



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

FLORIDA POWER CORPORATION

CITY OF ALACHUA

CITY OF BUSHNELL

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CITY OF NEW SMYRNA BEACH AND UTILITIES COMMISSION, CITY OF NEW SMYRNA BEACH

CITY OF OCALA

ORLANDO UTILITIES COMMISSION AND CITY OF ORLANDO

SEBRING UTILITIES COMMISSION

SEMINOLE ELECTRIC COOPERATIVE, INC.

CITY OF TALLAHASSEE

DOCKET NO. 50-302

CRYSTAL RIVER UNIT 3 NUCLEAR GENERATING PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.32  
License No. DPR-72

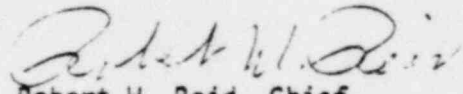
1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Florida Power Corporation, et al (the licensees) dated March 21, 1980, as revised and supplemented April 14 and 30, June 6 and 13, and July 22 and 31, 1980, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-72 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 32, are hereby incorporated in the license. Florida Power Corporation shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

  
Robert W. Reid, Chief  
Operating Reactors Branch #4  
Division of Licensing

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: August 1, 1980

ATTACHMENT TO LICENSE AMENDMENT NO. 32

FACILITY OPERATING LICENSE NO. DPR-72

DOCKET NO. 50-302

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain vertical lines indicating the area of change. The corresponding overleaf pages are also provided to maintain document completeness.

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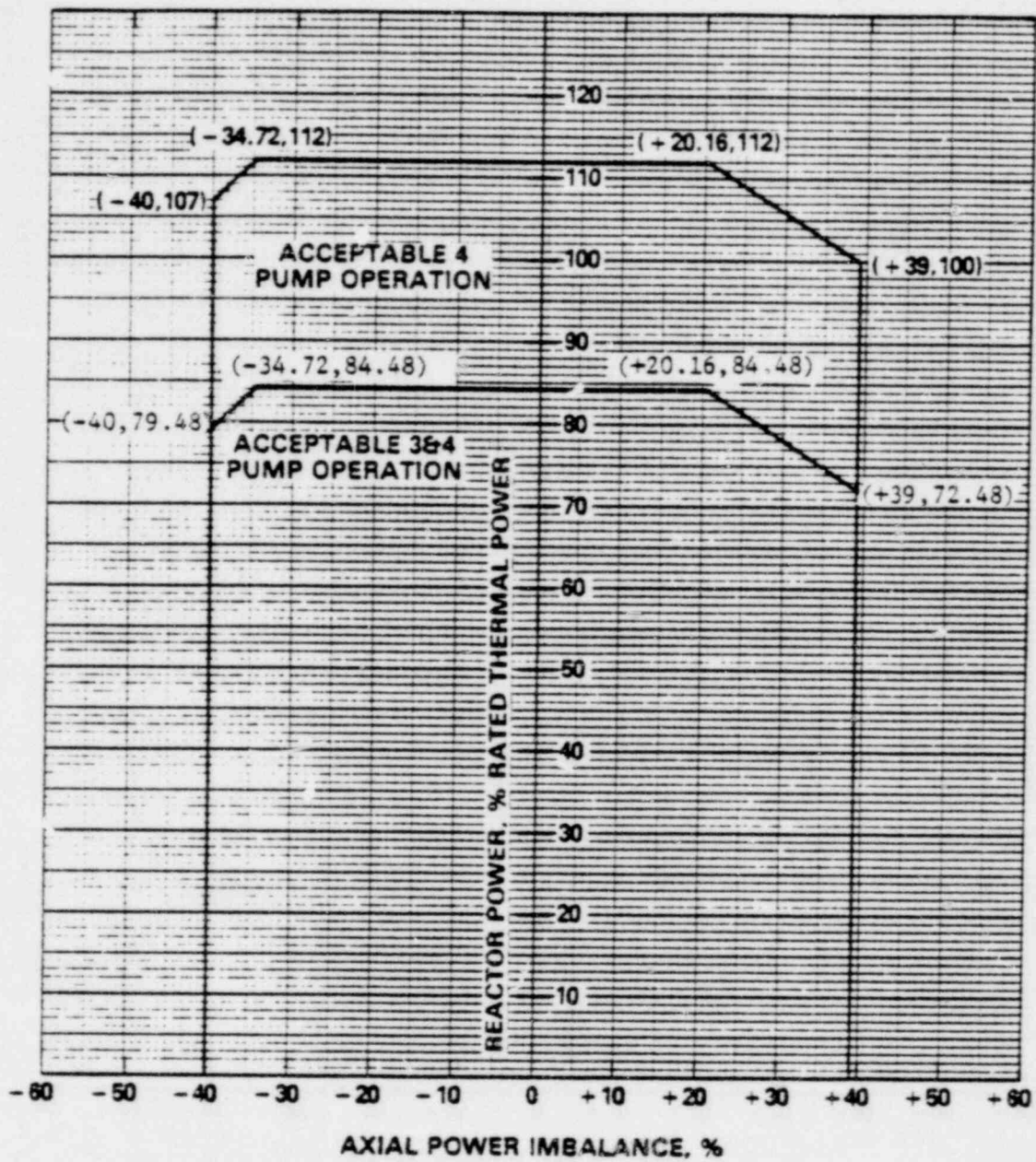


FIGURE 2.1-2  
REACTOR CORE SAFETY LIMIT

SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.2 LIMITING SAFETY SYSTEM SETTINGS

REACTOR PROTECTION SYSTEM SETPOINTS

2.2.1 The Reactor Protection System instrumentation setpoints shall be set consistent with the Trip Setpoint values shown in Table 2.2-1.

APPLICABILITY: As shown for each channel in Table 3.3-1.

ACTION:

With a Reactor Protection System instrumentation setpoint less conservative than the value shown in the Allowable Values column of Table 2.2-1, declare the channel inoperable and apply the applicable ACTION statement requirement of Specification 3.3.1.1 until the channel is restored to OPERABLE status with its trip setpoint adjusted consistent with the Trip Setpoint value.

TABLE 2.2-1

REACTOR PROTECTION SYSTEM INSTRUMENTATION TRIP SETPOINTS

<u>FUNCTIONAL UNIT</u>	<u>TRIP SETPOINT</u>	<u>ALLOWABLE VALUES</u>
1. Manual Reactor Trip	Not Applicable	Not Applicable
2. Nuclear Overpower	< 105.5% of RATED THERMAL POWER with four pumps operating	< 105.5% of RATED THERMAL POWER with four pumps operating
	< 77.98% of RATED THERMAL POWER with three pumps operating	< 77.98% of RATED THERMAL POWER with three pumps operating
3. RCS Outlet Temperature-High	≤ 619°F	≤ 619°F
4. Nuclear Overpower Based on RCS Flow and AXIAL POWER IMBALANCE (1)	Trip Setpoint not to exceed the limit line of Figure 2.2-1.	Allowable Values not to exceed the limit line of Figure 2.2-1.
5. RCS Pressure-Low <sup>(1)</sup>	≥ 1800 psig	≥ 1800 psig
6. RCS Pressure-High	≤ 2300 psig	≤ 2300 psig
7. RCS Pressure-Variable Low <sup>(1)</sup>	≥ (11.80 T <sub>out</sub> °F - 5209.2) psig	≥ (11.80 T <sub>out</sub> °F - 5209.2) psig



TABLE 2.2-1 (Continued)

REACTOR PROTECTION SYSTEM INSTRUMENTATION TRIP SETPOINTS

<u>FUNCTION UNIT</u>	<u>TRIP SETPOINT</u>	<u>ALLOWABLE VALUES</u>
B. Reactor Containment Vessel Pressure High	$\leq 4$ psig	$\leq 4$ psig

(1) Trip may be manually bypassed when RCS pressure  $\leq 1720$  psig by actuating Shutdown Bypass provided that:

- The Nuclear Overpower Trip Setpoint is  $< 5\%$  of RATED THERMAL POWER
- The Shutdown Bypass RCS Pressure - High Trip Setpoint of  $\leq 1720$  psig is imposed, and
- The Shutdown Bypass is removed when RCS Pressure  $> 1800$  psig.

