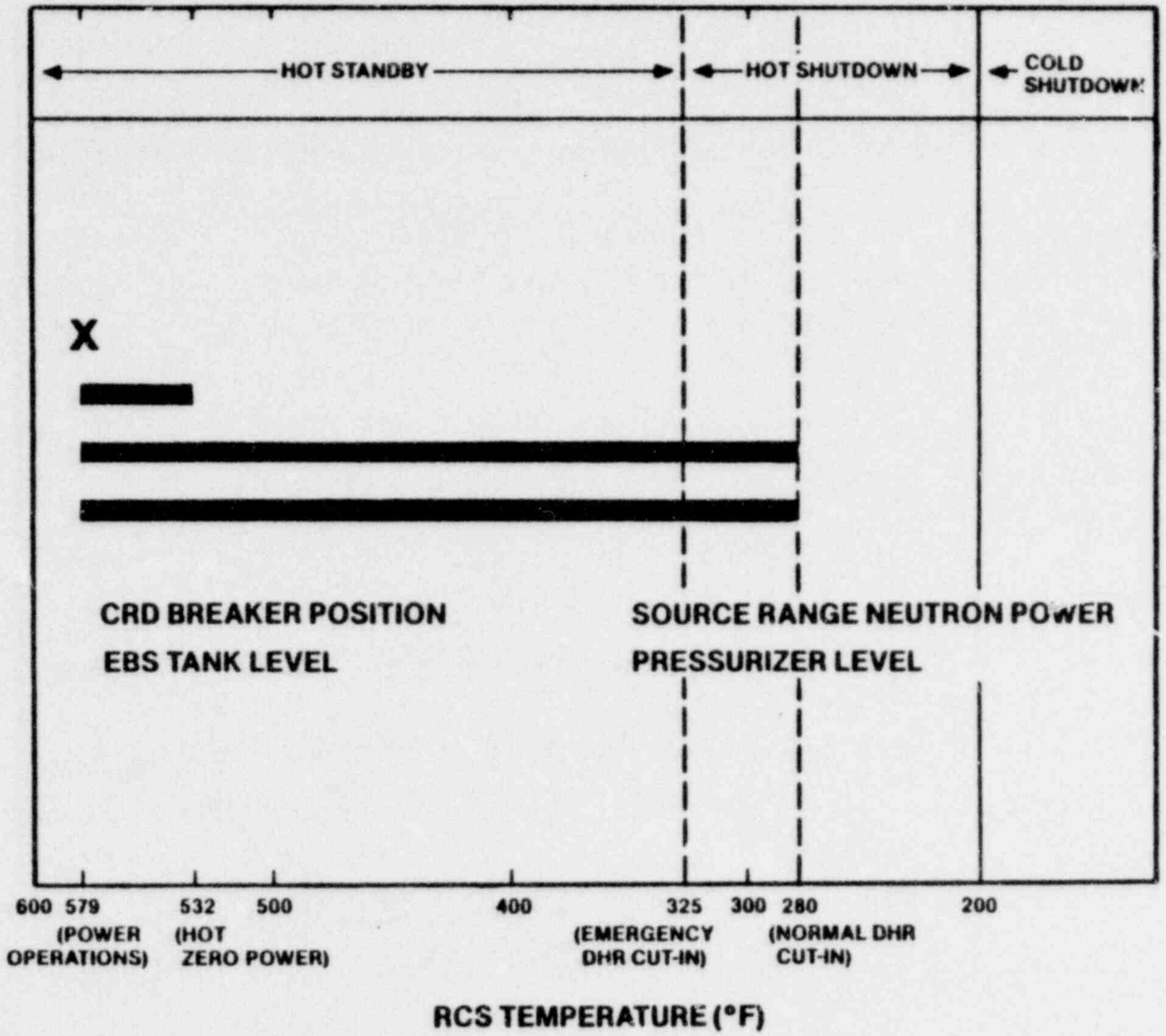
- ALL INSTRUMENTATION AND CONTROLS ESSENTIAL TO ACHIEVE AND/OR MAINTAIN COLD SHUTDOWN SHALL:
  - BE REDUNDANT in Their Intended Safety Function
  - MEET THE SINGLE-FAILURE CRITERION
  - HAVE CAPACITY AND RELIABILITY to Perform Their Intended Safety Functions Whenever Necessary
  - BE QUALIFIED to Function After the Design Basis Events for Which Their Operation Is Essential, Including Earthquakes and All FSAR Chapter 15 Accidents
  - Satisfy Applicable Criteria for Preoperational and Periodic TESTING, QUALITY Assurance, and Design Provisions for INDICATING SYSTEM AVAILABILITY
  - BE OPERABLE FROM OUTSIDE THE CONTROL ROOM at Local Control Panels with Appropriate Readouts, and Operate Independent of the Control Room

