

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 1A consisting of 28-volt D.C. bus No. 1A, 28-volt D.C. battery No. 1A and battery charger 1A1.

TRAIN 1B consisting of 28-volt D.C. bus No. 1B, 28-volt D.C. battery No. 1B and battery charger 1B1.

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 battery 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 at least once per 7 days 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. At least once per 7 days 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. At least once per 92 days 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. At least once per 92 days by verifying that:
  1. There is no visible corrosion at terminals or connectors or 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.
  2. The average electrolyte temperature of the representative cells is ≥ 65°F.
- d. At least once per 12 months 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.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

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- e. At least once per 18 months by verifying that the battery charger will supply  $\geq 150$  amperes at  $\geq 28$  volts for  $\geq 4$  hours.
- f. At least once per 18 months, 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. At least once per 60 months, 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)

TABLE 4.8.2.5-1

BATTERY CELL PARAMETER REQUIREMENTS

| PARAMETER                              | CATEGORY A:<br>LIMITS FOR EACH<br>DESIGNATED PILOT CELL  | CATEGORY B:<br>LIMITS FOR EACH<br>CONNECTED CELL  | CATEGORY C:<br>ALLOWABLE VALUE<br>FOR EACH<br>CONNECTED CELL  |
|--|--|---|---|
| Electrolyte<br>Level                   | >Minimum level<br>indication mark and<br>≤ 1/4 inch above<br>maximum level<br>indication mark <sup>(a)</sup> | >Minimum level<br>indication mark<br>and ≤ 1/4 inch<br>above maximum<br>level indication<br>mark <sup>(a)</sup> | Above top of<br>plates and not<br>overflowing   |
| Float Voltage                          | ≥2.13 V  | ≥2.13 V   | ≥2.07 V   |
| Specific<br>Gravity <sup>(b) (c)</sup> | ≥1.195   | ≥1.190<br><br>AND<br><br>Average of all<br>Connected cells<br>≥1.200  | Not more than<br>0.020 below the<br>average of all<br>connected cells<br><br>AND<br><br>Average of all<br>connected cells<br>≥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 - 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 at least once per 7 days 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. At least once per 7 days 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. At least once per 92 days 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. At least once per 92 days by verifying that:
  1. There is no visible corrosion at terminals or connectors or 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.
  2. The average electrolyte temperature of the representative cells is ≥ 65°F.
- d. At least once per 12 months 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:  
  
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ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

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- e. At least once per 18 months by verifying that the battery charger will supply  $\geq 150$  amperes at  $\geq 28$  volts for  $\geq 4$  hours.
- f. At least once per 18 months, 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. At least once per 60 months, 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

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| PARAMETER                              | CATEGORY A:<br>LIMITS FOR EACH<br>DESIGNATED PILOT CELL  | CATEGORY B:<br>LIMITS FOR EACH<br>CONNECTED CELL  | CATEGORY C:<br>ALLOWABLE VALUE<br>FOR EACH<br>CONNECTED CELL  |
|--|--|---|---|
| Electrolyte<br>Level                   | >Minimum level<br>indication mark and<br>≤ 1/4 inch above<br>maximum level<br>indication mark <sup>(a)</sup> | >Minimum level<br>indication mark<br>and ≤ 1/4 inch<br>above maximum<br>level indication<br>mark <sup>(a)</sup> | Above top of<br>plates and not<br>overflowing   |
| Float Voltage                          | ≥2.13 V  | ≥2.13 V   | ≥2.07 V   |
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- (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.
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