

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources — Operating

LCO 3.8.4 The Train A and Train B Auxiliary Building and Service Water Intake Structure (SWIS) DC electrical power subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Auxiliary Building DC electrical power subsystem inoperable.	A.1 Restore the Auxiliary Building DC electrical power subsystem to OPERABLE status.	2 hours 12 hours for 1B Auxiliary Building DC electrical power subsystem inoperable due to inoperable battery for cycle 19 only
B. One Auxiliary Building DC electrical power subsystem with battery connection resistance not within limit.	B.1 Restore the battery connection resistance to within limit.	24 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Be in MODE 5.	6 hours 36 hours
D. One required SWIS DC electrical power subsystem battery connection resistance not within limit.	D.1 Restore the battery connection resistance to within the limit.	24 hours
E. One required SWIS DC electrical power subsystem inoperable. <u>OR</u> Required Action and associated Completion Time of Condition D not met.	E.1 Declare the associated Service Water System train inoperable.	Immediately

BASES

ACTIONS

A.1

Condition A represents one train of Auxiliary Building DC electrical power with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected train. The 2 hour limit is consistent with the allowed time for an inoperable DC distribution system train.

[For Unit 1 only for cycle 19] The second Completion time for Condition A represents the 1B train of Auxiliary Building DC electrical power subsystem due to an inoperable battery. With the 1B Auxiliary Building battery inoperable, the DC bus is being supplied by the OPERABLE battery charger. Any event that results in a loss of the AC bus supporting the battery charger will also result in the loss of DC to that train. Recovery of the AC bus, especially if it is due to a loss of offsite power, will be hampered by the fact that many of the components necessary for the recovery (e.g., diesel generator control and field flash, AC load shed and diesel generator output breakers, etc.) rely upon the battery. The 12 hour limit allows sufficient time to effect restoration of the inoperable battery given that the majority of the conditions that lead to battery inoperability (e.g., loss of battery charger, battery cell voltage less than 2.02 volts, etc.) are identified in Specifications 3.8.4, 3.8.5, and 3.8.6 together with additional specific completion times.

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated inoperable battery), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst case single failure would, however, result in the complete loss of the remaining 125 VDC electrical power subsystems with attendant loss of ESF functions, in the case of the Auxiliary Building DC power subsystem, continued power operation should not exceed 2 hours. The 2 hour Completion Time is based on Regulatory Guide 1.93 (Ref. 8) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the Auxiliary Building DC electrical power subsystem is not restored to OPERABLE status, to prepare to effect an orderly and safe unit shutdown.

(continued)

BASES

ACTIONS
(continued)

B.1 and D.1

Conditions B and D represent one Auxiliary Building or SWIS DC electrical power subsystem with connection resistance not within the specified limit. Consistent with the guidance in IEEE-450, connection resistance not within the limit is an indication that the affected battery requires attention to restore the resistance to within the limit but is not a basis on which to declare the battery inoperable. Therefore, the 24 hour Completion Time allowed to restore the battery connection resistance to within the required limit is a reasonable time considering that variations in connection resistance do not mean the battery is incapable of performing its required safety function, but is an indication that the battery requires maintenance.

C.1 and C.2

If the inoperable Auxiliary Building DC electrical power subsystem cannot be restored to OPERABLE status or the connection resistance restored to within the limit within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit 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 unit conditions from full power conditions in an orderly manner and without challenging plant systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 8).

E.1

If a required SWIS DC electrical power subsystem is inoperable or the connection resistance is not restored to within the limit and the associated Completion Time has expired, the Service Water System train supported by the affected SWIS DC electrical power subsystem must be declared inoperable. The capability of the affected SWIS DC electrical power subsystem to fully support the associated train of Service Water is not assured. Therefore, consistent with the definition of OPERABILITY, the associated train of Service Water must be declared inoperable immediately, thereby limiting operation in this condition to the Completion Time associated with the affected Service Water System train.

BASES

**SURVEILLANCE
REQUIREMENTS**

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is applying a voltage to the battery to maintain it in a fully charged condition during normal operation. The float voltage of 2.2 V per cell or 132 V overall is higher than the nominal design voltage of 125 V and is consistent with the manufacturer's recommendations for maintaining a full charge. Verifying that terminal voltage is ≥ 127.8 V provides assurance that the average of all cell voltages is maintained greater than 2.13 V. Maintaining float voltage at the higher value of 2.2 V per cell prolongs cell life expectancy. The 7 day Frequency is consistent with IEEE-450 (Ref. 9).

SR 3.8.4.2

Visual inspection to detect excessive corrosion on the battery terminals or connectors, or measurement of the post to post resistance of these items provides an indication of the need for cleaning and/or retorquing.