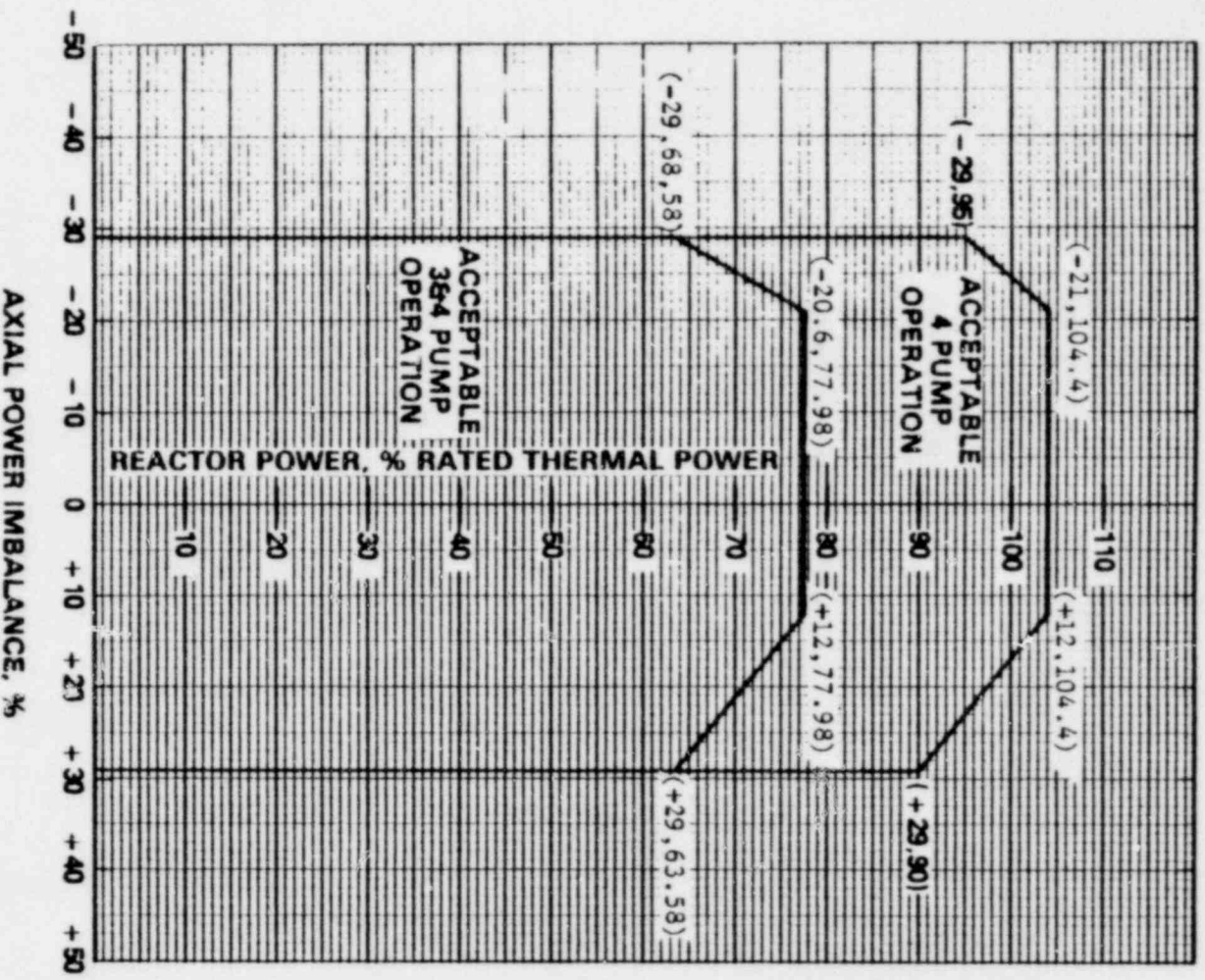


FIGURE 2.2-1  
TRIP SETPOINT FOR NUCLEAR OVERPOWER BASED ON  
RCS FLOW AND AXIAL POWER IMBALANCE

## 2.1 SAFETY LIMITS

### BASES

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#### 2.1.1 and 2.1.2 REACTOR CORE

The restrictions of this safety limit prevent overheating of the fuel cladding and possible cladding perforation which would result in the release of fission products to the reactor coolant. Overheating of the fuel cladding is prevented by restricting fuel operation to within the nucleate boiling regime where the heat transfer coefficient is large and the cladding surface temperature is slightly above the coolant saturation temperature.

Operation above the upper boundary of the nucleate boiling regime would result in excessive cladding temperatures because of the onset of departure from nucleate boiling (DNB) and the resultant sharp reduction in heat transfer coefficient. DNB is not a directly measurable parameter during operation and therefore THERMAL POWER and Reactor Coolant Temperature and Pressure have been related to DNB through the BAW-2 DNB correlation. The DNB correlation has been developed to predict the DNB flux and the location of DNB for axially uniform and non-uniform heat flux distributions. The local DNB heat flux ratio, DNBR, defined as the ratio of the heat flux that would cause DNB at a particular core location to the local heat flux, is indicative of the margin to DNB.

The minimum value of the DNBR during steady state operation, normal operational transients, and anticipated transients is limited to 1.30. This value corresponds to a 95 percent probability at a 95 percent confidence level that DNB will not occur and is chosen as an appropriate margin to DNB for all operating conditions.

The curve presented in Figure 2.1-1 represents the conditions at which a minimum DNBR of 1.30 is predicted for the maximum possible thermal power 112% when the reactor coolant flow is  $139.7 \times 10^6$  lbs/hr, which is 106.5% of the design flow rate for four operating reactor coolant pumps. This curve is based on the following nuclear power peaking factors with potential fuel densification effects:

$$F_Q^N = 2.57; \quad F_{\Delta H}^N = 1.71; \quad F_Z^N = 1.50$$

The design limit power peaking factors are the most restrictive calculated at full power for the range from all control rods fully withdrawn to minimum allowable control rod withdrawal, and form the core DNBR design basis.

## SAFETY LIMITS

### BASES.

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The reactor trip envelope appears to approach the safety limit more closely than it actually does because the reactor trip pressures are measured at a location where the indicated pressure is about 30 psi less than core outlet pressure, providing a more conservative margin to the safety limit.

The curves of Figure 2.1-2 are based on the more restrictive of two thermal limits and account for the effects of potential fuel densification and potential fuel rod bow:

1. The 1.30 DNBR limit produced by a nuclear power peaking factor of  $F_Q^N = 2.57$  or the combination of the radial peak, axial peak and position of the axial peak that yields no less than a 1.30 DNBR.
2. The combination of radial and axial peak that causes central fuel melting at the hot spot. The limit is 19.7 kw/ft.

Power peaking is not a directly observable quantity and therefore limits have been established on the basis of the reactor power imbalance produced by the power peaking.

The specified flow rates for curves 1 and 2 of Figure 2.1-2 correspond to the expected minimum flow rates with four pumps and three pumps respectively.

The curve of Figure 2.1-1 is the most restrictive of all possible reactor coolant pump-maximum thermal power combinations shown in BASES Figure 2.1. The curves of BASES Figure 2.1 represent the conditions at which a minimum DNBR of 1.30 is predicted at the maximum possible thermal power for the number of reactor coolant pumps in operation.

These curves include the potential effects of fuel rod bow and fuel densification.

The DNBR as calculated by the BAW-2 DNB correlation continually increases from point of minimum DNBR, so that the exit DNBR is always higher. Extrapolation of the correlation beyond its published quality range of 22% is justified on the basis of experimental data.

## LIMITING SAFETY SYSTEM SETTINGS

### BASES

#### RCS Outlet Temperature - High

The RCS Outlet Temperature High trip  $\leq 619^{\circ}\text{F}$  prevents the reactor outlet temperature from exceeding the design limits and acts as a backup trip for all power excursion transients.

#### Nuclear Overpower Based on RCS Flow and AXIAL POWER IMBALANCE

The power level trip setpoint produced by the reactor coolant system flow is based on a flux-to-flow ratio which has been established to accommodate flow decreasing transients from high power.

The power level trip setpoint produced by the power-to-flow ratio provides both high power level and low flow protection in the event the reactor power level increases or the reactor coolant flow rate decreases. The power level setpoint produced by the power-to-flow ratio provides overpower DNB protection for all modes of pump operation. For every flow rate there is a maximum permissible power level, and for every power level there is a minimum permissible low flow rate. Typical power level and low flow rate combinations for the pump situations of Table 2.2-1 are as follows:

1. Trip would occur when four reactor coolant pumps are operating if power is  $\geq 104.4\%$  and reactor flow rate is 100%, or flow rate is  $\leq 95.78\%$  and power level is 100%.
2. Trip would occur when three reactor coolant pumps are operating if power is  $\geq 77.98\%$  and reactor flow rate is 74.7%, or flow rate is  $\leq 71.84\%$  and power is 75%.

For safety calculations the maximum calibration and instrumentation errors for the power level were used.

## LIMITING SAFETY SYSTEM SETTINGS

### BASES

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The AXIAL POWER IMBALANCE boundaries are established in order to prevent reactor thermal limits from being exceeded. These thermal limits are either power peaking kw/ft limits or DNBR limits. The AXIAL POWER IMBALANCE reduces the power level trip produced by the flux-to-flow ratio such that the boundaries of Figure 2.2-1 are produced. The flux-to-flow ratio reduces the power level trip and associated reactor power-reactor power-imbalance boundaries by 1.044% for a 1% flow reduction.

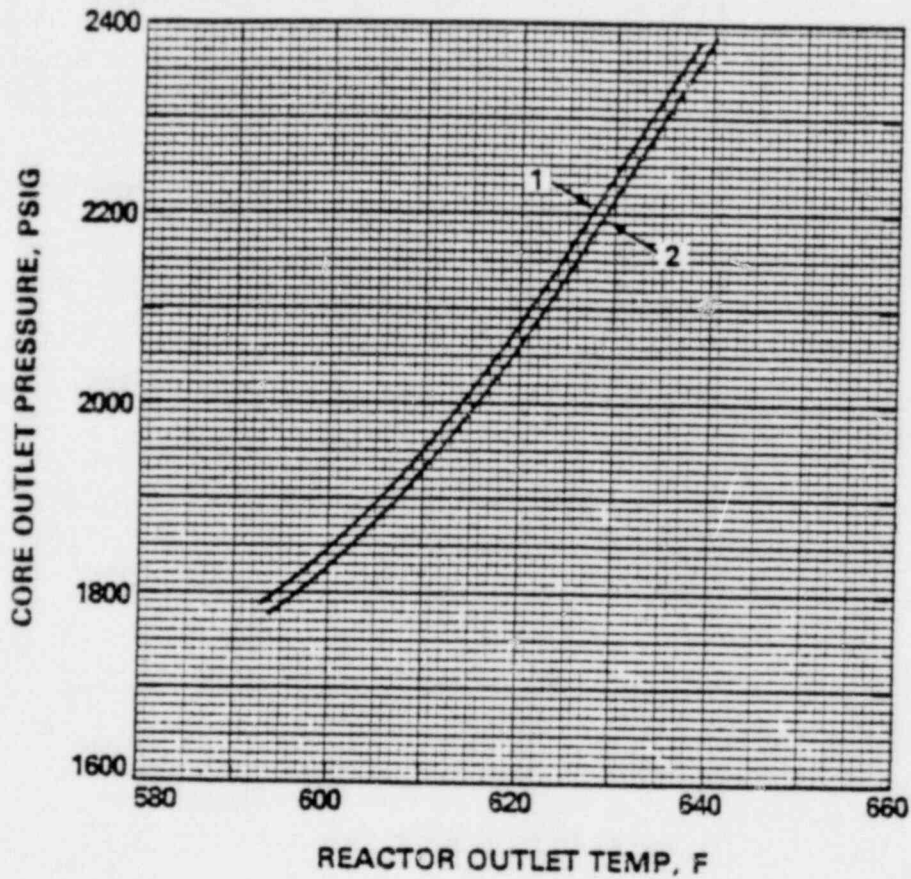
### RCS Pressure - Low, High and Variable Low

The High and Low trips are provided to limit the pressure range in which reactor operation is permitted.