# SHUTDOWN SYSTEMS OPERATIONAL RANGE

## SHUTDOWN FUNCTIONS AND SYSTEMS

## SHUTDOWN STAGE

SHUTDOWN MONITORING INSTRUMENTATION




**REACTIVITY CONTROL**

- Control Rods
- EBS
- Makeup from BWST
- Makeup from CAS

NORMAL OPERATING RANGE

AUTOMATIC ACTUATION

X MANUAL ACTION

G-1510-03

# SHUTDOWN SYSTEMS OPERATIONAL RANGE

**SHUTDOWN FUNCTIONS AND SYSTEMS**

**SHUTDOWN STAGE**

**SHUTDOWN MONITORING INSTRUMENTATION**

**PRESSURE CONTROL**

Pressurizer Heaters (5&6)

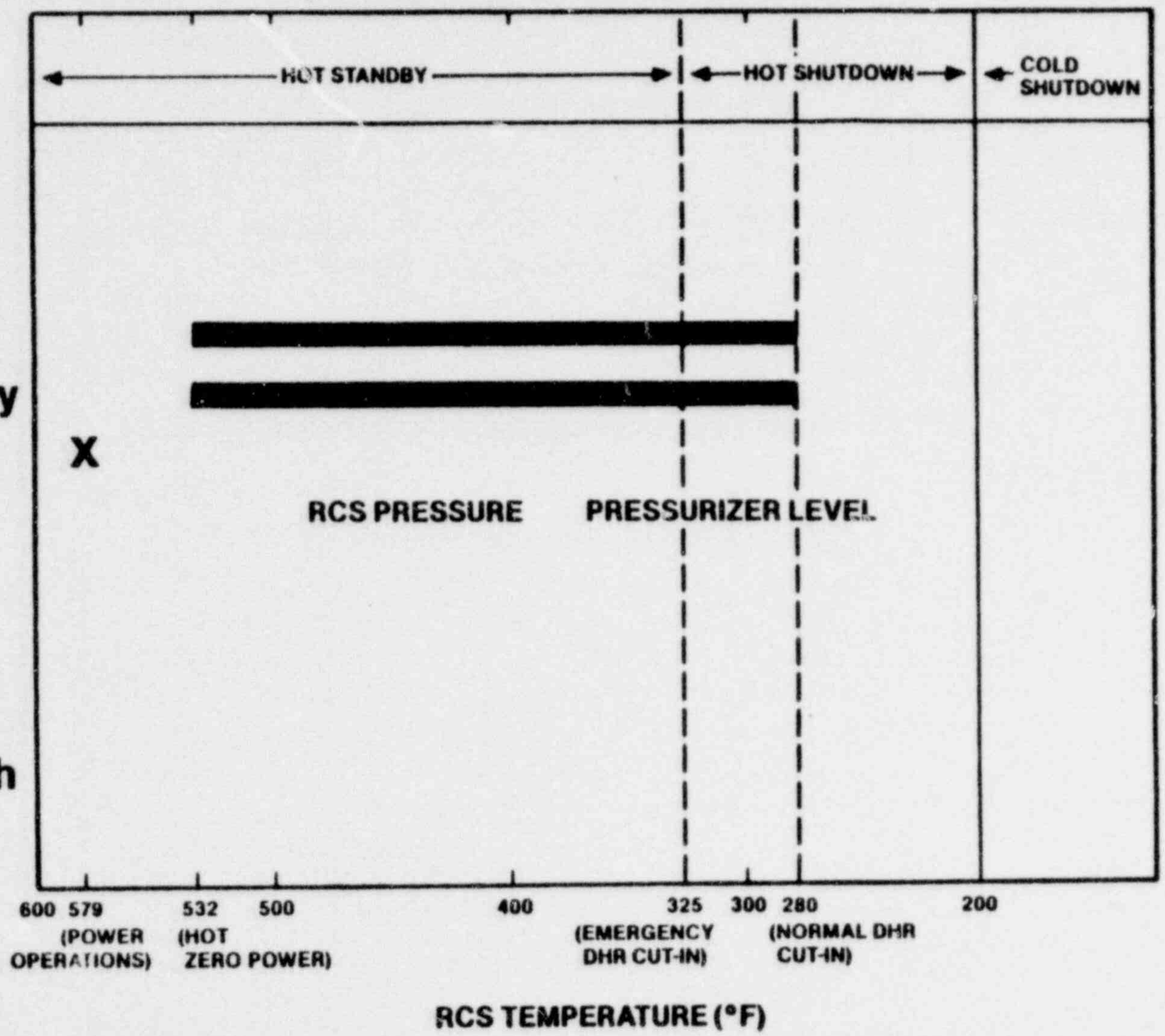
Auxiliary Pressurizer Spray

Letdown Isolation Valves

Pressurizer Safety Valves (Set at 2,500 psig)

PORV (Set at 2,260 psig)

PORV Block Valve (Set at 2,100 psig Coincident With PORV not Shut)



