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TRM2 - TECHNICAL REQUIREMENTS MANUAL UNIT 2

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Manual Title: TECHNICAL REQUIREMENTS MANUAL UNIT 2

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3.8 ELECTRICAL POWER

3.8.7 Battery Monitoring and Maintenance Program

TRO 3.8.7 Battery cell parameters for the Class 1E 250 V batteries and Class 1E 125 V batteries shall be within limits.

APPLICABILITY: When associated DC electrical power subsystems are required to be OPERABLE.

ACTIONS

NOTE

Separate Condition entry is allowed for each battery.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more batteries with one or more battery cell parameters not within Category A limits.	A.1	Verify pilot cell electrolyte level and float voltage meet Table 3.8.7-1 Category B limits.	1 hour
	AND		
	A.2	Verify battery cell parameters meet Table 3.8.7-1 Category B limits.	8 hours AND Once per 7 days thereafter
	AND		
	A.3	Restore battery cell parameters to Category A limits of Table 3.8.7-1.	31 days
B. Required Action A.1 or A.2 and associated Completion Time for Condition A not met.	B.1	Enter TS 3.8.6.	Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action A.3 and associated Completion Time for Condition A not met.	C.1	Declare associated battery inoperable.	Immediately
D. Entry into TS 3.8.6 Condition C with electrolyte level below the top of the plates.	D.1 AND	Apply equalizing charge to battery/or affected cell.	31 days
		Verify affected cell meets Table 3.8.7-1 Category A and B limits for float voltage and temperature.	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action D.1 and associated Completion Time for Condition D not met. OR One or more batteries on one 125 VDC electrical power subsystem or on one 250 VDC electrical power subsystem with average electrolyte temperature less than the Table 3.8.7-1 Category B Limits. OR One or more batteries on one 125 VDC electrical power subsystem or on one 250 VDC electrical power subsystem with connection resistance ≥ 100.0 E-6 ohms for any single connection or the calculated average resistance for the battery is > 50.0 E-6 ohms.	E.1 Declare associated battery inoperable.	Immediately

TECHNICAL REQUIREMENT SURVEILLANCE

	SURVEILLANCE	FREQUENCY
TRS 3.8.7.1	Verify for each terminal and connector No visible corrosion OR a. ≤ 50.0 E-6 ohms; OR b. ≤ 100.0 E-6 ohms with the calculated average resistance for the battery < 50.0 E-6 ohms.	92 days
TRS 3.8.7.2	Verify average electrolyte temperature (minimum of 10% of cells) is within Table 3.8.7-1 Category A limits.	92 days
TRS 3.8.7.3	Verify the average of the specific gravity (corrected for temperature) of all the connected cells is > 1.195 and no cell more than 0.020 below the average.	48 months
TRS 3.8.7.4	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that could potentially degrade battery performance.	48 months
TRS 3.8.7.5	Verify the battery connection resistance is: a. < 100.0 E-6 ohms for any single connection; AND b. The calculated average resistance for the battery is < 50.0 E-6 ohms.	48 months

Table 3.8.7-1 (page 1 of 1)
Battery/Battery Cell Parameter Requirements

CELL PARAMETER	CATEGORY A: LIMITS FOR EACH CONNECTED CELL	CATEGORY B: ALLOWABLE LIMITS FOR EACH CONNECTED CELL
Electrolyte Level	≥ Minimum level indication mark, and ≤ 1/4 inch above maximum level indication mark[(a)]	Above top of plates, and not overflowing
Float Voltage	≥ 2.13 V	≥ 2.07 V
Cell Temperature	≥ 60 Degrees F	≥ 60 Degrees F

(a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during and immediately following equalizing charges provided it is not overflowing.

B 3.8 ELECTRICAL POWER

B 3.8.7 Battery Monitoring and Maintenance Program

BASES

BACKGROUND

This TRO delineates the limits on electrolyte temperature, electrolyte level, float voltage, and specific gravity for the Unit 1, when common loads are aligned, and Unit 2 DC electrical power subsystems batteries and comprises the "Battery Monitoring and Maintenance Program" as required under Technical Specification 5.5.13. A discussion of these batteries and their OPERABILITY requirements is provided in the Bases for Technical Specification LCO 3.8.4, "DC Sources–Operating," and LCO 3.8.5, "DC Sources–Shutdown."

