

## ELECTRICAL POWER SYSTEMS

### 3/4.8.2 ONSITE POWER DISTRIBUTION SYSTEMS

#### A.C. DISTRIBUTION - OPERATING

#### LIMITING CONDITION FOR OPERATION

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3.8.2.1 The following A.C. electrical busses shall be OPERABLE and energized from sources of power other than the diesel generators:

4 kvolt	Vital Bus # 2A
4 kvolt	Vital Bus # 2B
4 kvolt	Vital Bus # 2C
460 volt	Vital Bus # 2A and associated control centers
460 volt	Vital Bus # 2B and associated control centers
460 volt	Vital Bus # 2C and associated control centers
230 volt	Vital Bus # 2A and associated control centers
230 volt	Vital Bus # 2B and associated control centers
230 volt	Vital Bus # 2C and associated control centers
115 volt	Vital Instrument Bus # 2A and Inverter *
115 volt	Vital Instrument Bus # 2B and Inverter *
115 volt	Vital Instrument Bus # 2C and Inverter *
115 volt	Vital Instrument Bus # 2D and Inverter *

APPLICABILITY: MODES 1, 2, 3 and 4.

#### ACTION:

- a. With less than the above complement of A.C. busses OPERABLE or energized, restore the inoperable busses to OPERABLE and energized status within 8 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- b. With one inverter inoperable, energize the associated A.C. Vital Bus within 8 hours; restore the inoperable inverter to OPERABLE and energized status within 7 days or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

#### SURVEILLANCE REQUIREMENTS

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4.8.2.1 The specified A.C. busses and inverters shall be determined OPERABLE and energized from A.C. sources other than the diesel generators in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignment and indicated voltage on the busses.

\* An inverter may be disconnected from its D.C. source for up to 24 hours for the purpose of performing an equalizing charge on its associated battery bank provided (1) its vital bus is OPERABLE and energized, and (2) the vital busses associated with the other battery banks are OPERABLE and energized.

## ELECTRICAL POWER SYSTEMS

### A.C. DISTRIBUTION - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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3.8.2.2 As a minimum, two A.C. electrical bus trains shall be OPERABLE and energized from sources of power other than a diesel generator but aligned to an OPERABLE diesel generator with each train consisting of:

- 1 - 4 kvolt Vital Bus
- 1 - 460 volt Vital Bus and associated control centers
- 1 - 230 volt Vital Bus and associated control centers
- 1 - 115 volt Instrument Bus energized from its respective inverter connected to its respective D.C. bus train.

APPLICABILITY: MODES 5 and 6.  
During movement of irradiated fuel assemblies.

#### ACTION:

With less than the above complement of A.C. busses and inverters OPERABLE and energized, immediately declare the affected required features inoperable, or suspend all operations involving CORE ALTERATIONS, positive reactivity changes, and movement of irradiated fuel assemblies until the minimum required A.C. electrical power sources are restored to OPERABLE status.

#### SURVEILLANCE REQUIREMENTS

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4.8.2.2 The specified A.C. busses and inverters shall be determined OPERABLE and energized from A.C. sources other than the diesel generators in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignment and indicated voltage on the busses.

## ELECTRICAL POWER SYSTEMS

### 125-VOLT D.C. DISTRIBUTION - OPERATING

#### LIMITING CONDITION FOR OPERATION

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3.8.2.3 The following D.C. bus trains shall be OPERABLE and energized:

TRAIN 2A	consisting of 125-volt D.C. bus No. 2A, 125-volt D.C. battery No. 2A and battery charger 2A1.
TRAIN 2B	consisting of 125-volt D.C. bus No. 2B, 125-volt D.C. battery No. 2B and battery charger 2B1.
TRAIN 2C	consisting of 125-volt D.C. bus No. 2C, 125-volt D.C. battery No. 2C* and battery charger 2C1.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

- a. With one 125-volt D.C. bus inoperable or not energized, restore the inoperable bus to OPERABLE and energized 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.
- b. With one 125-volt D.C. battery charger inoperable, restore the inoperable charger to OPERABLE status within 2 hours or connect the backup charger for no more than 7 days or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- c. With one or more 125-volt D.C. batteries with one or more battery cell parameters not within the Category A or B limits of Table 4.8.2.3-1:
  1. Verify within 1 hour, that the electrolyte level and float voltage for the pilot cell meets Table 4.8.2.3-1 Category C limits, and
  2. Verify within 24 hours, that the battery cell parameters of all connected cells meet Table 4.8.2.3-1 Category C limits, and
  3. Restore battery cell parameters to Category A and B limits of Table 4.8.2.3-1 within 31 days, and
  4. If any of the above listed requirements cannot be met, comply with the requirements of action f.
- d. With one or more 125-volt D.C. batteries with one or more battery cell parameters not within Table 4.8.2.3-1 Category C values, comply with the requirements of action f.
- e. With average electrolyte temperature of representative cells less than 65°F, comply with the requirements of action f.
- f. Restore the battery to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and COLD SHUTDOWN within the following 30 hours.

