4.6 EMERGENCY POWER SYSTEM PERIODIC TESTS

Applicability

Applies to periodic testing and surveillance requirements of the emergency power system.

Objective

To verify that the emergency power system will respond promptly and properly when required.

Specification

The following tests and surveillance shall be performed as stated:

4.6.1 Diesel Generators

4.6.1.1 On a monthly basis, each diesel generator shall be tested by manually-initiated start, followed by manual synchronization with other power sources, and verification that each diesel generator is loaded and operates for $\geq$ 60 minutes at a load $\geq$ 2350 kW and $\leq$ 2500 kW.

4.6.1.2 Automatic start of each diesel generator, load shedding and restoration to operation of particular vital equipment, initiated by a simulated loss of all normal A-C station service power supplies together with a simulated safety injection signal. This test will be conducted at each refueling interval, to assure that the diesel will start and assume required load within 50 seconds after the initial starting signal.

4.6.1.3 Each diesel generator shall be inspected at least once every refueling interval. The diesel protective bypasses listed in Specification 3.7.1.d shall be demonstrated to be operable by simulating a trip signal to each of the trip devices that is bypassed and observing that the diesel does not receive a trip signal.

4.6.1.4 The following diesel generator load limits shall be observed:

a. The continuous load rating for the diesel generator is 2500 kW. Continuous operation above this limit shall not be permitted, except as defined within Technical Specification 4.6.1.4.b.

b. The short-term, overload rating of the diesel generator is 2750 kW. Operation at this load shall not exceed 2 hours in any 24 hour period. Operation above the short-term, overload rating shall not be permitted.

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4.6.1.5 At each refueling interval, each diesel generator shall be tested by manually-initiated start, followed by manual synchronization with other power sources, and verification that each diesel generator is loaded and operates for ≥ 24 hours. During two hours of this test, the load shall be maintained between 2650 kW and 2750 kW*. During the remaining 22 hours of this test, the load shall be maintained between 2400 kW and 2500 kW*. The power factor shall be maintained between 0.8 and 0.9 during the entire test.

4.6.2 Diesel Fuel Tanks

A minimum fuel oil inventory sufficient to ensure 19,000 gallons available to the diesel generators shall be maintained at all times in the Unit 2 diesel generator fuel oil storage tank and an additional 15,000 gallons available to the diesel generators shall be maintained at all times in either the Unit 1 I-C turbine fuel oil storage tanks or a combination of the Unit 1 I-C turbine fuel oil storage tanks and the Unit 2 diesel generator fuel oil storage tank.

4.6.3 Station Batteries

4.6.3.1 The voltage and temperature of a pilot cell in each battery shall be measured and recorded daily, 5 days/week.

4.6.3.2 The specific gravity and voltage to the nearest 0.01 volt, the temperature reading of every fifth cell, the height of electrolyte and the amount of water added to each cell shall be measured and recorded monthly.

4.6.3.3 Each battery shall be subjected to an equalizing charge annually. The requirements in 4.6.3.2 above shall be performed after each equalizing charge.

4.6.3.4 At each time data is recorded, new data shall be compared with old to detect signs of abuse or deterioration.

* The minimum and maximum kW values are included as guidance to avoid overloading of the engine. Loads in excess of this range for special testing under direct monitoring of the manufacturer or momentary variations due to changing bus loads shall not invalidate this test.

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4.6.3.5 The batteries shall be subjected to a load test once every five years.

4.6.3.6 The batteries shall be subjected to a service test at least once per 18 months, during a shutdown, by verifying that the battery capacity is adequate supply and maintain in OPERABLE status all of the actual or simulated emergency loads for the design duty cycle. Surveillance 4.6.3.5 may be performed at five year intervals in lieu of this test.

4.6.4 Pressurizer Heaters' Emergency Power Supply

The emergency power supply for the pressurizer heaters shall be demonstrated operable each refueling shutdown by transferring power from normal to the emergency power supply and energizing the heaters.

4.6.5 Battery Chargers

Demonstrate the in-service battery charger is operable by monitoring the output voltage daily, five days per week, and during normal equalizing charges.

Basis

The tests specified are designed to demonstrate that the diesel generators will provide power for operation of equipment. They also assure that the emergency generator system controls and the control systems for the safety features equipment will function automatically in the event of a loss of all normal 480 V AC station service power.[1]

The test to ensure proper operation of engineered safety features upon loss of AC power is initiated by tripping the breakers supplying normal power to the 480 volt buses and initiating a safety injection signal. This test demonstrates the proper tripping of motor feeder breakers, main supply and tie breakers on the affected bus, operation of the diesel generators, and sequential starting of essential equipment.

