

3/4.8 ELECTRICAL POWER SYSTEMS

3/4.8.1 A. C. SOURCES

OPERATING

LIMITING CONDITION FOR OPERATION

3.8.1.1. As a minimum, the following A.C. electrical power sources shall be OPERABLE:

- a. Two physically independent circuits between the offsite transmission network and the onsite Class IE distribution system, and
- b. Two separate and independent Emergency Diesel Generators (EDG), each with:
 1. A separate day tank containing a minimum of 300 gallons of fuel, and
 2. A separate fuel storage system containing a minimum of 42,500 gallons of fuel, and
 3. A separate fuel transfer pump.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

- a. With one offsite circuit of 3.8.1.1.a inoperable:
 1. Demonstrate the OPERABILITY of the remaining offsite A.C. sources by performing Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter and,
 2. If either EDG has not been successfully tested within the past 24 hours, demonstrate its OPERABILITY by performing Surveillance Requirement 4.8.1.1.2.a.3 separately for each such EDG within 24 hours unless the diesel is already operating and,
 3. Restore the offsite circuit to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and COLD SHUTDOWN within the following 30 hours.
- b. With one EDG of 3.8.1.1.b inoperable:
 1. Demonstrate the OPERABILITY of the A.C. offsite sources by performing Surveillance Requirement 4.8.1.1.1.a within 1 hour and at least once per 8 hours thereafter and,
 2. If the EDG became inoperable due to any cause other than preplanned preventive maintenance or testing, demonstrate the OPERABILITY of the remaining EDG by performing Surveillance Requirement 4.8.1.1.2.a.3 within 24 hours* and,

*This test is required to be completed regardless of when the inoperable EDG is restored to OPERABILITY.

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ELECTRICAL POWER SYSTEMS

ACTION: (Continued)

3. Verify that required systems, subsystems, trains, components and devices that depend on the remaining EDG as a source of emergency power are also OPERABLE and in MODE 1, 2, or 3, that the Turbine Driven Emergency Feed Pump is OPERABLE within 2 hours. If these conditions are not satisfied within 2 hours be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
 4. Restore the EDG to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- c. With one offsite circuit and one EDG inoperable:
1. Demonstrate the OPERABILITY of the remaining offsite A.C. source by performing Surveillance Requirement 4.8.1.1.1.a within one hour and at least once per 8 hours thereafter and,
 2. If the EDG became inoperable due to any cause other than preplanned preventive maintenance or testing, demonstrate the OPERABILITY of the remaining EDG by performing Surveillance Requirement 4.8.1.1.2.a.3 within 8 hours * and,
 3. Verify that required systems, subsystems, trains, components and devices that depend on the remaining EDG as a source of emergency power are also OPERABLE and in MODE 1, 2, or 3, that the Turbine Driven Emergency Feed Pump is OPERABLE within 2 hours. If these conditions are not satisfied within 2 hours be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
 4. Restore one of the inoperable sources to OPERABLE status within 12 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours and,
 5. Restore the other A.C. power source (offsite circuit or diesel generator) to OPERABLE status in accordance with the provisions of Section 3.8.1.1 Action Statement a. or b., as appropriate, with the time requirement of that Action Statement based on the time of initial loss of the remaining inoperable A. C. power source.
- d. With two of the required offsite A.C. circuits inoperable:
1. Demonstrate the OPERABILITY of the two EDG's by sequentially performing Surveillance Requirement 4.8.1.1.2.a.3 on both within 8 hours, unless the EDG's are already operating and,

*This test is required to be completed regardless of when the inoperable EDG is restored to OPERABILITY.

ELECTRICAL POWER SYSTEMS

ACTION: (Continued)

2. Restore one of the inoperable offsite sources to OPERABLE status within 24 hours or be in at least HOT STANDBY within the next 6 hours.
 3. Following restoration of one offsite source, follow Action Statement a. with the time requirement of that Action Statement based on the time of initial loss of the remaining inoperable offsite A.C. circuit.
- e. With two of the above required EDG's inoperable:
1. Demonstrate the OPERABILITY of two offsite A.C. circuits by performing Surveillance Requirement 4.8.1.1.1.a within one hour and at least once per 8 hours thereafter and,
 2. Restore one of the inoperable EDG's to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
 3. Following restoration of one EDG, follow Action Statement b. with the time requirement of that Action Statement based on the time of initial loss of the remaining inoperable diesel generator.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS

4.8.1.1.1 Each of the above required physically independent circuits between the offsite transmission network and the onsite Class 1E distribution system shall be:

- a. Determined OPERABLE at least once per 7 days by verifying correct breaker alignment and indication of power availability, and
- b. Demonstrated OPERABLE at least once every 18 months by manually transferring the onsite Class 1E power supply from the normal circuit to the alternate circuit.