During a slow reactivity insertion startup accident from low power or a slow reactivity insertion from high power, the RCS Pressure-High setpoint is reached before the Nuclear Overpower Trip Setpoint. The trip setpoint for RCS Pressure-High, 2300 psig, has been established to maintain the system pressure below the safety limit, 2750 psig, for any design transient. The RCS Pressure-High trip is backed up by the pressurizer code safety valves for RCS over pressure protection, and is therefore set lower than the set pressure for these valves, 2500 psig. The RCS Pressure-High trip also backs up the Nuclear Overpower trip.

The RCS Pressure-Low, 1800 psig, and RCS Pressure-Variable Low, (11.80 T<sub>out</sub> °F-5209.2) psig, Trip Setpoints have been established to maintain the DNB ratio greater than or equal to 1.30 for those design accidents that result in a pressure reduction. It also prevents reactor operation at pressures below the valid range of DNB correlation limits, protecting against DNB.

Due to the calibration and instrumentation errors, the safety analysis used a RCS Pressure-Variable Low Trip Setpoint of (11.80 T<sub>out</sub> °F-5249.2) psig.



REACTOR COOLANT FLOW

CURVE	FLOW (% DESIGN)	POWER (RTP)	PUMPS OPERATING (TYPE OF LIMIT)
1	$139.7 \times 10^6$ (106.5%)	117.3%	4 PUMPS (DNBR)
2	$104.4 \times 10^6$ (79.6%)	90.5%	3 PUMPS (DNBR)

PRESSURE/TEMPERATURE LIMITS AT MAXIMUM  
ALLOWABLE POWER FOR MINIMUM DNBR

BASES FIGURE 2.1

LIMITING SAFETY SYSTEM SETTINGS

BASES

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Reactor Containment Vessel Pressure - High

The Reactor Containment Vessel Pressure-High Trip Setpoint  $\leq 4$  psig, provides positive assurance that a reactor trip will occur in the unlikely event of a steam line failure in the containment vessel or a loss-of-coolant accident, even in the absence of a RCS Pressure - Low trip.



### 3/4.1 REACTIVITY CONTROL SYSTEMS

#### 3/4.1.1 BORATION CONTROL

##### SHUTDOWN MARGIN - OPERATING

##### LIMITING CONDITION FOR OPERATION

---

3.1.1.1.1 The SHUTDOWN MARGIN shall be  $\geq 1\% \Delta k/k$ .

APPLICABILITY: SS 1, 2\*, and 3.

ACTION:

With the SHUTDOWN MARGIN  $< 1\% \Delta k/k$ , immediately initiate and continue boration at  $\geq 10$  gpm of 11,600 ppm boric acid solution or its equivalent, until the required SHUTDOWN MARGIN is restored.

##### SURVEILLANCE REQUIREMENTS

---

4.1.1.1.1.1 The SHUTDOWN MARGIN shall be determined to be  $\geq 1\% \Delta k/k$ :

- a. Within one hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the above required SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable control rod(s).
- b. When in MODES 1 or 2<sup>#</sup>, at least once per 12 hours, by verifying that regulating rod groups withdrawal is within the limits of Specification 3.1.3.6.
- c. When in MODE 2<sup>##</sup> within 4 hours prior to achieving reactor criticality by verifying that the predicted critical control rod position is within the limits of Specification 3.1.3.6.
- d. Prior to initial operation above 5% RATED THERMAL POWER after each fuel loading by consideration of the factors of e. below, with the regulating rod groups at the maximum insertion limit of Specification 3.1.3.6.

<sup>#</sup>With  $K_{eff} \geq 1.0$ .

<sup>##</sup>With  $K_{eff} < 1.0$ .

\* See Special Test Exception 3.10.4.

REACTIVITY CONTROL SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

e. When in MODE 3, at least once per 24 hours by consideration of the following factors:

1. Reactor coolant system boron concentration,
2. Control rod position,
3. Reactor coolant system average temperature,
4. Fuel burnup based on gross thermal energy generation,
5. Xenon concentration, and
6. Samarium concentration.

4.1.1.1.1.2 The overall core reactivity balance shall be compared to predicted values to demonstrate agreement within  $\pm 1\% \Delta k/k$  at least once per 31 Effective Full Power Days (EFPD). This comparison shall consider at least those factors stated in Specification 4.1.1.1.1.e above. The predicted reactivity values shall be adjusted (normalized) to correspond to the actual core conditions prior to exceeding a fuel burnup of 60 Effective Full Power Days after each fuel loading.

CRYSTAL RIVER - UNIT 3

3/4 1-2

Amendment No. 20

JUL 3 1979

### 3/4.1 REACTIVITY CONTROL SYSTEM

#### 3/4.1.1 BORATION CONTROL

##### SHUTDOWN MARGIN - SHUTDOWN

##### LIMITING CONDITION FOR OPERATION

---

3.1.1.1.2 The SHUTDOWN MARGIN shall be  $\geq 3.0\%$   $\Delta k/k$ .

APPLICABILITY: MODES 4 and 5.

##### ACTION:

###### MODE 4

With the SHUTDOWN MARGIN  $< 3.0\%$   $\Delta k/k$ , immediately initiate and continue boration at  $\geq 10$  gpm of 11,600 ppm boric acid solution or its equivalent until the required SHUTDOWN MARGIN is restored.

###### MODE 5

With the SHUTDOWN MARGIN  $< 3.0\%$   $\Delta k/k$ , immediately initiate and continue boration at  $\geq 10$  gpm of 11,600 ppm boric acid solution or its equivalent until the required SHUTDOWN MARGIN is restored.

##### SURVEILLANCE REQUIREMENTS

---

4.1.1.1.2.1 The SHUTDOWN MARGIN shall be determined to be  $\geq 3.0\%$   $\Delta k/k$ :

- a. Within one hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the above required SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable control rod(s).
- b. At least once per 24 hours by consideration of the following factors:
  1. Reactor coolant system boron concentration,
  2. Control rod position,
  3. Reactor coolant system average temperature,
  4. Fuel burnup based on gross thermal energy generation,
  5. Xenon concentration, and
  6. Samarium concentration

REACTIVITY CONTROL SYSTEMS

FLOW PATHS - OPERATING

LIMITING CONDITION FOR OPERATION

---

3.1.2.2 Each of the following boron injection flow paths shall be OPERABLE:

- a. A flow path from the concentrated boric acid storage system via a boric acid pump and makeup or decay heat removal (DHR) pump to the Reactor Coolant System, and
- b. A flow path from the borated water storage tank via makeup or DHR pump to the Reactor Coolant System.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

MODES 1, 2 and 3

- a. With the flow path from the concentrated boric acid storage system inoperable, restore the inoperable flow path to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1%  $\Delta k/k$  at 200°F within the next 6 hours; restore the flow path to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
- b. With the flow path from the borated water storage tank inoperable, restore the flow path to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

MODE 4

- a. With the flow path from the concentrated boric acid storage system inoperable, restore the inoperable flow path to OPERABLE status within 72 hours or be borated to a SHUTDOWN MARGIN equivalent to 3.0%  $\Delta k/k$  at 200°F within the next 6 hours; restore the flow path to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

## REACTIVITY CONTROL SYSTEMS

ACTION: (Continued)

- b. With the flow path from the borated water storage tank inoperable, restore the flow path to OPERABLE status within one hour or be in COLD SHUTDOWN within the following 30 hours.

## SURVEILLANCE REQUIREMENTS

4.1.2.2 Each of the above required flow paths shall be demonstrated OPERABLE:

- a. At least once per 7 days by verifying that the pipe temperature of the heat traced portion of the flow path from the concentrated boric acid storage system is  $\geq 105^{\circ}\text{F}$ .
- b. At least once per 31 days by verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

REACTIVITY CONTROL SYSTEMS

MAKEUP PUMP - SHUTDOWN

LIMITING CONDITION FOR OPERATION

---

3.1.2.3 At least one makeup pump in the boron injection flow path required by Specification 3.1.2.1 shall be OPERABLE and capable of being powered from an OPERABLE emergency bus.

APPLICABILITY: MODE 5\*.

ACTION:

With no makeup pump OPERABLE, suspend all operations involving positive reactivity changes until at least one makeup pump is restored to OPERABLE status.

SURVEILLANCE REQUIREMENTS

---

4.1.2.3 No additional Surveillance Requirements other than those required by Specification 4.0.5.

\* RCS Pressure  $\geq$  150 psig.

## REACTIVITY CONTROL SYSTEMS

### MAKEUP PUMPS - OPERATING

#### LIMITING CONDITION FOR OPERATION

---

3.1.2.4.1 At least two makeup pumps shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3

ACTION:

With only one makeup pump OPERABLE, restore at least two makeup pumps to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1%  $\Delta k/k$  at 200°F within the next 6 hours; restore at least two makeup pumps to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

#### SURVEILLANCE REQUIREMENTS

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4.1.2.4.1 No additional Surveillance Requirements other than those required by Specification 4 J.5.

REACTIVITY CONTROL SYSTEMS

MAKEUP PUMPS - OPERATING

LIMITING CONDITION FOR OPERATION

---

3.1.2.4.2 At least one makeup pump shall be OPERABLE.

APPLICABILITY: MODE 4\*

ACTION:

With no makeup pump OPERABLE, restore at least one makeup pump to OPERABLE status within one hour or be borated to a SHUTDOWN MARGIN equivalent to 3.0%  $\Delta k/k$  at 200°F and be in COLD SHUTDOWN within the next 30 hours.

SURVEILLANCE REQUIREMENTS

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4.1.2.4.2 No additional Surveillance Requirements other than those required by Specification 4.0.5.

\*With RCS pressure  $\geq$  150 psig.