APPLICABLE SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in FSAR, Chapter 6 (Ref. 1) and Chapter 15 (Ref. 2), assume Engineered Safety Feature systems are OPERABLE. The DC electrical power subsystems provide normal and emergency DC electrical power for the diesel generators (DGs), emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources identified in Technical Specification Table 3.8.4-1 OPERABLE during accident conditions, in the event of:

a. An assumed loss of all offsite AC or all onsite AC power; and

b. A worst case single failure.

Since battery cell parameters support the operation of the DC electrical power subsystems, they satisfy Criterion 3 of the NRC Policy Statement (Ref. 3).

TRO

Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA.

Electrolyte limits are conservatively established, allowing continued DC electrical system function even with Category A limits not met.

BASES

APPLICABILITY

The battery cell parameters are required solely for the support of the associated DC electrical power subsystem. Therefore, battery cell parameters are required to be within required limits only when the associated DC power source is required to be OPERABLE. Refer to the Applicability discussions in Technical Specification Bases for LCO 3.8.4 and LCO 3.8.5.

ACTIONS

A Note has been added to provide clarification that, for the purpose of this TRO, separate Condition entry is allowed for each battery. This is acceptable, since the Required Actions for each Condition provide appropriate compensatory actions for each inoperable battery. Complying with the Required Actions may allow for continued operation, and subsequent inoperable batteries are governed by subsequent Condition entry and application of associated Required Actions.

A.1, A.2, and A.3

With parameters of one or more cells in one or more batteries not within Category A limits but within the Category B limits specified in Table 3.8.7-1, the battery is degraded but there is still sufficient capacity to perform the intended function. Therefore, the affected battery is not required to be considered inoperable solely as a result of Category A limits not met and continued operation is permitted for a limited period.

The pilot cell electrolyte level and float voltage are required to be verified to meet the Category B limits within 1 hour (Required Action A.1). This check provides a quick indication of the status of the remainder of the battery cells. One hour provides time to inspect the electrolyte level and to confirm the float voltage of the pilot cell. One hour is considered a reasonable amount of time to perform the required verification.

Verification that the Category B limits are met (Required Action A.2) provides assurance that during the time needed to restore the parameters to the Category A limits, the battery is still capable of performing its intended function. A period of 8 hours is allowed to complete the initial verification because average temperature measurement must be obtained for the battery. Taking into consideration both the time required to perform the required verification and the assurance that the battery cell parameters are not severely degraded, this time is considered reasonable

BASES

ACTIONS (continued)

A.1, A.2, and A.3 (continued)

Verification of the average temperature of the battery within the design bases ensures operability. The verification is repeated at 7-day intervals until the parameters are restored to Category A limits.

Continued operation is only permitted for 31 days before battery cell parameters must be restored to within Category A limits. Taking into consideration that, while battery capacity is degraded, sufficient capacity exists to perform the intended function and to allow time to fully restore the battery cell parameters to normal limits, this time is acceptable for operation prior to declaring the DC batteries inoperable.

B.1

Failure to complete the checks required for Actions A.1 or A.2 require immediate action. Entry into Technical Specification 3.8.6 must be entered immediately.

C.1

When any battery parameter is outside the Category B limit for any connected cell, sufficient capacity to supply the maximum expected load requirement is not ensured and the corresponding DC electrical power subsystem must be declared inoperable. Additionally, other potentially extreme conditions, such as not completing the Required Action A.3 within the required Completion Time also are cause for immediately declaring the associated DC electrical power subsystem inoperable.

D.1

Cells that have been discovered with electrolyte level below the top of the plates are equalized and tested IAW Technical Specification 5.5.13

E.1

Required Action E.1 is to ensure that under extreme conditions, such as failure to complete the required Action D.1 within the required completion time, average electrolyte temperature falling below 60° F, or intercell connections found not within required connection resistance also are cause for immediately declaring the associated battery inoperable.