4.8.1.1.2 Each EDG shall be demonstrated OPERABLE:

- a. In accordance with the frequency specified in Table 4.8-1 on a STAGGERED TEST BASIS by:
 1. Verifying the fuel level in the day tank and fuel storage tank.
 2. Verifying the fuel transfer pump can be started and transfers fuel from the storage system to the day tank.
 3. Verifying the diesel generator can start* and accelerate to synchronous speed (504 rpm) with generator voltage and frequency at 7200 ± 720 volts and 60 ± 1.2 Hz. Subsequently verifying the generator is synchronized, gradually loaded* to an indicated 4150-4250 kW** and operates for at least 60 minutes.
- b. At least once per 31 days and after each operation of the diesel where the period of operation was greater than or equal to 1 hour by removing accumulated water from the day tank.
- c. By obtaining a sample of fuel oil in accordance with ASTM-D270-1975 at least once per 92 days and prior to the addition of new fuel oil to the storage tanks and verifying that the sample meets the following minimum requirements and is tested within the specified time limits:
 1. As soon as the sample is taken (or prior to adding new fuel to the storage tank) verify in accordance with the tests specified in ASTM-D975-77 that the sample has:
 - a) A water and sediment content of less than or equal to 0.05 volume percent.

*This test shall be conducted in accordance with the manufacturer's recommendations regarding engine pre-lube and warmup procedures, and as applicable regarding loading recommendations.

**This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band shall not invalidate the test.

SURVEILLANCE REQUIREMENTS (Continued)

- b) A kinematic viscosity @ 40°C of greater than or equal to 1.9 centistokes, but less than or equal to 4.1 centistokes.
 - c) A specific gravity as specified by the manufacturer @ 60/60°F of greater than or equal to 0.83 but less than or equal to 0.89 or an API gravity @ 60°F of greater than or equal to 27 degrees but less than or equal to 39 degrees.
2. Within 1 week after obtaining the sample, verify an impurity level of less than 2 mg of insolubles per 100 ml when tested in accordance with ASTM-D2274-70.
 3. Within 2 weeks of obtaining the sample, verify that the other properties specified in Table 1 of ASTM-D975-77 and Regulatory Guide 1.137 Position 2.a are met when tested in accordance with ASTM-D975-77.
- d. At least once per 184 days by:
1. Starting and accelerating the EDG to synchronous speed (504 rpm) with generator voltage and frequency at 7200 ± 720 volts and 60 ± 1.2 Hz within 10 seconds after the start signal. The EDG shall be started for this test by using one of the following signals:
 - a) Simulated loss of offsite power by itself.
 - b) Simulated loss of offsite power in conjunction with an ESF actuation test signal.
 - c) An ESF actuation test signal by itself.
 - d) Simulated degraded offsite power by itself.
 - e) Manual.
 2. The generator shall be manually synchronized, loaded to an indicated 4150 - 4250** kW in less than or equal to 60 seconds, and operate for at least 60 minutes.
- e. At least once every 18 months by:
1. Subjecting the diesel to an inspection in accordance with procedures prepared in conjunction with its manufacturer's recommendations for this class of standby service.
 2. Verifying that, on rejection of a load of greater than or equal to 729 kW the voltage and frequency are maintained at 7200 ± 720 volts and 60 ± 1.2 Hz.
 3. Verifying the generator capability to reject a load of 4250 kW without tripping. The generator voltage shall not exceed 7920 volts during and following the load rejection.

**This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band shall not invalidate the test.

SURVEILLANCE REQUIREMENTS (Continued)