## REACTIVITY CONTROL SYSTEMS

### BORIC ACID PUMPS - OPERATING

#### LIMITING CONDITION FOR OPERATION

---

3.1.2.7 At least one boric acid pump in the boron injection flow path required by Specification 3.1.2.2a shall be OPERABLE and capable of being powered from an OPERABLE emergency bus if the flow path through the boric acid pump in Specification 3.1.2.2a is OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

#### ACTION:

MODES 1, 2 and 3

With no boric acid pump OPERABLE, restore at least one boric acid pump to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1%  $\Delta k/k$  at 200°F within the next 6 hours; restore at least one boric acid pump to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

MODE 4

With no boric acid pump OPERABLE, restore at least one boric acid pump to OPERABLE status within 72 hours or be borated to a SHUTDOWN MARGIN equivalent to 3.0%  $\Delta k/k$  at 200°F within the next 6 hours; restore at least one boric acid pump to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

#### SURVEILLANCE REQUIREMENTS

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4.1.2.7 No additional Surveillance Requirements other than those required by Specification 4.0.5.

REACTIVITY CONTROL SYSTEMS

BORATED WATER SOURCES - SHUTDOWN

LIMITING CONDITION FOR OPERATION

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3.1.2.8 As a minimum, one of the following borated water sources shall be OPERABLE:

- a. A concentrated boric acid storage system and associated heat tracing with:
  - 1. A minimum contained borated water volume of 6615 gallons,
  - 2. Between 11,600 and 14,000 ppm of boron, and
  - 3. A minimum solution temperature of 105°F.
- b. The borated water storage tank (BWST) with:
  - 1. A minimum contained borated water volume of 13,500 gallons,
  - 2. A minimum boron concentration of 2270 ppm, and
  - 3. A minimum solution temperature of 40°F.

APPLICABILITY: MODES 5 and 6.

ACTION:

With no borated water sources OPERABLE, suspend all operations involving CORE ALTERATION or positive reactivity changes until at least one borated water source is restored to OPERABLE status.

SURVEILLANCE REQUIREMENTS

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---

4.1.2.8 The above required borated water source shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  - 1. Verifying the boron concentration of the water,
  - 2. Verifying the contained borated water volume of the tank, and

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REACTIVITY CONTROL SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

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3. Verifying the concentrated boric acid storage system solution temperature when it is the source of borated water.
- b. At least once per 24 hours by verifying the BWST temperature when it is the source of borated water and the outside air temperature is  $< 40^{\circ}\text{F}$ .

REACTIVITY CONTROL SYSTEMS

BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

---

3.1.2.9 Each of the following borated water sources shall be OPERABLE:

- a. The concentrated boric acid storage system and associated heat tracing with:
  1. A minimum contained borated water volume of 6615 gallons,
  2. Between 11,600 and 14,000 ppm of boron, and
  3. A minimum solution temperature of 105°F.
- b. The borated water storage tank (BWSr) with:
  1. A contained borated water volume of between 415,200 and 449,000 gallons,
  2. Between 2270 and 2450 ppm of boron, and
  3. A minimum solution temperature of 40°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

MODES 1, 2, and 3:

- a. With the concentrated boric acid storage system inoperable, restore the storage system to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to 1%  $\Delta k/k$  at 200°F within the next 6 hours; restore the concentrated boric acid storage system to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.
- b. With the borated water storage tank inoperable, restore the tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

MODE 4:

- a. With the concentrated boric acid storage system inoperable, restore the storage system to OPERABLE status within 72 hours or be

## REACTIVITY CONTROL SYSTEMS

### ACTION: (Continued)

borated to a SHUTDOWN MARGIN equivalent to 3.0%  $\Delta k/k$  at 200°F within the next 6 hours; restore the concentrated boric acid storage system to OPERABLE status within the next 7 days or be in cold shutdown within the next 30 hours.

- b. With borated water storage tank inoperable, restore the tank to OPERABLE status within one hour or be in COLD SHUTDOWN within the next 30 hours.

## SURVEILLANCE REQUIREMENTS

4.1.2.9 Each borated water source shall be demonstrated OPERABLE:

- a. At least once per 7 days by:
  1. Verifying the boron concentration in each water source,
  2. Verifying the contained borated water volume of each water source, and
  3. Verifying the concentrated boric acid storage system solution temperature.
- b. At least once per 24 hours by verifying the BHST temperature when outside air temperature is < 40°F.

## REACTIVITY CONTROL SYSTEMS

### 3/4.1.3 MOVABLE CONTROL ASSEMBLIES

#### GROUP HEIGHT - SAFETY AND REGULATING ROD GROUPS

#### LIMITING CONDITION FOR OPERATIONS

---

3.1.3.1 All control (safety and regulating) rods shall be OPERABLE and positioned within  $\pm 6.5\%$  (indicated position) of their group average height.

APPLICABILITY: MODES 1\* and 2\*.

ACTION:

- a. With one or more control rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied within one hour and be in at least HOT STANDBY within 6 hours.
- b. With more than one control rod inoperable or misaligned from its group average height by more than  $\pm 6.5\%$  (indicated position), be in at least HOT STANDBY within 6 hours.
- c. With one control rod inoperable due to causes other than addressed in ACTION a, above, or misaligned from its group average height by more than  $\pm 6.5\%$  (indicated position), POWER OPERATION may continue provided that within one hour either:
  1. The control rod is restored to OPERABLE status within the above alignment requirements, or
  2. The control rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:
    - a) An analysis of the potential ejected rod worth is performed within 72 hours and the rod worth is determined to be  $< 1.0\% \Delta k$  at zero power and  $< 0.65\% \Delta k$  at RATED THERMAL POWER for the remainder of the fuel cycle, and
    - b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours, and

\*See Special Test Exceptions 3.10.1 and 3.10.2.