The Surveillance Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.4.3

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 necessarily represent a failure of this SR, 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 18 month frequency for this SR is sufficient to detect abnormal deterioration and has been shown to be adequate by operating experience.

(continued)

BASES

**SURVEILLANCE
REQUIREMENTS**
(continued)

SR 3.8.4.4 and SR 3.8.4.5

Visual inspection and post to post resistance measurements of battery terminals or connectors provide an indication of the need for cleaning and/or retorquing. The anticorrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection. The removal of visible corrosion is a preventive maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR provided visible corrosion is removed during performance of SR 3.8.4.4.

The 18 month frequency for this SR is sufficient to detect abnormal deterioration and has been shown to be adequate by operating experience.

SR 3.8.4.6

This SR requires that each required battery charger be capable of supplying 536 amps (Auxiliary Building chargers) and 3 amps (SWIS chargers) at 125 V for ≥ 4 hours. These requirements are based on the design capacity of the chargers (Ref. 4). According to Regulatory Guide 1.32 (Ref. 10), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

The Surveillance Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 18 month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

This surveillance is modified by a Note which clarifies that it may be performed in any mode of operation provided certain conditions are met. The design is such that any battery charger may be tested while a spare or redundant battery and/or charger is in service in its place. The spare or redundant battery and/or charger must be within the 18 month surveillance frequency to maintain the DC subsystem(s) to which they are aligned OPERABLE. This operational flexibility maintains TS OPERABILITY of the applicable battery and DC train while testing the normally aligned charger.

(continued)

BASES

**SURVEILLANCE
REQUIREMENTS**
(continued)

SR 3.8.4.7

A battery service test is a special test of battery capability, as found, to satisfy the design requirements (design load profile) of the DC electrical power system. The discharge rate and test length should correspond to the design load profile requirements as specified in Reference 4.

The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 10), which states that the battery service test should be performed during refueling operations or at some other outage, (applicable to Auxiliary Building batteries only) with intervals between tests, not to exceed 18 months.

This SR is modified by three Notes. Note 1 allows the performance of a performance discharge test in lieu of a service test once per 60 months. Note 2 allows the performance of a modified performance discharge test in lieu of a service test at any time.

The modified performance discharge test is a simulated duty cycle consisting of just two rates: the one minute rate published for the battery or the largest current load of the duty cycle, followed by the test rate employed for the performance test, both of which envelop the duty cycle of the service test. Since the ampere-hours removed by a rated one minute discharge represents a very small portion of the battery capacity, the test rate can be changed to that for the performance test without compromising the results of the performance discharge test. The battery terminal voltage for the modified performance discharge test should remain above the minimum battery terminal voltage specified in the battery service test for the duration of time equal to that of the service test.

A modified discharge test is a test of the battery capacity and its ability to provide a high rate, short duration load (usually the highest rate of the duty cycle). This will often confirm the battery's ability to meet the critical period of the load duty cycle, in addition to determining its percentage of rated capacity. Initial conditions for the modified performance discharge test should be identical to those specified for a service test.

The reason for Note 3 is that performing the Surveillance for the Auxiliary Building batteries would perturb the electrical distribution system and challenge safety systems.

(continued)

BASES

**SURVEILLANCE
REQUIREMENTS**
(continued)

SR 3.8.4.8

A battery performance discharge test is a test of constant current capacity of a battery, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

A battery modified performance discharge test is described in the Bases for SR 3.8.4.7. Either the battery performance discharge test or the modified performance discharge test is acceptable for satisfying SR 3.8.4.8. The modified performance discharge test may be used to satisfy SR 3.8.4.8 while simultaneously satisfying the requirements of SR 3.8.4.7 at any time. The performance discharge test may be used to satisfy 3.8.4.8 while simultaneously satisfying the requirements of SR 3.8.4.7 once per 60 months.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 9). This reference recommends that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

The Surveillance Frequency for this test is normally 60 months. If the battery shows degradation, or if the battery has reached 85% of its expected life or 17 years, whichever comes first, the Surveillance Frequency is reduced to 18 months. Degradation is indicated, according to IEEE-450 (Ref. 9), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is > 10% below the manufacturer's rating. These Frequencies are consistent with the recommendations in IEEE-450 (Ref. 9).

This SR is modified by a Note. The reason for the Note is that performing the Surveillance for the Auxiliary Building batteries would perturb the electrical distribution system and challenge safety systems.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17.
2. Regulatory Guide 1.6, March 10, 1971.

(continued)

BASES

REFERENCES
(continued)

3. IEEE-308-1971.
 4. FSAR, Section 8.3.
 5. None.
 6. FSAR, Chapter 6.
 7. FSAR, Chapter 15.
 8. Regulatory Guide 1.93, December 1974.
 9. IEEE-450-1980.
 10. Regulatory Guide 1.32, February 1972.
-