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\* During the one-time on-line replacement of station battery 2C, this LCO can be satisfied by a temporary battery as described in PSEG LAR submittal dated March 29, 2010.

## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS

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4.8.2.3.1 Each D.C. bus train shall be determined OPERABLE and energized in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignment and voltage on the bus.

4.8.2.3.2 Each required 125-volt battery and charger shall be demonstrated OPERABLE:

- a. In accordance with the Surveillance Frequency Control Program by verifying that:
  1. The parameters in Table 4.8.2.3-1 meet Category A limits.
  2. The overall battery voltage is greater than or equal to 125 volts on float charge.
- b. In accordance with the Surveillance Frequency Control Program and once within 24 hours after a battery discharge < 110 V and once within 24 hours after a battery overcharge > 150 V by verifying that the parameters in Table 4.8.2.3-1 meet the Category B limits.
- c. In accordance with the Surveillance Frequency Control Program by verifying that:
  1. There is no visible corrosion at terminals or connectors or the connection resistance is:
    - ≤ 150 micro ohms for inter-cell connections,
    - ≤ 350 micro ohms for inter-rack connections,
    - ≤ 350 micro ohms for inter-tier connections,
    - ≤ 70 micro ohms for field cable terminal connections, and
    - ≤ 2500 micro ohms for the total battery connection resistance which includes all inter-cell connections (including bus bars), all inter-rack connections (including cable resistance), all inter-tier connections (including cable resistance), and all field terminal connections at the battery.
  2. The average electrolyte temperature of the representative cells is above 65°F.
- d. In accordance with the Surveillance Frequency Control Program by verifying that:
  1. The cells, cell plates and battery racks show no visual indication of physical damage or abnormal deterioration.
  2. Remove visible terminal corrosion and verify cell-to-cell and terminal connections are coated with anti-corrosion material.

## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS (Continued)

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3. The connection resistance is:
- ≤150 micro ohms for inter-cell connections,
  - ≤350 micro ohms for inter-rack connections,
  - ≤350 micro ohms for inter-tier connections,
  - ≤70 micro ohms for field cable terminal connections, and
  - ≤2500 micro ohms for the total battery connection resistance which includes all inter-cell connections (including bus bars), all inter-rack connections (including cable resistance) all inter-tier connections (including cable resistance) and all field terminal connections at the battery.
- e. In accordance with the Surveillance Frequency Control Program by verifying that the battery charger will supply at least 170 amperes at 125 volts for at least 4 hours.
- f. In accordance with the Surveillance Frequency Control Program, during shutdown\*, by verifying that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated emergency loads for the design duty cycle when the battery is subjected to a battery service test.
- g. In accordance with the Surveillance Frequency Control Program, during shutdown\*, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. Satisfactory completion of this performance discharge test shall also satisfy the requirements of Specification 4.8.2.3.2.f if the performance discharge test is conducted during a shutdown\* where that test and the battery service test would both be required.
- h. At least once per 12 months, during shutdown, if the battery shows signs of degradation OR has reached 85% of the service life with a capacity less than 100% of manufacturers rating, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its capacity on the previous performance test, or is below 90% of the manufacturer's rating.
- i. At least once per 24 months, during shutdown, if the battery has reached 85% of the service life with capacity greater than or equal to 100% of manufacturers rating, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test.