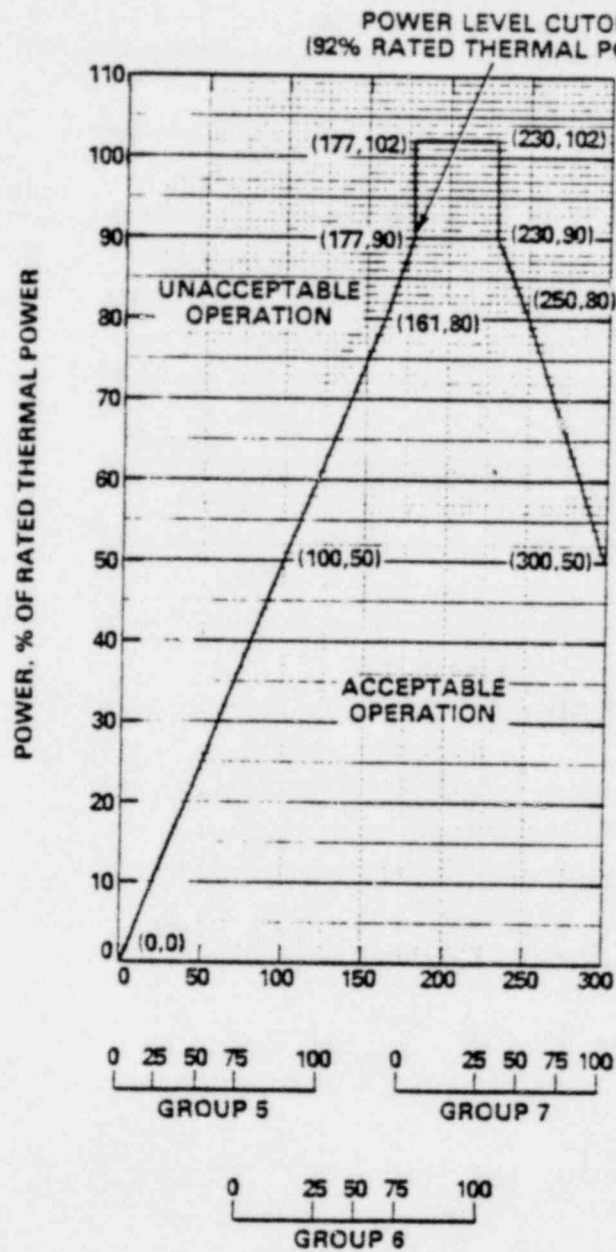


FIGURE 3.1-1  
REGULATING ROD GROUP INSERTION LIMITS FOR 4 PUMP  
OPERATION FROM 0 EFPD TO 250 ± 10 EFPD

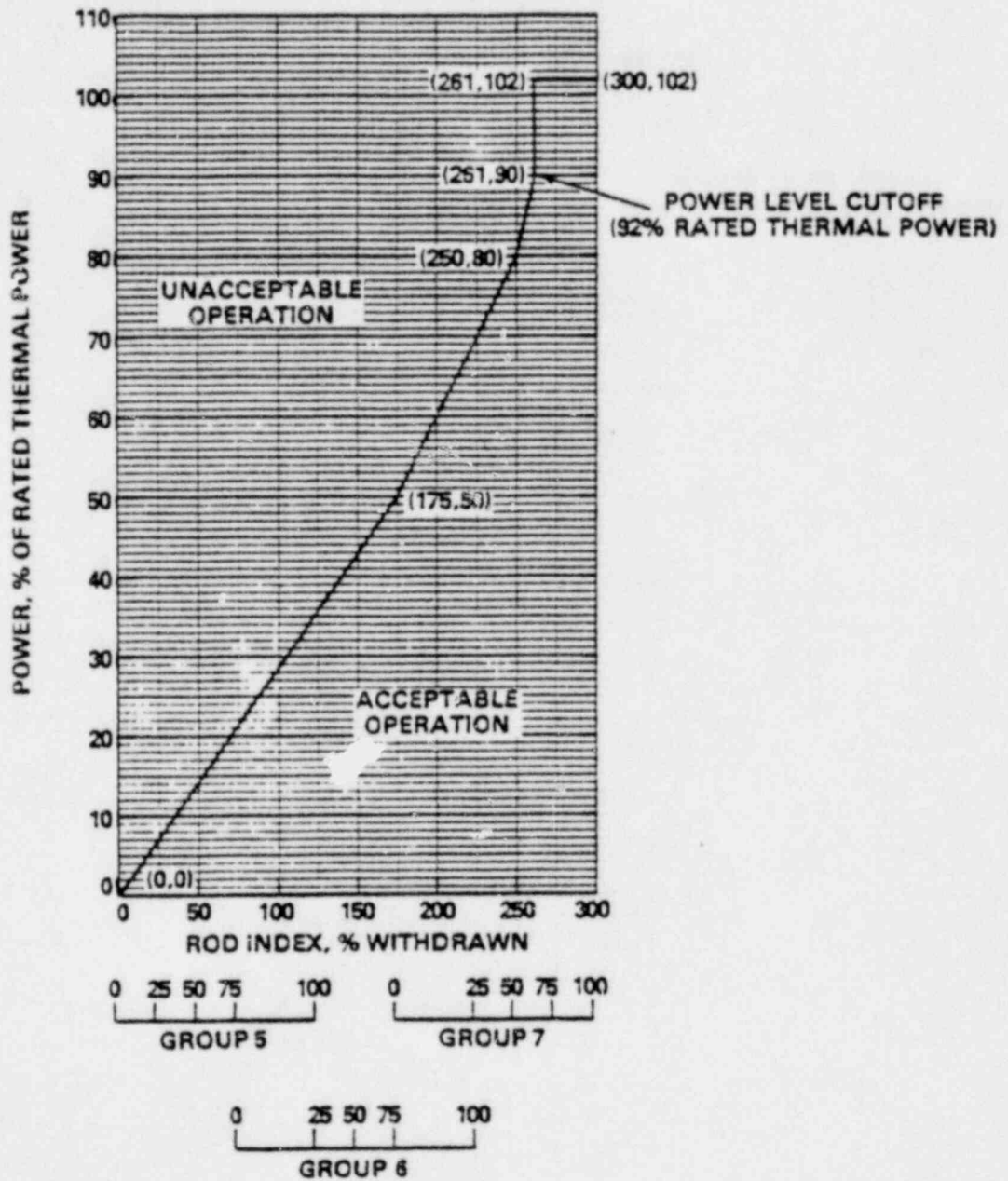


FIGURE 3.1-2

REGULATING ROD GROUP INSERTION LIMITS FOR  
4 PUMP OPERATION AFTER  $250 \pm 10$  EFPD



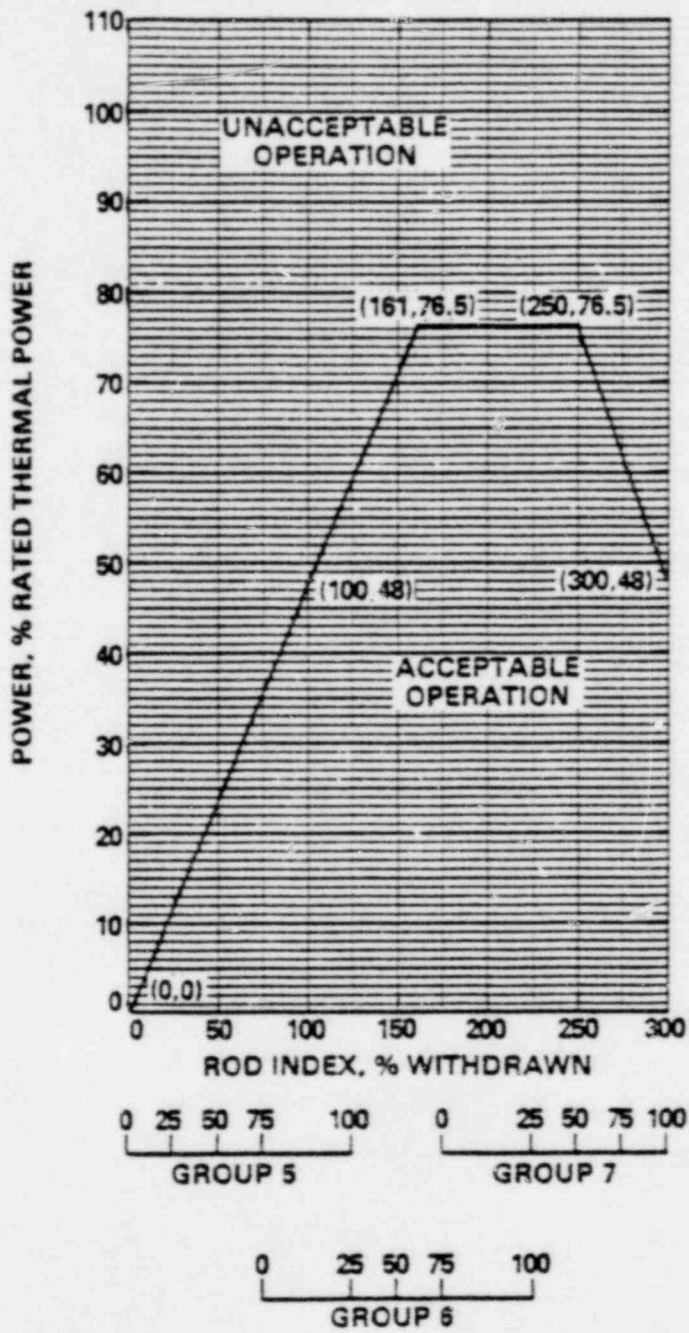


FIGURE 3.1-3

REGULATING ROD GROUP INSERTION LIMITS FOR 3 PUMP  
OPERATION FROM 0 EFPD TO 250 ± 10 EFPD

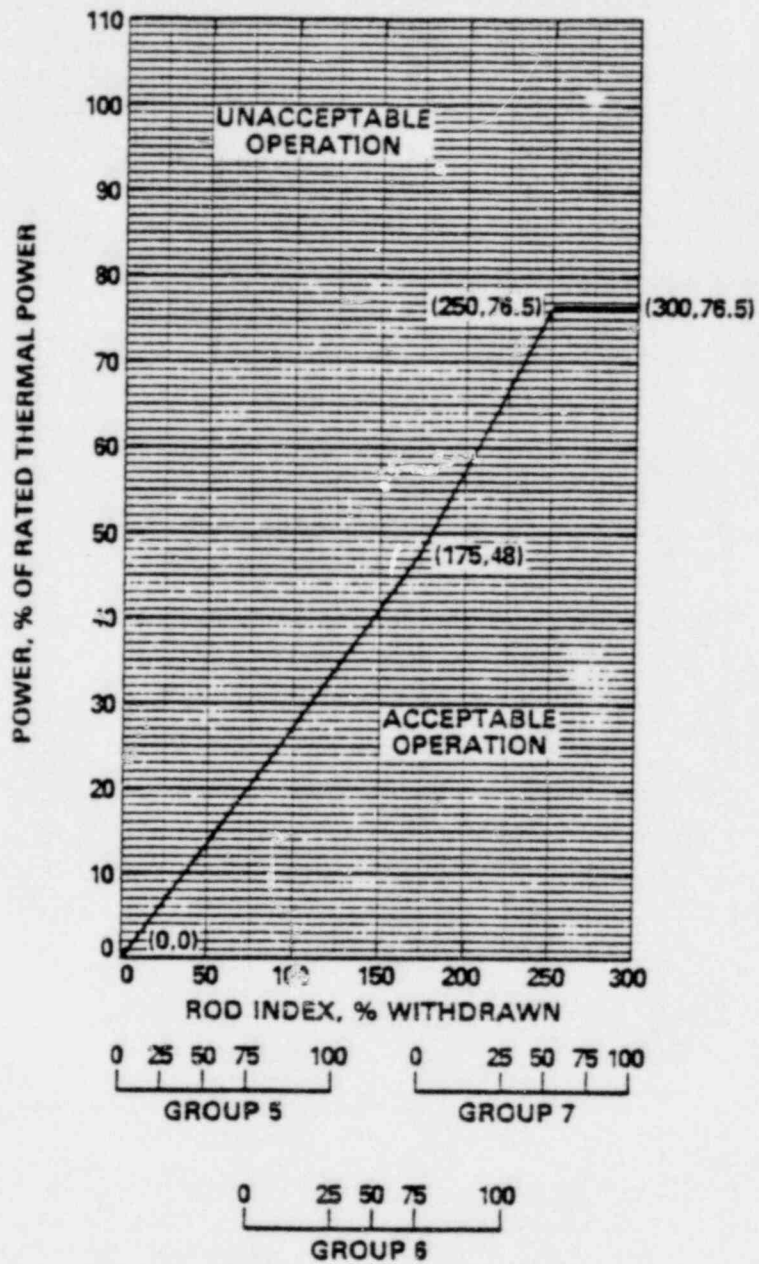


FIGURE 3.1-4

REGULATING ROD GROUP INSERTION LIMITS FOR  
3 PUMP OPERATION AFTER 250 ± 10 EFPD

REACTIVITY CONTROL SYSTEMS

AXIAL POWER SHAPING ROD INSERTION LIMITS

LIMITING CONDITION FOR OPERATION

3.1.3.9 The axial power shaping rod group shall be limited in physical insertion as shown on Figures 3.1-9 and 3.1-10.

APPLICABILITY: MODES 1 and 2\*.

ACTION:

With the axial power shaping rod group outside the above insertion limits, either:

- a. Restore the axial power shaping rod group to within the limits within 2 hours, or
- b. Reduce THERMAL POWER to less than or equal to that fraction of RATED THERMAL POWER which is allowed by the rod group position using the above figure within 2 hours, or
- c. Be in at least HOT STANDBY within 6 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.9 The position of the axial power shaping rod group shall be determined to be within the insertion limits at least once every 12 hours.

\*With  $k_{eff} \geq 1.0$ .

