

3.7 ELECTRICAL SYSTEMS

Applicability

Applies to the availability of electrical power for the operating of plant components.

Objective

To define those conditions of electrical power availability necessary to provide for safe reactor operation and the continuing availability of engineered safety features.

3.7.1 Specifications

The primary coolant system shall not be heated or maintained at temperatures above 325°F if the following electrical systems are not operable:

- a. Station power transformer 1-2 (2400 V).
- b. Start-up transformer 1-2 (2400 V).
- c. 2400 V engineered safeguards buses 1C and 1D.
- d. 480 V distribution buses 11 and 12.
- e. 480 V distribution buses 19 and 20.
- f. MCC numbers 1, 2, 25 and 26.
- g. MCC numbers 7, 8, 21, 22, 23 and 24.
- h. 125 V d-c buses D10 and D20.
- i. Four preferred a-c buses Y10, Y20, Y30 and Y40.
- j. Two station batteries and the d-c systems including at least one battery charger on each bus.
- k. Both diesel generators, with a minimum of 2500 gallons of fuel in each day tank and a minimum of 16,000 gallons of fuel in the underground storage tank.
- l. Switchyard battery and the d-c system with one battery charger.
- m. 240 V a-c power panels No 1 and 2, and their associated Air Blast Circuit Breaker (ABCB) distribution systems, which are located in the switchyard.
- n. 2400 V bus 1E.

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3.7.2 With the Primary Coolant System at a temperature greater than 325°F, the requirements of Specification 3.7.1 may be modified to permit one of the following conditions to exist. If any of the provisions of those exceptions are violated, the reactor shall be placed in a hot shutdown condition within 12 hours. If the violation is not corrected within 24 hours, the reactor shall be placed in a cold shutdown condition within 24 hours.

- a. Station power transformer 1-2 (2400 V) may be inoperable for up to 24 hours provided the operability of both diesel generators is demonstrated immediately.
- b. Start-up transformers 1-2 (2400 V) may be inoperable for up to 24 hours provided the operability of both diesel generators is demonstrated immediately. Continued operation beyond 24 hours is permissible provided that a report is sent to the NRC immediately with an outline of the plans for prompt restoration of the start-up transformer and the additional precautions to be taken while the transformer is out of service, and continue operating until notified differently by the NRC.
- c. 2400 V engineered safeguards bus 1C or 1D may be inoperable for up to 8 hours provided the operability of the diesel generator associated with the operable bus is demonstrated immediately and there are no inoperable engineered safety feature components associated with the operable bus.
- d. 480 V distribution bus 11 or 12 may be inoperable for up to 8 hours provided there are no inoperable safety feature components associated with the operable bus.
- e. 480 V distribution bus 19 or 20 may be inoperable for up to 8 hours provided there are no inoperable safety feature components associated with the operable bus.
- f. MCC 1 and 25 or 2 and 26 may be inoperable for up to 8 hours provided there are no inoperable safety feature components associated with the operable trio of MCC's.
- g. MCC 7, 21 and 23 or 8, 22 and 24 may be inoperable for up to 8 hours provided there are no inoperable safety feature components associated with the operable trio of MCC.
- h. 125 V d-c bus D10 or D20 may be inoperable for up to 8 hours provided there are no inoperable safety feature components associated with the operable bus and adequate portable emergency lighting is available during the inoperability of the D20 bus.
- i. One of the four preferred a-c buses may be inoperable for 8 hours provided the reactor protection and engineered safety feature systems supplied by the remaining three buses are all operable.

- j. One of the station batteries may be inoperable for 24 hours, providing both battery chargers on the affected bus are in operation.
- k. One of the diesel generators may be inoperable for up to 7 days (total for both) during any 30-day period, provided the other diesel is started to verify operability, shutdown and the controls are left in the automatic mode, and there are no inoperable engineered safety feature components associated with the operable diesel generator.
- l. 240 V a-c power panel No 1 or power panel No 2 may be inoperable provided that the associated ABCBs are maintained operable by other means. If the ABCBs are not maintained operable, either power panel may be inoperable for up to 24 hours provided that the associated ABCBs are in the "open" position.
- m. The switchyard battery may be inoperable for 24 hours provided both battery chargers are operable.
- n. The 2400 V bus 1E may be inoperable up to 24 hours.
- o. The switchyard 125 V d-c power panel No 1 or power panel No 2 may be inoperable provided the associated ABCBs are maintained operable by other means. If the ABCBs are not maintained operable, either power panel may be inoperable for up to 24 hours provided that the associated ABCBs are in the "open" position.
- p. The contents of the underground fuel oil storage tank may be between 16,000 gallons and 10,000 gallons for 72 hours.
- q. Both fuel oil transfer pumps may be inoperable for 16 hours.