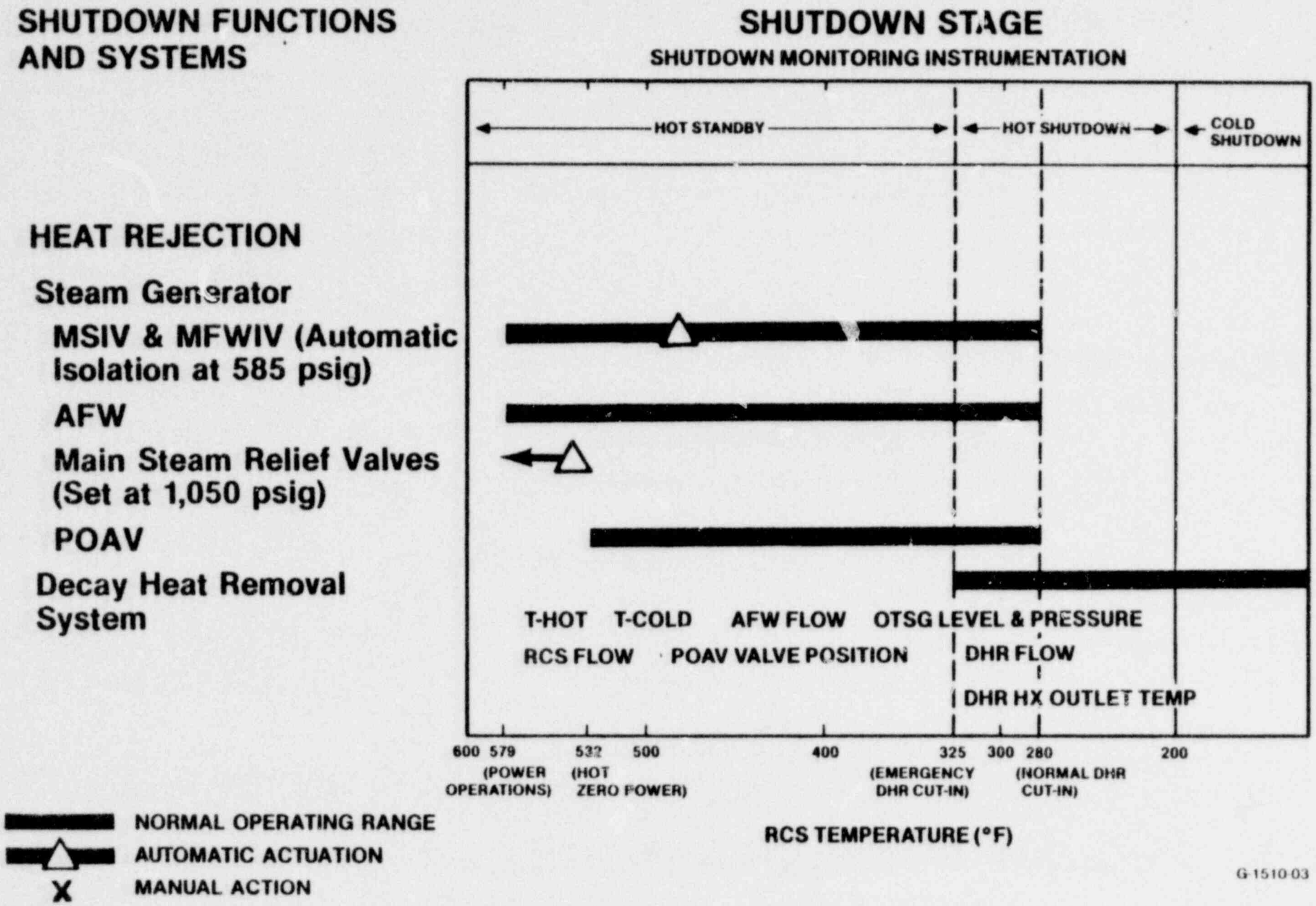

NORMAL OPERATING RANGE

AUTOMATIC ACTUATION

X MANUAL ACTION

G-1510-03

# SHUTDOWN SYSTEMS OPERATIONAL RANGE



# APPENDIX

Question 211.35 (5.4.7)

Should the Midland plants experience an event that will require eventual cooldown to permit either long-term cooling with the DHR system or going to cold shutdown for inspection and repairs (extended loss of offsite power, steam generator tube rupture, failure of steam generator relief valves to reclose, etc), it is desirable that qualified systems be available to perform the operation safely and in an orderly manner. Discuss the capability of the Midland plants to be taken to a cold shutdown condition using only safety-grade equipment, assuming only onsite or offsite power is available, and considering a single failure. Address each of the following areas of concern in your response:

1. Discuss the capability of the single DHR drop line to provide for the cooldown of the plant assuming a single active failure, including manual actions inside or outside of containment or the return to hot standby until manual actions or maintenance can be performed to correct the failure.

   With regard to the Midland shutdown capability, we note that manual operation outside the control room is required for normal shutdown, and containment entry is required for a failure of a motor-operated DHR suction valve. With regard to reducing the need for such manual actions, address the following areas: 9

   a. Discuss the modifications required to provide the capability to conduct a normal shutdown from the control room.

   b. Justify the viability of the manual actions required after a suction valve failure (i.e., opening cross-connects 093, 094). Address times required, doses expected, and potential for inadvertent opening of cross-connects during high primary side pressure conditions. Compare the Midland cross-connect design to Davis-Besse Unit 1. Provide a reliability analysis for the manual action outside the control room and discuss the incremental increase in reliability expected for various selected design modifications.

2. Provide safety-grade steam generator dump valves, operators, air, and power supplies which meet the single failure criterion.

3. Provide the capability to cool down to cold shutdown assuming the most limiting single failure in less than 36 hours or show that manual actions inside or outside containment or return to hot standby until the manual

actions or maintenance can be performed provides an acceptable alternative.

4. Provide the capability to depressurize the reactor coolant system with only safety grade systems assuming a single failure, or show that manual actions inside or outside containment or remaining at hot standby until manual actions or repairs are complete provides an acceptable alternative.