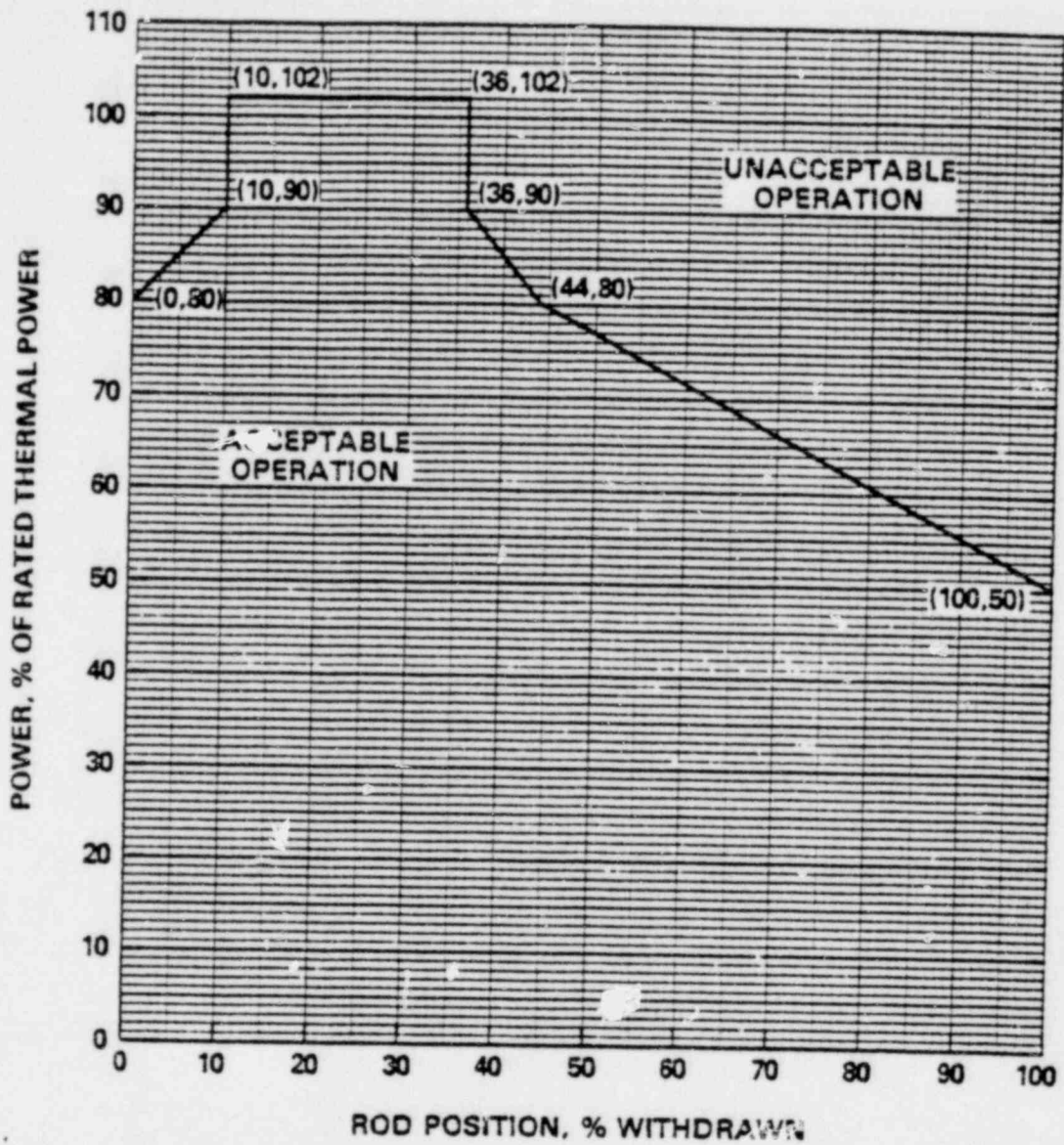


FIGURE 3.1-9

AXIAL POWER SHAPING ROD GROUP INSERTION LIMITS  
FROM 0 EFPD TO 250 ± 10 EFPD

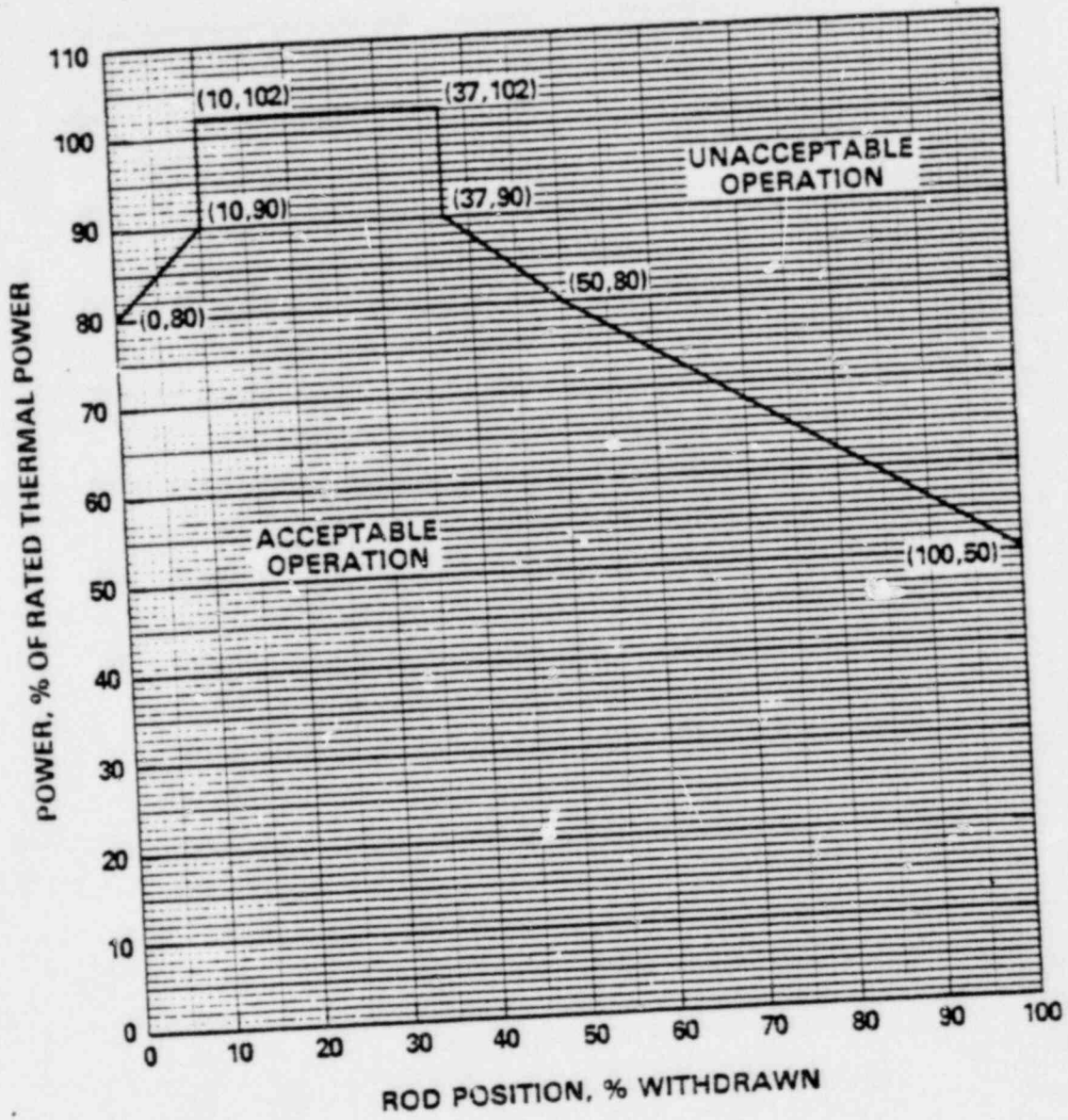


FIGURE 3.1-10  
 AXIAL POWER SHAPING ROD GROUP  
 INSERTION LIMITS AFTER  $250 \pm 10$  EFPD

### 3/4.2 POWER DISTRIBUTION LIMITS

#### AXIAL POWER IMBALANCE

#### LIMITING CONDITION FOR OPERATION

---

3.2.1 AXIAL POWER IMBALANCE shall be maintained within the limits shown on Figures 3.2-1 and 3.2-2.

APPLICABILITY: MODE 1 above 40% of RATED THERMAL POWER.\*

#### ACTION:

With AXIAL POWER IMBALANCE exceeding the limits specified above, either:

- a. Restore the AXIAL POWER IMBALANCE to within its limits within 15 minutes, or
- b. Be in at least HOT STANDBY within 2 hours.

#### SURVEILLANCE REQUIREMENTS

---

4.2.1 The AXIAL POWER IMBALANCE shall be determined to be within limits in each core quadrant at least once every 12 hours when above 40% of RATED THERMAL POWER except when an AXIAL POWER IMBALANCE monitor is inoperable, then calculate the AXIAL POWER IMBALANCE in each core quadrant with an inoperable monitor at least once per hour.

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\* See Special Test Exception 3.10.1.