4. Simulating a loss of offsite power by itself, and:
 - a) Verifying de-energization of the emergency busses and load shedding from the emergency busses.
 - b) Verifying the diesel starts on the auto-start signal, energizes the emergency busses with permanently connected loads within 10 seconds, energizes the auto-connected shutdown loads through the load sequencer and operate for greater than or equal to 5 minutes while its generator is loaded with the shutdown loads. After energization of these loads, the steady state voltage and frequency shall be maintained at 7200 ± 720 volts and 60 ± 1.2 Hz.
5. Verifying that on an ESF actuation test signal, without loss of offsite power, the diesel generator starts on the auto-start signal and operates on standby for greater than or equal to 5 minutes. The generator voltage and frequency shall be 7200 ± 720 volts and 60 ± 1.2 Hz within 10 seconds after the auto-start signal; the steady-state generator voltage and frequency shall be maintained within these limits during this test. After 5 minutes of standby operation verify that on a simulated loss of offsite power:
 - a) the loads are shed from the emergency busses,
 - b) the diesel generator does not connect to the bus for at least 5 seconds, and
 - c) that subsequent loading of the diesel generator is in accordance with design requirements.
6. Simulating a loss of offsite power in conjunction with an ESF actuation test signal, and
 - a) Verifying de-energization of the emergency busses and load shedding from the emergency busses.
 - b) Verifying the EDG starts in the emergency mode, energizes the emergency busses with permanently connected loads within 10 seconds, energizes the auto-connected emergency (accident) loads through the load sequencer and operates for greater than or equal to 5 minutes and maintains the steady state voltage and frequency at 7200 ± 720 volts and 60 ± 1.2 Hz.
 - c) Verifying that all EDG trips, except engine overspeed, generator differential and low lube oil pressure are automatically bypassed upon loss of voltage on the emergency bus concurrent with a safety injection actuation signal.

7. Verifying the EDG operates for at least 24 hours.
 - a) The EDG shall be loaded to the continuous rating (4150-4250 kW**) for the time required to reach engine temperature equilibrium, at which time the EDG shall be loaded to an indicated target value of 4676 kw (between 4600-4700kW**) and maintained for 2 hours.
 - b) During the remaining 22 hours of this test, the EDG shall be loaded to an indicated 4150-4250 kW**.
 - c) During this test the steady state voltage and frequency shall be maintained at 7200 ± 720 volts and 60 ± 1.2 Hz.
 - d) Within 5 minutes after completing this 24-hour test, perform Surveillance Requirement 4.8.1.1.2.e.4.b.
8. Verifying that the auto-connected loads to each EDG do not exceed the 2000 hour rating of 4548 kW.
9. Verifying the EDG's capability to:
 - a) Synchronize with the offsite power source while the generator is loaded with its emergency loads upon a simulated restoration of offsite power,
 - b) Transfer its loads to the offsite power source, and
 - c) Be restored to its standby status.
10. Verifying that with the diesel generator operating in a test mode, connected to its bus, a simulated safety injection signal overrides the test mode by (1) returning the diesel generator to standby operation and (2) automatically energizes the emergency loads with offsite power.
11. Verifying that the fuel transfer pump transfers fuel from each fuel storage tank to the day tank of each diesel via the installed cross connection lines.
12. Verifying that the automatic load sequence timer is OPERABLE with the interval between each load block within $\pm 10\%$ of its design interval.
13. Verifying that the following diesel generator lockout features prevent diesel generator starting only when required:
 - a) Barring Device
 - b) Remote-Local-Maintenance Switch

**This band is meant as guidance to avoid routine overloading of the engine. Loads in excess of this band shall not invalidate the test.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

- f. At least once per 10 years or after any modifications which could affect diesel generator interdependence by starting the diesel generator simultaneously, during shutdown, and verifying that the diesel generators accelerate to at least 504 rpm in less than or equal to 10 seconds.
- g. At least once per 10 years by:
 - 1. Draining each fuel oil storage tank removing the accumulated sediment and cleaning the tank using a sodium hypochlorite solution or its equivalent, and
 - 2. Performing a pressure test of those portions of the diesel fuel oil system designed to Section III subsection ND of the ASME Code at a test pressure equal to 110 percent of the system design pressure.

4.8.1.1.3 Reports - All diesel generator failures, valid or non-valid, shall be reported to the Commission pursuant to Specification 6.9.2. Reports of diesel generator failures shall include the information recommended in Regulatory Position C.3.b of Regulatory Guide 1.108, Revision 1, August 1977. If the number of failures in the last 100 valid tests (on a per diesel generator basis) is greater than or equal to 7, the report shall be supplemented to include the additional information recommended in Regulatory Position C.3.b of Regulatory Guide 1.108, Revision 1, August 1977.

TABLE 4.8-1

DIESEL GENERATOR TEST SCHEDULE

<u>Number of Failures in Last 20 Valid Tests*</u>	<u>Number of Failures in Last 100 Valid Tests*</u>	<u>Test Frequency</u>
<u>≤1</u>	<u>≤4</u>	Once per 31 days
<u>≥2**</u>	<u>≥5</u>	Once per 7 days

*Criteria for determining number of failures and number of valid tests shall be in accordance with Regulatory Position C.2.e of Regulatory Guide 1.108, but determined on a per diesel generator basis.

