

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters-Operating

LCO 3.8.7 One inverter in each of four channels shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

| CONDITION   | REQUIRED ACTION   | COMPLETION TIME                  |
|---|---|----------------------------------|
| <p>A. One inverter in one channel inoperable.</p>                 | <p>A.1 -----NOTE-----<br/>Enter applicable Conditions and Required Actions of LCO 3.8.9, "Distribution Systems-Operating", with any AC Vital Bus deenergized.<br/><br/>-----<br/>Restore inverter to OPERABLE status.</p> | <p>24 hours</p>                  |
| <p>B. Required Action and associated Completion Time not met.</p> | <p>B.1 Be in MODE 3.<br/><u>AND</u><br/>B.2 Be in MODE 5.</p>   | <p>6 hours<br/><br/>36 hours</p> |

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters - Operating

BASES

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BACKGROUND

The inverters are the preferred source of power for the AC vital buses because of the stability and reliability they achieve. There is one inverter per channel supplying two AC vital buses (Unit 1 and Unit 2) making a total of four inverters. The function of the inverter is to provide AC electrical power to the AC vital buses. The inverters can be powered from an internal AC source/rectifier or from the vital battery. The vital battery provides an uninterruptible power source for the instrumentation and controls for the Reactor Protective System (RPS) and the Engineered Safety Feature Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in the Watts Bar FSAR, Section 8 (Ref. 1).

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APPLICABLE  
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Section 6 (Ref. 2) and Section 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the RPS and ESFAS instrumentation and controls so that the fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Section 3.2, Power Distribution Limits; Section 3.4, Reactor Coolant System (RCS); and Section 3.6, Containment Systems.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the plant. This includes maintaining required AC vital buses OPERABLE during accident conditions in the event of:

- a. An assumed loss of all offsite AC electrical power or all onsite AC electrical power; and
- b. A worst case single failure.

(continued)

BASES

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APPLICABLE  
SAFETY ANALYSIS  
(continued)

Inverters are a part of the distribution systems and, as such, satisfy Criterion 3 of the NRC Policy Statement.

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LCO

The inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Maintaining the required inverters OPERABLE ensures that the redundancy incorporated into the design of the RPS and ESFAS instrumentation and controls is maintained. The four inverters (one per channel) ensure an uninterruptible supply of AC electrical power to the AC vital buses even if the 6.9 kV shutdown boards are de-energized.

OPERABLE inverters require the associated AC vital bus to be powered by the inverter with output voltage and frequency within tolerances and power input to the inverter from a 125 VDC vital battery. Alternatively, power supply may be from an internal AC source via rectifier as long as the vital battery is available as the uninterruptible power supply. Additionally, the inverter channel must not be connected to the cross train 480 V power supply.

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APPLICABILITY

The inverters are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

- a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and
- b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Inverter requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.8, "Inverters - Shutdown."

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BASES (continued)

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ACTIONS

A.1

With one inverter in a channel inoperable, its associated AC vital buses become inoperable until they are manually re-energized from their associated 120 V AC instrument power distribution panel or inverter internal AC source.

For this reason, a Note has been included in Condition A requiring the entry into the Conditions and Required Actions for LCO 3.8.9, "Distribution Systems-Operating." This ensures that the vital bus is reenergized within 2 hours.

Required Action A.1 allows 24 hours to fix the inoperable inverter and return it to service. The 24 hour limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the plant is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When the AC vital bus is powered from its associated 120 V AC instrument power distribution panel, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible inverter source to the AC vital buses is the preferred source for powering instrumentation trip setpoint devices.

B.1 and B.2

If the inoperable devices or components cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

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BASES (continued)

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LCO

The inverters ensure the availability of electrical power for the instrumentation for systems required to shutdown the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. The battery powered inverters provide uninterruptible supply of AC electrical power to the AC vital buses even if the 6.9 kV shutdown boards are de-energized. OPERABILITY of the inverters requires that the AC vital buses required by LCO 3.8.10, "Distribution Systems - Shutdown" be powered by the inverter. As a minimum, either the channel I and III or II and IV inverters shall be OPERABLE to support the distribution systems required by LCO 3.8.10. Additionally, the inverter channel must not be connected to the cross-train 480 V power supply. This ensures the availability of sufficient inverter power sources to operate the plant in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel handling accidents).

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APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

- a. Systems needed to mitigate a fuel handling accident are available;
- b. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- c. Instrumentation and control capability is available for monitoring and maintaining the plant in a cold shutdown condition or refueling condition.

Inverter requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.7.

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ACTIONS

A.1, A.2.1, A.2.2, A.2.3, and A.2.4

If two trains are required by LCO 3.8.10, the remaining OPERABLE Inverters may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS,

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