5. Discuss the capability for boration with only safety-grade systems assuming a single failure or show that manual actions inside or outside containment or remaining at hot standby until manual action or repairs are completed provides an acceptable alternative.

6. Discuss the capability for the collection and containment of DHR system pressure relief valve discharge.

7. Conduct tests to study the mixing of the added borated water and cooldown under natural circulation conditions with and without a single failure of a steam generator atmospheric dump valve. 9

8. Commit to providing specific procedures for cooling down using natural circulation and submit a summary of these procedures.

9. Provide a Seismic Category I AWF [SIC] supply for at least 4 hours at hot shutdown plus cooldown to the DHR system cut-in based on the longest time (for only onsite or offsite power and assuming the worst single failure), or show that an adequate alternate Seismic Category I source is available.

<u>Response</u>

The Midland design basis provides f the ility to achieve and 30
maintain, by safety grade means, the hot shutdown condition as described in Section 7.4 of the FSAR. As discussed in the response to Question 110.16, hot shutdown provides for an 14
extremely stable and safe condition at which the plant can be maintained until an eventual cooldown can proceed. Although not a design basis, the Midland design does incorporate the ability 30
to be taken to the cold shutdown condition using only safety grade equipment, assuming only onsite or offsite power is 14
available and considering a single failure. Therefore, in the unlikely event that a design basis earthquake occurs which results in the need to achieve cold shutdown expeditiously, 30
design features exist to accomplish this evolution. This

capability is discussed in the following point-by-point response keyed to the item numbers of NRC Question 211.35: 18

1. The suction side of the decay heat removal (DHR) system inside containment has been upgraded to incorporate motor operators for the previously manual bypass valves. These bypass valves are supplied with redundant Class 1E power (channel E) through manual transfer switches operated outside containment. Therefore, operator action inside containment is not required assuming a 30 single active failure. In addition, the isolation valve outside containment (1MO-1010 or 2MO-1110) is mechanically locked open. Therefore, this valve is not susceptible to an active failure.

   To align the DHR system for cooldown will require limited operator action outside the control room. The operator actions required are: 14

   a. The operator must open the DHR pump suction cross-connect manual valves (Unit 1 valves 009 and 016 or Unit 2 valves 003 and 008) to establish the suction flowpath. 18

   b. The operator must reestablish power to the DHR cooler bypass valve (1MO-1014A, B or 2MO-1114A, B). This valve is electrically locked closed during normal reactor operation.

   To reduce the need for manual actions outside the control room for initiating the normal DHR system cooldown, the DHR system would require:

   a. Replacement of the DHR pump suction cross-connect manual valves with power operated valves

   b. Removal of the electrical lock on the DHR cooler bypass valves. These valves would be ensured 14 closed during normal reactor operation by administrative control.

   The multiple purposes of the DHR system pump suction cross-connect manual isolation valves are given below:

   a. During power operation (DHR system aligned for standby low-pressure injection (LPI) mode), the valves function to separate the suction of the LPI pumps.

   b. During the DHR mode of operation, the valves provide the capability to isolate one DHR train while providing DHR with the other train.

This combination of functions requires manual valves and operator actions outside the control room, or power 14
operated valves controlled from the control room, to align the system for decay heat removal operations.
Because ample time is available for operator action to 30
align the system for DHR operation (approximately
6 hours), and because of the cost of equipment 14
considerations, manual valves were selected for the appplication.