For the purposes of determining the required test frequency, the previous test failure count may be reduced to zero if, in conjunction with the manufacturer a complete diesel overhaul to like-new conditions is completed, and if acceptable reliability has been demonstrated. The reliability criterion shall be the successful completion of 14 consecutive tests in a single series. Ten of these tests shall be in accordance with Surveillance Requirement 4.8.1.1.2.a.3; four tests, in accordance with Surveillance Requirement 4.8.1.1.2.d. If this criterion is not satisfied during the first series of tests, any alternate criterion to be used to transvalue the failure count to zero requires NRC approval.

**The associated test frequency shall be maintained until seven consecutive failure free demands have been performed and the number of failures in the last 20 valid demands has been reduced to one.

ELECTRICAL POWER SYSTEMS

A.C. SOURCES

SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.8.1.2 As a minimum, the following A.C. electrical power sources shall be OPERABLE:

- a. One circuit between the offsite transmission network and the onsite Class 1E distribution system, and
- b. One diesel generator* with:
 1. A day tank containing a minimum volume of 300 gallons of fuel,
 2. A fuel storage system containing a minimum volume of 30,000 gallons of fuel, and
 3. A fuel transfer pump.

APPLICABILITY: MODES 5 and 6.

ACTION:

With less than the above minimum required A.C. electrical power sources OPERABLE, immediately suspend all operations involving CORE ALTERATIONS, positive reactivity changes, movement of irradiated fuel, or crane operation with loads over the fuel storage pool. In addition, when in MODE 5 with the Reactor Coolant loops not filled, or in MODE 6 with the water level less than 23 feet above the reactor vessel flange, immediately initiate corrective action to restore the required sources to OPERABLE status as soon as possible.

SURVEILLANCE REQUIREMENTS

4.8.1.2 The above required A.C. electrical power sources shall be demonstrated OPERABLE by the performance or verification of each of the Surveillance Requirements of 4.8.1.1.1 and 4.8.1.1.2.

*ESF Load Sequencer may be deenergized in Mode 5 and 6.

3/4.8 ELECTRICAL POWER SYSTEMS

BASES

3/4.8.1, 3/4.8.2 AND 3/4.8.3 A.C. SOURCES, D.C. SOURCES AND ONSITE POWER DISTRIBUTION SYSTEMS

The OPERABILITY of the A.C. and D.C. power sources and associated distribution systems during operation ensures that sufficient power will be available to supply the safety related equipment required for 1) the safe shutdown of the facility and 2) the mitigation and control of accident conditions within the facility. The minimum specified independent and redundant A.C. and D.C. power sources and distribution systems satisfy the requirements of General Design Criterion 17 of Appendix "A" to 10 CFR 50.

The ACTION requirements specified for the levels of degradation of the power sources provide restriction upon continued facility operation commensurate with the level of degradation. The OPERABILITY of the power sources are consistent with the initial condition assumptions of the safety analyses and are based upon maintaining at least one redundant set of onsite A.C. and D.C. power sources and associated distribution systems OPERABLE during accident conditions coincident with an assumed loss of offsite power and single failure of the other onsite A.C. source. The A.C. and D.C. source allowable out-of-service times are based on Regulatory Guide 1.93, "Availability of Electrical Power Source," December 1974. When one diesel generator is inoperable, there is an additional ACTION requirement to verify that all required systems, subsystems, trains, components and devices, that depend on the remaining OPERABLE diesel generator as a source of emergency power, are also OPERABLE, and that the steam-driven auxiliary feedwater pump is OPERABLE. This requirement is intended to provide assurance that a loss of offsite power event will not result in a complete loss of offsite power event will not result in a complete loss of safety function of critical systems during the period one of the diesel generators is inoperable. The term verify as used in this context means to administratively check by examining logs or other information to determine if certain components are out-of-service for maintenance or other reasons. It does not mean to perform the surveillance requirements needed to demonstrate the OPERABILITY of the component.

The OPERABILITY of the minimum specified A.C. and D.C. power sources and associated distribution systems during shutdown and refueling ensures that 1) the facility can be maintained in the shutdown or refueling condition for extended time periods and 2) sufficient instrumentation and control capability is available for monitoring and maintaining the unit status.

The Surveillance Requirements for demonstrating the OPERABILITY of the diesel generators are in accordance with the recommendations of Regulatory Guides 1.9, "Selection of Diesel Generator Set Capacity for Standby Power Supplies," March 10, 1971, 1.108, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," Revision 1, August 1977, and 1.137, "Fuel-Oil Systems for Standby Diesel Generators," Revision 1, October 1979, as modified by the NRC's review and approval of South Carolina Electric & Gas Company's June 10, 1985 and December 6, 1985 amendment requests.