BASES

TRS

TRS 3.8.7.1

The quarterly inspection for visible corrosion at the terminal and connector is consistent with IEEE-450. The "OR" condition is to ensure, if there is visible corrosion, intercell connection resistance is not impacted.

TRS 3.8.7.2

The quarterly inspection of average electrolyte temperature is consistent with IEEE-450 recommendation to check 10% of the connected cells. Lower than normal temperatures act to inhibit or reduce battery capacity. This TRS ensures that the operating temperatures remain within an acceptable operating range. This limit is based on manufacturer's recommendations and battery sizing calculations.

TRS 3.8.7.3

IEEE-450 (Ref. 4) recommends a check of specific gravity every year. The Frequency of the TRS is acceptable because other administrative controls ensure adequate battery performance between performances of TRS 3.8.7.3 and aligns performance of TRS 3.8.7.3 with refueling outage intervals.

The limit specified for specific gravity for each connected cell is no more than 0.020 below the average of all connected cells with the temperature corrected average $\geq$ 1.195. These values are based on manufacturer's recommendations for the minimum required value. The minimum specific gravity value required for each cell ensures that the effects of a highly charged or newly installed cell do not mask overall degradation of the battery.

Specific gravity gradients produced during the recharging process may result in delays of several days until the specific gravity stabilizes. However, a minor battery recharge (such as equalizing charge that does not follow a deep discharge) does not produce specific gravity gradients that are significant.

BASES

TRS (continued)

TRS 3.8.7.4

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The presence of physical damage or deterioration does not represent a failure of the TRS, provided an evaluation determines that the physical damage or deterioration does not affect the OPERABILITY of the battery (its ability to perform its design function). The Frequency of the TRS is acceptable because other administrative controls ensure adequate battery performance between performances of TRS 3.8.7.4 and aligns performance of TRS 3.8.7.4 with refueling outage intervals.

TRS 3.8.7.5

The connection resistance limits for this TRS must be below the limits specified in the TRS. The calculated average resistance limit ensure that the total voltage drop across the battery connections is consistent to those assumed in the battery calculations, while the upper limit for battery resistance prevents the possibility of battery damage due to overheating of the connections.

The Frequency of this TRS is acceptable because other administrative controls ensure adequate battery performance between performances of TRS 3.8.7.5 and aligns performance of TRS 3.8.7.5 with refueling outage intervals

Table 3.8.7-1

This table delineates the limits on electrolyte level, float voltage, and temperature for two different categories. The meaning of each category is discussed below.

Category A defines the normal parameter limits for each connected cell. The term "connected cell" excludes any battery cell that may be jumpered out.

BASES

TRS (continued)

Table 3.8.7-1 (continued)

The Category A limits specified for electrolyte level are based on manufacturer's recommendations and are consistent with the guidance in IEEE-450 (Ref. 4), with the extra ¼ inch allowance above the high water level indication for operating margin to account for temperature and charge effects. In addition to this allowance, footnote (a) to Table 3.8.7-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions. IEEE-450 (Ref. 4) recommends that electrolyte level readings should be made only after the battery has been at float charge for at least 72 hours.

The Category A limit specified for float voltage is $\geq$ 2.13 V per cell. This value is based on the recommendation of IEEE-450 (Ref. 4) which states that prolonged operation of cells below 2.13 V can reduce the life expectancy of cells.

Category B defines the limits for each connected cell. These values, although reduced, provide assurance that sufficient capacity exists to perform the intended function and maintain a margin of safety. When any battery parameter is outside the Category B limits, the assurance of sufficient capacity described above no longer exists, and Technical Specification 3.8.6 must be entered immediately.

The Category B limit specified for electrolyte level (above the top of the plates and not overflowing) ensures that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category B allowable limit for voltage is based on IEEE-450 (Ref. 4), which states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.

BASES

REFERENCES

1. FSAR, Chapter 6

2. FSAR, Chapter 15

3. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132)

4. IEEE Standard 450-1995