The Davis-Besse Unit 1 DHR suction cross-connect design is similar to the Midland design. The outstanding differences are that the Davis-Besse DHR pump suction valves are provided with motor operators, no containment isolation valve is provided, and the bypass valves inside containment are not motorized. Incorporation of pump suction valve motor operators for Midland would reduce one of the manual actions outside the control room required to align the DHR system for plant cooldowns. However, the operator has at least 6 hours to perform this action. The valves should be opened after plant cooldown commences with the steam generator, but before cooldown commences with the DHR system. Due to the magnitude of the time available to perform the
action, the modification is not deemed necessary. 30

2,3. To remove heat after a postulated design basis earthquake, two Class 1E power operated atmospheric vent (POAV) valves are provided on each steam line between the once-through steam generator (OTSG) outlet nozzle and the main steam isolation valve. These valves and their actuators are qualified as seismic active components. The POAV valves are capable of being jogged to any position between full open and full closed by operator action from the main control room or the auxiliary shutdown panel. Each valve has individual manual isolation provisions. The existence of four POAV valves per unit (two per steam generator) ensures the capability of conducting a balanced cooldown regardless of the occurrence of a single active failure. This cooldown will proceed until the emergency DHR cut-in temperature of 325F is achieved. Operation of the DHR system at this temperature is described in Subsection 5.4.7.1.1.1. A detailed description of the POAV valves and their associated controls can be found in Subsections 10.3.2 and 7.4.1.2.1.

Water is added to the steam generators by a safety grade, seismically qualified auxiliary feedwater system.
This system will provide adequate water assuming a loss 14
of offsite power and a single active failure. The steam produced in the steam generators will be relieved by the
POAV valves as discussed above. 30

4. During normal plant cooldown, the reactor coolant system (RCS) is depressurized through normal pressurizer spray. The driving force for this spray flow is derived from the reactor coolant pump head. Assuming loss of offsite power, reactor coolant pumps stop and are unavailable to provide normal pressurizer spray flow. Under these circumstances, RCS depressurization can be achieved through the operation of the high-pressure auxiliary pressurizer spray system. This system utilizes the discharge of the high-pressure injection (HPI)/makeup pumps to supply spray flow to the pressurizer. Two Class 1E, parallel, motor operated valves are provided that can be jogged by the operator to control the rate of depressurization. The design of this system incorporates a seismic Category I connection from the makeup pump discharge to the auxiliary pressurizer spray line. The system can perform its function assuming a single active failure. A detailed description of this system and its associated controls is presented in FSAR Subsection 9.3.4.2.3.9.

5. The chemical addition system provides the means to borate the RCS to the required shutdown levels during 30
normal plant cooldown. Using this method, boron is added to the RCS while simultaneously creating volume for this addition through primary letdown. Neither the chemical addition nor the letdown systems are qualified to operate after a design basis earthquake and therefore may not be available after this postulated event. Under these circumstances, coincident with a stuck rod, boration to the cold shutdown concentration can be achieved through use of the emergency boration system (EBS). This system stores 6 weight percent boric acid which can be injected into the RCS by the HPI/makeup pumps. If necessary, the operator can add the contents of this system through pump and valve manipulations from the control room after initial manual system alignment. The concentration and storage volume of the EBS, coupled with available excess volume in the pressurizer, ensures that the necessary boric acid required to maintain hot shutdown and achieve cold shutdown concentrations can be injected into the RCS without letdown.

   The EBS is a safety grade system capable of performing its design function assuming a single active failure. A detailed description of this system is provided in FSAR Subsection 9.3.10.

6. DHR pressure relief capacity is described in FSAR Subsection 5.4.7.1.1.3. The discharge fluid is directed 14
to the reactor building sump. A further description of

relief valve design is contained in the revised FSAR Table 5.4-10. 14

7. A natural circulation cooldown test will be referenced if it has been conducted on a plant similar to Midland. 18
If such a test is not available, a test will be conducted to verify that operation of the POAV valves 30
under natural circulation will satisfactorily remove heat required to cool down the plant. This test will demonstrate the ability to cool down approximately 50F 18
under natural circulation conditions and compare the temperature versus time plot developed with an analytical plot derived for the entire cooldown process. 30
The test will therefore be used to verify the analytical results.

8. Operating procedures for natural circulation cooldown will be written and made available to the operators before initial criticality. 18

9. As detailed in our response to Question 010.34 and 14
revised Subsection 10.4.9.2.3, an adequate seismic Category I feedwater source is available. 30