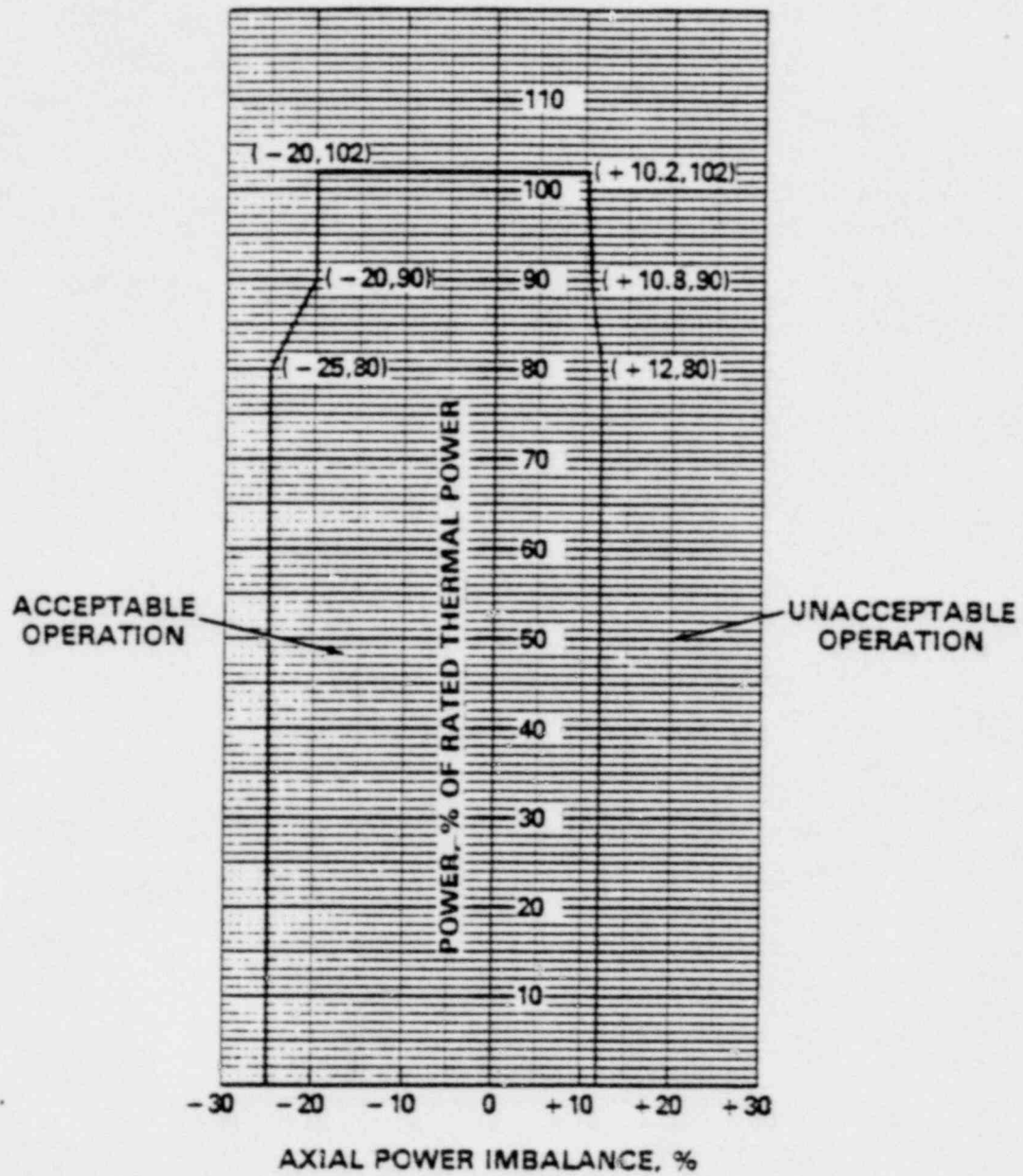


FIGURE 3.2-1

AXIAL POWER IMBALANCE ENVELOPE FOR  
OPERATION FROM 0 EFPD TO 250 ± 10 EFPD

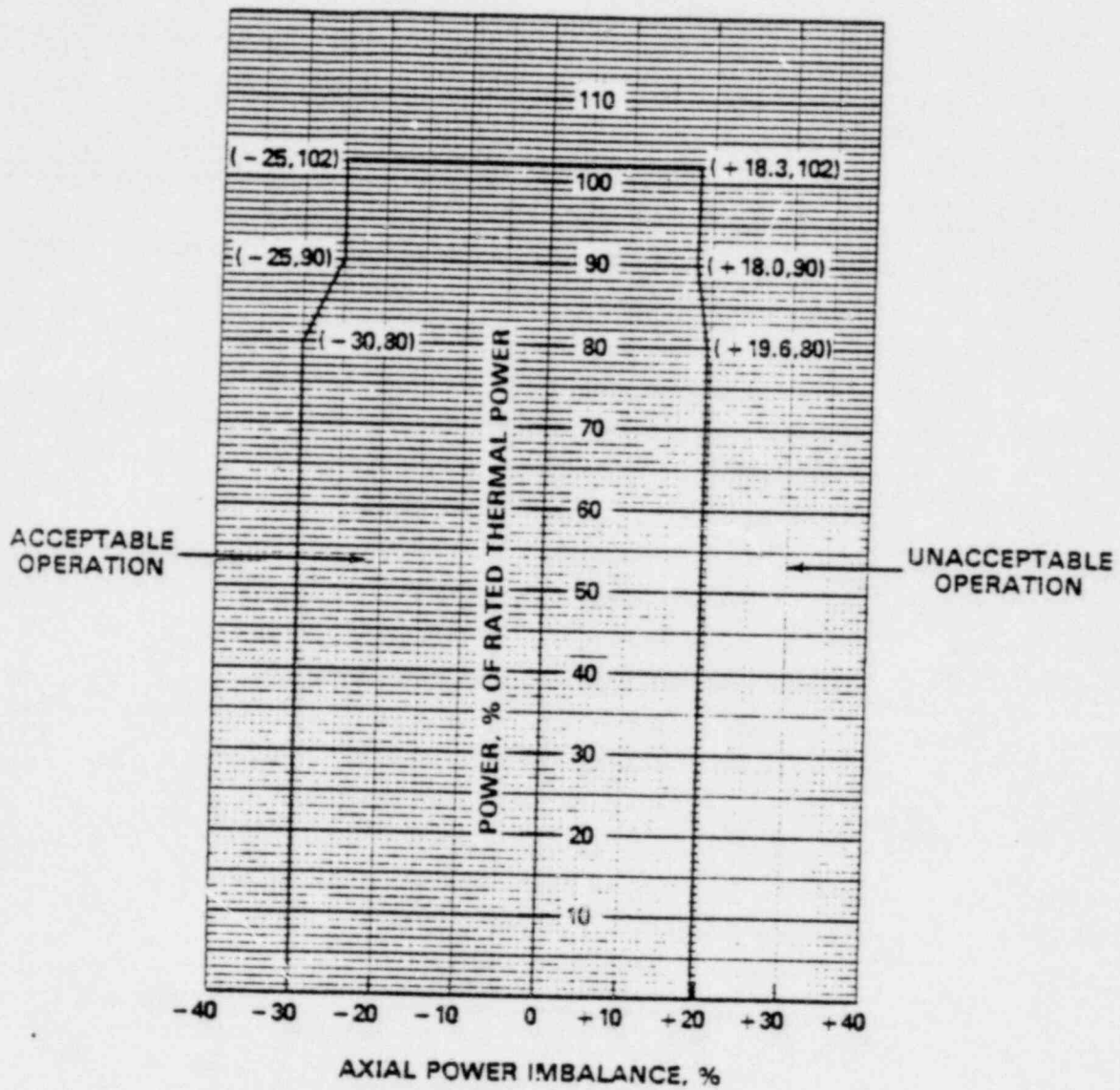


FIGURE 3.2-2  
 AXIAL POWER IMBALANCE ENVELOPE FOR  
 OPERATION AFTER 250 ± 10 EFPO



POWER DISTRIBUTION LIMITS

NUCLEAR HEAT FLUX HOT CHANNEL FACTOR -  $F_Q$

LIMITING CONDITION FOR OPERATION

3.2.2  $F_Q$  shall be limited by the following relationships:

$$F_Q \leq \frac{3.08}{P}$$

where  $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$  and  $P \leq 1.0$ .

APPLICABILITY: MODE 1.

ACTION:

With  $F_Q$  exceeding its limit:

- a. Reduce THERMAL POWER at least 1% for each 1%  $F_Q$  exceeds the limit within 15 minutes and similarly reduce the Nuclear Overpower Trip Setpoint and Nuclear Overpower based on RCS Flow and AXIAL POWER IMBALANCE Trip Setpoint within 4 hours.
- b. Demonstrate through in-core mapping that  $F_Q$  is within its limit within 24 hours after exceeding the limit or reduce THERMAL POWER to less than 5% of RATED THERMAL POWER within the next 2 hours.
- c. Identify and correct the cause of the out of limit condition prior to increasing THERMAL POWER above the reduced limit required by a or b, above; subsequent POWER OPERATION may proceed provided that  $F_Q$  is demonstrated through in-core mapping to be within its limit at a nominal 50% of RATED THERMAL POWER prior to exceeding this THERMAL POWER, at a nominal 75% of RATED THERMAL POWER prior to exceeding this THERMAL POWER and within 24 hours after attaining 95% or greater RATED THERMAL POWER.

SURVEILLANCE REQUIREMENTS

4.2.2.1  $F_Q$  shall be determined to be within its limit by using the incore detectors to obtain a power distribution map:

TABLE 3.2-2

QUADRANT POWER TILT LIMITS

	<u>STEADY STATE LIMIT</u>	<u>TRANSIENT LIMIT</u>	<u>MAXIMUM LIMIT</u>
QUADRANT POWER TILT as Measured by:			
Symmetrical Incore Detector System	3.31	8.81	20.0
Power Range Channels	1.96	6.96	20.0
Minimum Incore Detector System	1.90	4.40	20.0

POWER DISTRIBUTION LIMITS

DNB PARAMETERS

LIMITING CONDITION FOR OPERATION

---

3.2.5 The following DNB related parameters shall be maintained within the limits shown on Table 3.2-1:

- a. Reactor Coolant Hot Leg Temperature
- b. Reactor Coolant Pressure
- c. Reactor Coolant Flow Rate

APPLICABILITY: MODE 1.

ACTION:

With any of the above parameters exceeding its limit, restore the parameter to within its limit within 2 hours or reduce THERMAL POWER to less than 5% of RATED THERMAL POWER within the next 4 hours.

SURVEILLANCE REQUIREMENTS

---

4.2.5.1 Each of the parameters of Table 3.2-1 shall be verified to be within their limits at least once per 12 hours.

4.2.5.2 The Reactor Coolant System total flow rate shall be determined to be within its limit by measurement at least once per 18 months.

TABLE 3.2-1

DNB MARGIN

Parameter	<u>LIMITS</u>	
	Four Reactor Coolant Pumps Operating	Three Reactor Coolant Pumps Operating
Reactor Coolant Hot Leg Temperature, $T_H$ °F	$\leq 604.6$	$\leq 604.6^{(1)}$
Reactor Coolant Pressure, psig <sup>(2)</sup>	$\geq 2061.6$	$\geq 2057.2^{(1)}$
Reactor Coolant Flow Rate, lb/hr	$\geq 139.7 \times 10^6$	$\geq 104.4 \times 10^6$

(1) Applicable to the loop with 2 Reactor Coolant Pumps Operating.

(2) Limit not applicable during either a THERMAL POWER ramp increase in excess of 5% of RATED THERMAL POWER per minute or a THERMAL POWER step increase of greater than 10% of RATED THERMAL POWER.