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\* This battery surveillance may be performed, as required, associated with a one-time replacement of station battery 2C when the unit is not shutdown. This testing shall be done when the battery is disconnected from the 2C DC bus. This testing must be completed by February 1, 2011.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

Table 4.8.2.3-1  
Battery Cell Parameters Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE VALUE FOR EACH CONNECTED CELL
Electrolyte level	> Minimum level indication mark, and $\leq$ 1/4 inch above maximum level indication mark (a)	> Minimum level indication mark, and $\leq$ 1/4 inch above maximum level indication mark (a)	Above top of plates, and not overflowing
Float Voltage	$\geq$ 2.13 V	$\geq$ 2.13 V	$\geq$ 2.07 V
Specific Gravity (b) (c)	$\geq$ 1.195	$\geq$ 1.190 AND Average of all connected cells $\geq$ 1.200	Not more than 0.020 below average of all connected cells AND Average of all connected cells $\geq$ 1.190

- (a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during equalizing charge provided it is not overflowing.
- (b) Corrected for electrolyte temperature and level. Level correction is not required, however, when battery charging is < 3 amps when on float charge.
- (c) Or battery charging current is < 3 amps when on float charge. This is acceptable only during a maximum of 7 days following a battery recharge.

## ELECTRICAL POWER SYSTEMS

### 125-VOLT D.C. DISTRIBUTION - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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3.8.2.4 As a minimum, the following D.C. electrical equipment and bus shall be energized and OPERABLE:

- 2 - 125-volt D.C. busses, and
- 2 - 125-volt batteries, each with at least one full capacity charger, associated with each of the above D.C. busses.

APPLICABILITY: MODES 5 and 6.  
During movement of irradiated fuel assemblies.

#### ACTION:

With less than the above complement of D.C. equipment and busses OPERABLE, immediately declare the affected required features inoperable, or suspend all operations involving CORE ALTERATIONS, positive reactivity changes, and movement of irradiated fuel assemblies until the minimum required 125 Volt D.C. electrical power sources are restored to OPERABLE status.

#### SURVEILLANCE REQUIREMENTS

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4.8.2.4.1 The above required 125-volt D.C. busses shall be determined OPERABLE and energized in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignment and indicated power availability.

4.8.2.4.2 The above required 125-volt batteries and chargers shall be demonstrated OPERABLE per Surveillance Requirement 4.8.2.3.2.

ELECTRICAL POWER SYSTEMS

28-VOLT D.C. DISTRIBUTION - OPERATING

LIMITING CONDITION FOR OPERATION

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3.8.2.5 The following D.C. bus trains shall be energized and OPERABLE:

TRAIN 2A consisting of 28-volt D.C. bus No. 2A, 28-volt D.C. battery No. 2A and battery charger 2A1.

TRAIN 2B consisting of 28-volt D.C. bus No. 2B, 28-volt D.C. battery No. 2B, and battery charger 2B1.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

- a. With one 28-volt D.C. bus inoperable or not energized, restore the inoperable bus to OPERABLE and energized 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.
- b. With one required 28-volt D.C. battery charger inoperable, restore the inoperable charger to OPERABLE status within 2 hours or connect the backup charger for no more than 7 days or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.
- c. With one or more 28-volt D.C. batteries with one or more battery cell parameters not within the Category A or B limits of Table 4.8.2.5-1:
  1. Verify within 1 hour, that the electrolyte level and float voltage for the pilot cell meets Table 4.8.2.5-1 Category C limits, and
  2. Verify within 24 hours, that the battery cell parameters of all connected cells meet Table 4.8.2.5-1 Category C limits, and
  3. Restore battery cell parameters to Category A and B limits of Table 4.8.2.5-1 within 31 days, and
  4. If any of the above listed requirements cannot be met, comply with the requirements of action f.
- d. With one or more 28-volt D.C. batteries with one or more battery cell parameters not within Table 4.8.2.5-1 Category C values, comply with the requirements of action f.
- e. With average electrolyte temperature of representative cells less than 65°F, comply with the requirements of action f.
- f. Restore the battery to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and COLD SHUTDOWN within the following 30 hours.

## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS

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4.8.2.5.1 Each D.C. bus train shall be determined OPERABLE and energized in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignment and power availability.

4.8.2.5.2 Each 28-volt battery and above required charger shall be demonstrated OPERABLE:

- a. In accordance with the Surveillance Frequency Control Program by verifying that:
  1. The parameters in Table 4.8.2.5-1 meet Category A limits.
  2. The overall battery voltage is greater than or equal to 27 volts on float charge.
- b. In accordance with the Surveillance Frequency Control Program and once within 24 hours after a battery discharge  $< 25.7$  V and once within 24 hours after a battery overcharge  $> 35$  V by verifying that the parameters in Table 4.8.2.5-1 meet the Category B limits.
- c. In accordance with the Surveillance Frequency Control Program by verifying that:
  1. There is no visible corrosion at terminals or connectors or the connection resistance is:
    - $\leq 50$  micro ohms for inter-cell connections,
    - $\leq 200$  micro ohms for inter-tier connections,
    - $\leq 70$  micro ohms for field cable terminal connections, and
    - $\leq 500$  micro ohms for the total battery connection resistance which includes all inter-cell connections (including bus bars), all inter-tier connections (including cable resistance) and all field terminal connections at the battery.
  2. The average electrolyte temperature of the representative cells is  $\geq 65^{\circ}\text{F}$ .

## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS (Continued)

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- d. In accordance with the Surveillance Frequency Control Program by verifying that:
  - 1. The cells, cell plates and battery racks show no visual indication of physical damage or abnormal deterioration.
  - 2. Remove visible terminal corrosion and verify cell-to-cell and terminal connections are coated with anti-corrosion material.
  - 3. The connection resistance is:
    - ≤ 50 micro ohms for inter-cell connections,
    - ≤ 200 micro ohms for inter-tier connections,
    - ≤ 70 micro ohms for field cable terminal connections, and
    - ≤ 500 micro ohms for the total battery connection resistance which includes all inter-cell connections (including bus bars), all inter-tier connections (including cable resistance) and all field terminal connections at the battery.
- e. In accordance with the Surveillance Frequency Control Program by verifying that the battery charger will supply ≥ 150 amperes at ≥ 28 volts for ≥ 4 hours.
- f. In accordance with the Surveillance Frequency Control Program, during shutdown, by verifying that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated emergency loads for the design duty cycle when the battery is subjected to a battery service test.
- g. In accordance with the Surveillance Frequency Control Program, during shutdown, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. Satisfactory completion of this performance discharge test shall also satisfy the requirements of Specification 4.8.2.5.2.f if the performance discharge test is conducted during a shutdown where that test and the battery service test would both be required.
- h. At least once per 12 months, during shutdown, if the battery shows signs of degradation OR has reached 85% of the service life with a capacity less than 100% of manufacturers rating, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its capacity on the previous performance test, or is below 90% of the manufacturer's rating.
- i. At least once per 24 months, during shutdown, if the battery has reached 85% of the service life with capacity greater than or equal to 100% of manufacturers rating, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

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TABLE 4.8.2.5-1

BATTERY CELL PARAMETER REQUIREMENTS

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE VALUE FOR EACH CONNECTED CELL
Electrolyte Level	>Minimum level indication mark and ≤ 1/4 inch above maximum level indication mark <sup>(a)</sup>	>Minimum level indication mark and ≤ 1/4 inch above maximum level indication mark <sup>(a)</sup>	Above top of plates and not overflowing
Float Voltage	≥2.13 V	≥2.13 V	≥2.07 V
Specific Gravity <sup>(b) (c)</sup>	≥1.195	≥1.190  AND  Average of all Connected cells ≥1.200	Not more than 0.020 below the average of all connected cells  AND  Average of all connected cells ≥1.190

- (a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during equalizing charge provided it is not overflowing.
- (b) Corrected for electrolyte temperature and level. Level correction is not required, however, when battery charging is < 2 amps when on float charge.
- (c) Or battery charging current is < 2 amps when on float charge. This is acceptable only during a maximum of 7 days following a battery recharge.

## ELECTRICAL POWER SYSTEMS

### 28-VOLT D.C. DISTRIBUTION - SHUTDOWN

#### LIMITING CONDITION FOR OPERATION

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3.8.2.6 As a minimum, the following D.C. electrical equipment and bus shall be energized and OPERABLE:

- 1 - 28-volt D.C. bus, and
- 1 - 28-volt battery and at least one full capacity charger associated with the above D.C. bus.

APPLICABILITY: MODES 5 and 6.  
During movement of irradiated fuel assemblies.

#### ACTION:

With less than the above complement of D.C. equipment and busses OPERABLE, immediately declare the affected required features inoperable, or suspend all operations involving CORE ALTERATIONS, positive reactivity changes, and movement of irradiated fuel assemblies until the minimum required 28 Volt D.C. electrical power sources are restored to OPERABLE status.

#### SURVEILLANCE REQUIREMENTS

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4.8.2.6.1 The above required 28-volt D.C. bus shall be determined OPERABLE and energized in accordance with the Surveillance Frequency Control Program by verifying correct breaker alignment and voltage on the bus.

4.8.2.6.2 The above required 28-volt batteries and charger shall be demonstrated OPERABLE per Surveillance Requirement 4.8.2.5.2.