Basis

The electrical system equipment is arranged so that no single contingency can inactivate enough safeguards equipment to jeopardize the plant safety. The 480 V equipment is arranged on four buses. The 2400 V equipment is supplied from two buses.

The normal source of auxiliary power with the plant at power is from the station power transformers being fed from the main generator with standby power from the start-up transformer and emergency power from either one of two diesel generators.⁽¹⁾ To supplement the standby power source, a spare 345 -2.4/4.16 kV 25 MVA transformer is installed and can be connected in place of a start-up transformer within 3 days.⁽²⁾ There are two emergency power sources on site which do not require outside power or use of the start-up transformer. Upon loss of normal and standby power sources, the 2400 V buses are energized from the diesel generators. Bus load shedding, transfer to the diesel generator and pickup of critical loads are carried out automatically.⁽³⁾

When the turbine generator is out of service for an extended period, the generator can be isolated by the removal of links in the bus between the generator and the main transformer, allowing the main transformer and the station power transformers to be returned to service. (1)

The two 4160 V buses each provide power for two primary coolant pumps and a condensate pump. (4) Operation of the plant could continue if one of these buses were not available as long as power level, etc, were in accordance with Sections 2 and 3.1.2 of these specifications. The design of the electrical system has been carried out with reliability as a prime consideration. Station power is provided from three independent sources. The outage of any two sources will not cause interruption of service to the station power supply 2400 V or below, down to and including 125 V d-c supply.

Equipment served by the engineered safeguards buses is arranged so that loss of an entire bus does not compromise safety of the plant during DBA conditions. (3) For example, if 2400 V bus 1D is lost, two service water pumps, one containment spray pump and three containment air cooler recirculation fans are lost. This leaves two containment spray pumps, one containment air cooler recirculation fan and one service water pump, which is more than sufficient to control containment pressure below the design value during the DBA.

The requirements for MCC No. 1, 2, 7, 8, 21, 22, 23, 24, 25, and 26 as well as the 480 V distributions buses 11, 12, 19 and 20 will assure availability of safety equipment such as charging pumps, boric acid pumps and safety injection valves. The 125 V d-c buses D10 and D20 are required for critical instrument and control operations.

The required minimum fuel oil availability of 2500 gallons in each diesel's day tank is considered adequate since approximately 20 hours running time (worst case loading) is available before transfer to fuel oil from the storage tank is mandatory. The fuel oil transfer pumps are used for transferring fuel oil from the storage tank to the day tanks. In addition, a connection is available outside the diesel rooms to pump oil directly into the day tanks from an oil tanker truck. The 16,000 gallons in the storage tank in addition to the day tank will provide a diesel operation under required loading conditions for a minimum period of 6 days. (5) It is considered incredible not to be able to secure fuel oil from one of several sources within a radius of 70 miles in less than three days under the worst of weather conditions. One battery charger on each battery shall be operating so that the batteries will always be at full charge in anticipation of loss-of-ac power incident. This insures that adequate d-c power will be available for starting the emergency generators and other emergency uses. Each battery has two battery chargers available rated at 200 amperes each. Except for the first minute following a DBA, the capacity of the two battery chargers will handle all required loads. The second battery continues to be available in the event of a DBA to pick up the load from its half of the installed engineered

safeguards. (6) Each of the reactor protective system channels and the engineered safeguards instrumentation channels is supplied by one of the preferred a-c buses. The removal of one of the preferred a-c buses is permitted as the 2-of-4 logic can be changed to a 2-of-3 or 1-of-2 logic without compromising reactor safety. (7)

Reliable switchyard operation requires the availability of the d-c system in the switchyard for breaker controls and the 240 V a-c system for air compressor operation. The power and air requirements are small, however, and readily adaptable to temporary hookup to alternate power panels or air compressors, so continued operation without the time limitations is permitted provided the affected Air Blast Circuit Breakers (ABCBs) can be restored to operability through such temporary hookups. In all such situations, restoration to normal conditions shall be accomplished as soon as practicable.

The 2400 V bus 1E is required to assure availability of the pressurizer heaters.

To attain a high degree of reliability for starting and assuming load, the diesel generators are started to prove operability and shutdown with the controls left in the automatic "start" position.

References

- (1) FSAR, Section 8.1.2.
- (2) FSAR Update, Section 8.1.
- (3) FSAR, Section 8.3.2 and 8.4.
- (4) FSAR, Section 8.3.1.
- (5) FSAR, Section 8.4.1.3.
- (6) FSAR, Section 8.4.2.
- (7) FSAR, Section 8.3.5.