### 3/4.4 REACTOR COOLANT SYSTEM

#### REACTOR COOLANT LOOPS

#### LIMITING CONDITION FOR OPERATION

---

3.4.1 Both reactor coolant loops and both reactor coolant pumps in each loop shall be in operation.

APPLICABILITY: As noted below, but excluding MODE 6.\*

#### ACTION:

MODES 1 and 2:

- a. With one reactor coolant pump not in operation, STARTUP and POWER OPERATION may be initiated and may proceed provided THERMAL POWER is restricted to less than 77.98% of RATED THERMAL POWER and within 4 hours the setpoints for the following trips have been reduced to the values specified in Specification 2.2.1 for operation with three reactor coolant pumps operating:

1. Nuclear Overpower

MODES 3, 4 and 5:

- a. Operation may proceed provided at least one reactor coolant loop is in operation with an associated reactor coolant pump or decay heat removal pump.
- b. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

#### SURVEILLANCE REQUIREMENTS

---

4.4.1 The Reactor Protective Instrumentation channels specified in the applicable ACTION statement above shall be verified to have had their trip setpoints changed to the values specified in Specification 2.2.1 for the applicable number of reactor coolant pumps operating either:

- a. Within 4 hours after switching to a different pump combination if the switch is made while operating, or
- b. Prior to reactor criticality if the switch is made while shutdown.

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\* See Special Test Exception 3.10.3.

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SPECIAL TEST EXCEPTION

NO FLOW TEST

LIMITING CONDITION FOR OPERATION

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3.10.3 The limitations of Specification 3.4.1 may be suspended during the performance of startup and PHYSICS TESTS provided:

- a. The THERMAL POWER does not exceed 5% of RATED THERMAL POWER, and
- b. The reactor trip setpoints on the OPERABLE Nuclear Overpower channels are set  $\leq$  25% of RATED THERMAL POWER.

APPLICABILITY: During startup and PHYSICS TESTS.

ACTION:

With the THERMAL POWER greater than 5% of RATED THERMAL POWER, immediately open the control rod drive trip breakers.

SURVEILLANCE REQUIREMENTS

---

4.10.3.1 The THERMAL POWER shall be determined to be  $\leq$  5% of RATED THERMAL POWER at least once per hour during startup and PHYSICS TESTS.

4.10.3.2 Each Nuclear Overpower Channel shall be subjected to a CHANNEL FUNCTIONAL TEST within 12 hours prior to initiating startup or PHYSICS TESTS.

SPECIAL TEST EXCEPTION

SHUTDOWN MARGIN

LIMITING CONDITION FOR OPERATION

3.10.4 The SHUTDOWN MARGIN requirement of Specification 3.1.1.1.1 may be suspended for measurement of control rod worth and shutdown margin provided:

- a. Reactivity equivalent to at least the highest estimated control rod worth is available for trip insertion from OPERABLE control rod(s), and
- b. All axial power shaping rods are withdrawn to at least 35% (indicated position) and OPERABLE.

APPLICABILITY: MODE 2.

ACTION:

- a. With any safety or regulating control rod not fully inserted and with less than the above reactivity equivalent available for trip insertion or the axial power shaping rods not within their withdrawal limits, immediately initiate and continue boration at  $\geq 10$  gpm of 11,600 ppm boric acid solution or its equivalent, until the SHUTDOWN MARGIN required by Specification 3.1.1.1.1 is restored.
- b. With all safety or regulating control rods fully inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at  $\geq 10$  gpm of 11,600 ppm boric acid solution or its equivalent, until the SHUTDOWN MARGIN required by Specification 3.1.1.1.1 is restored.

SURVEILLANCE REQUIREMENTS

4.10.4.1 The position of each safety, regulating, and axial power shaping rod either partially or fully withdrawn shall be determined at least once per 2 hours.

4.10.4.2 Each safety or regulating control rod not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 24 hours prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.1.

4.10.4.3 The axial power shaping rods shall be demonstrated OPERABLE by moving each axial power shaping rod  $\geq 6.5\%$  (indicated position) within 4 hours prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.1.



## 3/4.1 REACTIVITY CONTROL SYSTEMS

### BASES

#### 3/4.1.1 BORATION CONTROL

##### 3/4.1.1.1 SHUTDOWN MARGIN

A sufficient SHUTDOWN MARGIN ensures that 1) the reactor can be made subcritical from all operating conditions, 2) the reactivity transients associated with postulated accident conditions are controllable within acceptable limits, and 3) the reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition. During Modes 1 and 2 the SHUTDOWN MARGIN is known to be within limits if all control rods are OPERABLE and withdrawn to or beyond the insertion limits.

SHUTDOWN MARGIN requirements vary throughout core life as a function of fuel depletion, RCS boron concentration and RCS  $T_{avg}$ . The most restrictive condition for Modes 1, 2, and 3 occurs at EOL, with  $T_{avg}$  at no load operating temperature, and is associated with a postulated steam line break accident and resulting uncontrolled RCS cooldown. In the analysis of this accident a minimum SHUTDOWN MARGIN of 0.60%  $\Delta k/k$  is initially required to control the reactivity transient. Accordingly, the SHUTDOWN MARGIN required is based upon this limiting condition and is consistent with FSAR safety analysis assumptions.

The most restrictive condition for MODES 4 and 5 occurs at BOL, and is associated with deboration due to inadvertent injection of sodium hydroxide. The higher requirement for these modes insures the accident will not result in criticality.

##### 3/4.1.1.2 BORON DILUTION

A minimum flow rate of at least 2700 GPM provides adequate mixing, prevents stratification and ensures that reactivity changes will be gradual through the Reactor Coolant System in the core during boron concentration reductions in the Reactor Coolant System. A flow rate of at least 2700 GPM will circulate an equivalent Reactor Coolant System volume of 12,000 cubic feet in approximately 30 minutes. The reactivity change rate associated with boron concentration reduction will be within the capability for operator recognition and control.

##### 3/4.1.1.3 MODERATOR TEMPERATURE COEFFICIENT

The limitations on moderator temperature coefficient (MTC) are provided to ensure that the assumptions used in the accident and transient analyses remain valid through each fuel cycle. The surveillance requirement for measurement of the MTC each fuel cycle are adequate to confirm the MTC value since this coefficient changes slowly due principally to the reduction in RCS boron concentration associated with fuel burnup. The confirmation that the measured MTC value is within its limit provides assurance that the coefficient will be maintained within acceptable values throughout each fuel cycle.

## REACTIVITY CONTROL SYSTEMS

### BASES

#### 3/4.1.1.4 MINIMUM TEMPERATURE FOR CRITICALITY

This specification ensures that the reactor will not be made critical with the Reactor Coolant System average temperature less than 525°F. This limitation is required to ensure 1) the moderator temperature coefficient is within its analyzed temperature range, 2) the protective instrumentation is within its normal operating range, 3) the pressurizer is capable of being in an OPERABLE status with a steam bubble, and 4) the reactor pressure vessel is above its minimum RT<sub>NDT</sub> temperature.

#### 3/4.1.2 BORATION SYSTEMS

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include 1) borated water sources, 2) makeup or DHR pumps, 3) separate flow paths, 4) boric acid pumps, 5) associated heat tracing systems, and 6) an emergency power supply from OPERABLE emergency busses.

With the RCS average temperature above 200°F, a minimum of two separate and redundant boron injection systems are provided to ensure single functional capability in the event an assumed failure renders one of the systems inoperable. Allowable out-of-service periods ensure that minor component repair or corrective action may be completed without undue risk to overall facility safety from injection system failures during the repair period.

The boration capability of either system is sufficient to provide a SHUTDOWN MARGIN from all operating conditions of 3.0%  $\Delta k/k$  after xenon decay and cooldown to 200°F. The maximum boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires either 6615 gallons of 11,600 ppm boric acid solution from the boric acid storage tanks or 45,421 gallons of 2270 ppm borated water from the borated water storage tank.

The requirements for a minimum contained volume of 415,200 gallons of borated water in the borated water storage tank ensures the capability for borating the RCS to the desired level. The specified quantity of borated water is consistent with the ECCS requirements of Specification 3.5.4. Therefore, the larger volume of borated water is specified.

With the RCS temperature below 200°F, one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE ALTERATIONS and positive reactivity change in the event the single injection system becomes inoperable.

## REACTIVITY CONTROL SYSTEMS

### BASES

#### 3/4.1.2 BORATION SYSTEMS (Continued)

The boron capability in Modes 4 and 5 is based on a potential moderator dilution accident and is sufficient to provide a SHUTDOWN MARGIN of 3.0%  $\Delta k/k$  after xenon decay and a cooldown from 200°F to 140°F. This condition requires either 300 gallons of 11,600 ppm boron from the boric acid storage system or 1608 gallons of 2270 ppm boron from the borated water storage tank. To envelop future cycle BWST contained borated water volume requirements, a minimum volume of 13,500 gallons is specified.

The contained water volume limits include allowance for water not available because of discharge line location and other physical characteristics. The limits on contained water volume, and boron concentration ensure a pH value of between 7.2 and 11.0 of the solution sprayed within containment after a design basis accident. The pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion cracking on mechanical systems and components.

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

#### 3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section (1) ensure that acceptable power distribution limits are maintained, (2) ensure that the minimum SHUTDOWN MARGIN is maintained, and (3) limit the potential effects of a rod ejection accident. OPERABILITY of the control rod position indicators is required to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits.

The ACTION statements which permit limited variations from the basic requirements are accompanied by additional restrictions which ensure that the original criteria are met. For example, misalignment of a safety or regulating rod requires a restriction in THERMAL POWER. The reactivity worth of a misaligned rod is limited for the remainder of the fuel cycle to prevent exceeding the assumptions used in the safety analysis.

The position of a rod declared inoperable due to misalignment should not be included in computing the average group position for determining the OPERABILITY of rods with lesser misalignments.

## REACTIVITY CONTROL SYSTEMS

### BASES

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#### 3/4.1.3 MOVABLE CONTROL ASSEMBLIES (Continued)

The maximum rod drop time permitted is consistent with the assumed rod drop time used in the safety analyses. Measurement with  $T_{avg} \geq 525^{\circ}\text{F}$  and with reactor coolant pumps operating ensures that the measured drop times will be representative of insertion times experienced during a reactor trip at operating conditions.

Control rod positions and OPERABILITY of the rod position indicators are required to be verified on a nominal basis of once per 12 hours with frequent verifications required if an automatic monitoring channel is inoperable. These verification frequencies are adequate for assuring that the applicable LCO's are satisfied.

The limitation on THERMAL POWER based on xenon reactivity is necessary to ensure that power peaking limits are not exceeded even with specified rod insertion limits satisfied.

The limitation on Axial Power Shaping Rod insertion is necessary to ensure that power peaking limits are not exceeded.