The testing frequency specified will be often enough to identify and correct any mechanical or electrical deficiency before it can result in a system failure. The fuel supply and starting circuits and controls are continuously monitored and any faults are alarm indicated. An abnormal condition in these systems would be signaled without having to place the diesel generators themselves on test.

The test of the diesel protective bypass circuits is performed to verify their operability. This surveillance demonstrates the noncritical protective features are bypassed while the Trips Defeat Switch is in the "Trips Defeat" mode. The noncritical trips are bypassed during Loss of Coolant Accidents (LOCAs) and provide an alarm during an abnormal engine condition. This alarm provides the operator with sufficient time to react appropriately. The diesel generator availability to mitigate the LOCA is more critical than protecting the engine against minor problems that are not detrimental to emergency operation of the diesel generator.

A refueling interval frequency is based on engineering judgment taking into consideration unit conditions required to perform the surveillance and is intended to be consistent with expected fuel cycle lengths. Operating experience has shown that these components usually pass the surveillance requirements when performed at a refueling interval frequency. Therefore, the frequency was concluded to be acceptable from a reliability standpoint.

On-site emergency power is available from two emergency diesel-generator sets. Each engine-generator set consists of a Fairbanks-Morse Model 38TD8-1/8 engine coupled to a Fairbanks-Morse 3125 kva, 0.8 power factor, 900 RPM, 3 phase, 60 cycle, 480 volt generator. The units have a continuous rating of 2500 kW with a 2-hour overload capability of 2750 kW in any 24-hour period.

Each unit as a backup to the normal standby AC power supply is capable of sequentially starting and supplying the power requirement of one complete set of safety features equipment. It can accept full load within 35 seconds after the initial starting signal,[1] and will sequentially start and supply the power requirements of one complete set of safety features equipment in 50 seconds.[2]

The 24 hour full-load test demonstrates the ability of the diesel generators to provide the necessary power to the emergency buses under accident loading conditions. The 2 hour portion of the testing at 110 percent of full-load encompasses the maximum expected analyzed load.

The testing shall be performed for a duration of not less than 24 hours which includes 2 hours at or up to 110 percent of the continuous duty rating of the generator in a 24 hour period. The remainder of the test shall be performed at a load equivalent to 100 percent of the continuous duty rating of the generator. The generator load shall be maintained at a power factor of 0.8 to 0.9 to ensure the diesel generator is tested under load conditions as close to design conditions as possible.

A supply of 19,000 gallons of fuel will ensure the operation of both diesels carrying rated design capacity for at least 48 hours or one diesel for at least 96 hours. An additional 15,000 gallons will be available to assure an adequate fuel supply for at least seven days of operation of a single diesel generator at its rated design capacity. Rated design capacity for this specification is defined as operation at 2500 kW for 22 hours and at 2750 kW for two hours in any 24-hour period.

Station batteries will deteriorate with time, but precipitous failure is extremely unlikely. The surveillance specified is that which has been demonstrated over the years to provide an indication of a cell becoming unserviceable long before it fails.

The equalizing charge, as recommended by the manufacturer, is vital to maintaining the ampere-hour capability of the battery. As a check upon the effectiveness of the equalizing charge, the battery should be loaded rather heavily and the voltage monitored as a function of time. Experience has shown that this test should be repeated at intervals to detect deterioration of cells.[3][4] If a cell has deteriorated or if a connection is loose, the voltage under load will drop excessively indicating replacement or maintenance.

References

(1) FSAR Section 8.2
(2) FSAR Table 8.2-4
(3) AEC Information Letter ROE: 67-1, January 31, 1967.
(4) FSAR Section 8.3.2

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4.6.1.3 Each diesel generator shall be inspected at each refueling.

4.6.1.4 The following diesel generator load limits shall be observed:

a. The continuous load rating for the diesel generator is 2500 kW. Continuous operation above this limit shall not be permitted, except as defined within Technical Specification 4.6.1.4.b.

b. The short-term, overload rating of the diesel generator is 2750 kW. Operation at this load shall not exceed 2 hours in any 24 hour period. Operation above the short-term, overload rating shall not be permitted.

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