

3.10 CONTROL ROD AND POWER DISTRIBUTION LIMITS

Applicability:

Applies to the operation of the control rods and power distribution limits.

Objective:

To ensure (1) core subcriticality after a reactor trip, (2) limited potential reactivity insertions from a hypothetical control rod ejection, and (3) an acceptable core power distribution during power operation.

Specification:

3.10.1 Control Rod Insertion Limits

- 3.10.1.1 When the reactor is subcritical prior to startup, the hot shutdown margin shall be at least that shown in Figure 3.10-3. The shutdown margin as used here is defined as the amount by which the reactor core would be subcritical at hot shutdown conditions if all control rods were tripped, assuming that the highest worth control rod remained fully withdrawn, and assuming no changes in xenon, boron, or part-length rod position.
- 3.10.1.2 When the reactor is critical, except for physics tests and control rod exercises indicated in Table 4.1-3, the shutdown control rods shall be fully withdrawn.
- 3.10.1.3 When the reactor is critical, except for physics tests and control rod exercises, the control group rods shall be no further inserted than the limits shown by the lines on Figure 3.10-1 for 4 loop operation, on Figure 3.10-2 for 3 loop operation.
- 3.10.1.4 During physics tests and control rod exercises indicated in Table 4.1-3, the insertion limits need not be observed, but the Figure 3.10-3 must be observed except for rod worth measurements.
- 3.10.1.5 When the reactor is critical, except for physics tests and control rod exercises, the part-length rods shall not be more than 70% inserted.

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3.10.2 Power-Distribution Limits and Misaligned Control Rod

3.10.2.1 The moveable detector system shall be used to confirm power distribution, such that design limits are not exceeded, after initial fuel loading and after each fuel reloading, prior to operation of the plant above 75% of rated power.

If the core is operating above 75% power with one excore nuclear channel out of service, then the core quadrant power balance shall be determined once a day by at least one of the following means:

- a. Moveable detectors (at least 2 thimbles per quadrant)
- b. Core-exit thermocouples (at least 4 thermocouples per quadrant)

In addition, when operating above 50% power, the moveable detector system shall be used to confirm power distribution monthly.

3.10.2.2 At all times, except for physics tests at 90% of rated power or less, the hot channel factors must meet the following limits:

$F_Q^N \leq 2.62 [1 + 0.2 (1-P)]$ in the indicated flux difference range of +7 to -12 percent.

$$F_{\Delta H}^N \leq 1.65 [1 + 0.2 (1-P)]$$

where P is the fraction of full power at which the core is operating.

The measured values, with due allowance for measurement error must be corrected by including a penalty as shown on Figure 3.10-4 (at the approximate core location) to account for fuel densification effects before comparison with the limiting values above.

If the hot channel factors exceed these limits, the reactor power and high neutron flux trip setpoints shall be reduced by 1 percent for every percent excess over F_Q^N or $F_{\Delta H}^N$, whichever is limiting. If the hot channel factors cannot be corrected within one day, the