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2.6.1 AC Electric Power Systems

2.6.1.1 Design Description

The ac electric power system includes the following system and components: offsite transmission system, plant switchyard, main transformer (MT), main generator (MG), generator load break switch (GLBS), unit auxiliary transformers (UATs), reserve auxiliary transformers (RATs), station service transformers (SSTs), switchgear, load centers, motor control centers (MCCs), panel boards, and cables for power, control and instrumentation. The 6.9kV buses of the onsite Class 1E ac electric power systems are supplied from offsite sources through the UATs, RATs or from onsite EPSs. Normal preferred supply to the Class 1E 6.9kV buses is through the RATs. During SBO, these buses can be powered from onsite AAC power sources. ~~Separation is maintained between these buses for all incoming circuits. Class 1E divisional independence is maintained through all voltage levels.~~ Class 1E power systems have four independent redundant divisions, A, B, C and D, corresponding to four divisions of safety-related load groups except for systems containing two 100% redundant load groups. The two 100% load groups are powered from divisions A and D distribution systems identified as A1 and D1. The A1 buses can be powered from A or B division power sources, and D1 buses can be powered from D or C division power sources.

Comment [TEH1]: These statements are addressed in items 2, 3, 4, and 5.

1. The functional arrangement of the ac electrical power systems is as described in the Design Description of this Subsection 2.6.1 and as shown in ~~onsite electric power system configuration is depicted on~~ Figure 2.6.1-1. ~~Table 2.6.1-1 shows electrical and seismic classification of major Class 1E ac electrical power distribution equipment.~~

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~~Class 1E power systems have four independent redundant divisions, A, B, C and D, corresponding to four divisions of safety related load groups except for systems containing two 100% redundant load groups. The two 100% load groups are powered from divisions A and D distribution systems identified as A1 and D1. The A1 buses can be powered from A or B division power sources, and D1 buses can be powered from D or C division power sources.~~

Comment [TEH2]: Moved to lead-in paragraph.

2. Independence is maintained between each division of the four divisions of the Class 1E equipment and circuits, and between Class 1E equipment and circuits and non-Class 1E equipment and circuits.
- 2.3. Independence between Class 1E electric power distribution equipment and non-Class 1E loads is maintained by Class 1E qualified isolation devices.
- 3.4. ~~Independence is established between each of the four divisions of the Class 1E AC electric power system and its associated distribution equipment.~~ Class 1E electric power distribution equipment of redundant divisions, shown in Table 2.6.1-1, is located in separate rooms in the reactor building. ~~Areas containing Class 1E power distribution equipment are designated as vital areas and have controlled access.~~

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5. Each Class 1E ~~The A, B, C and D~~ EPSs are located in a separate rooms in the power source buildings.
- 4.6. a. Each of the four divisions of the Class 1E AC electrical power system equipment, identified in Table 2.6.1-1 is designed to withstand seismic design basis loads without loss of safety function.

~~All Class 1E equipment and raceway are seismic Category I and qualified for postulated environmental conditions.~~

6. b. ~~During all normal modes of plant operation and accident conditions, the Class 1E 6.9kV buses are powered through the RATs.~~ If power from the RATs is not available, the buses ~~is~~are automatically transferred to the UATs, if ~~they are~~available.
6. c. If both offsite sources are not available, the Class 1E medium voltage bus ~~buses~~ automatically connects to its~~their~~ respective EPS.
7. For all plant trip conditions, except for a trip due to electrical fault in the MT, MG, GLBS, UATs and associated equipment and circuits, the GLBS is opened.
- ~~6-8.~~ For electrical faults in the MT, MG, GLBS, UATs and associated equipment and circuits, ~~these equipment and circuits,~~ the MT circuit breaker at the switchyard ~~opens~~is opened.
9. Reserved
10. The UATs and RATs power sources are sized for worst case loading conditions for all modes of plant operation and accident conditions.
11. a. The Class 1E distribution equipment and circuits are sized to carry the worst case load currents, to withstand the maximum fault currents, and to provide minimum design basis voltage at load terminals to support accomplishment of its safety functions.
11. b. The Class 1E cables are sized considering derating due to ambient temperature and raceway loading.
12. The interrupting ratings of the Class 1E circuit breakers and fuses are adequate for maximum available fault currents.
13. The MT, UATs, and RATs have their own fire deluge system, oil pit and drain system.
14. The UATs power feeders are separated from RATs power feeders.
15. The MT and GLBS power feeders are separated from the RATs power feeders.
16. The dc control power for Class 1E switchgear and load centers of each division are supplied from the same division of the dc system.

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17. Equipment and circuits of each Class 1E division are uniquely identified.
18. The Class 1E equipment is protected from sustained degraded voltage conditions.
19. There is no provision for automatic connection between redundant Class 1E buses.

~~Class 1E ac electric distribution system overcurrent protection is set for proper coordination.~~

Comment [TEH3]: Moved to item #21.

~~The post fire safe shutdown circuit analysis ensures that one success path of shutdown SSCs remains free of fire damage.~~

Comment [TEH4]: Moved to item #22.

~~The potential effects of harmonics introduced by non-linear loads are evaluated for effects on Class 1E equipment.~~

Comment [TEH5]: Moved to item #23.
Reworded to match DC.

20. a. The voltage and current of the Class 1E medium voltage bus are displayed in the MCR.

20. b. Class 1E 6.9kV switchgear and 480V load center bus incoming circuit breakers listed in Table 2.6.1-2 have local and MCR ~~remote~~ control, and status displays in the MCR. ~~See Table 2.6.1-2 for details.~~

21. Class 1E ac electric distribution system overcurrent protection is set for proper coordination.

22. The post-fire safe-shutdown circuit analysis ensures that one success path of shutdown SSCs remains free of fire damage.

23. The potential effects on Class 1E equipment of harmonics introduced by non-linear loads is maintained within requirements.

~~20.~~24. The non-segregated busducts/cable buses to Class 1E buses in the T/B electrical room are segregated into two groups by qualified fire barriers.

~~The Class 1E ac power systems are designed to permit periodic inspection and testing at appropriate intervals in order to assess system continuity, availability and the condition of system components. Class 1E ac power systems are designed to provide the capability to perform integral periodic testing of safety systems.~~

~~The connection between the Class 1E 6.9kV buses and non-Class 1E AAC power sources is provided through two isolation devices in series, which are normally open. One Class 1E circuit breaker is provided at the Class 1E 6.9kV switchgear and the other is a non-Class 1E disconnect switch at the selector circuits.~~

Comment [TEH6]: Addressed in the DD for Section 2.6.5.

~~Independence is maintained between Class 1E electric power distribution equipment and non safety-related loads by Class 1E qualified isolation devices.~~

Comment [TEH7]: Moved to item #3.

~~IATs, RATs, SSTs and EPSs are sized for worst case loading conditions for all normal modes of plant operation, including safe shutdown and accident conditions. The Class 1E distribution equipment and circuits are sized to carry the worst case load currents, to~~

Comment [TEH8]: Moved to item #10.

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~~withstand the maximum fault currents, and to provide minimum design basis voltage at load terminals for all modes of plant operation and accident conditions. Cables are sized considering their potential derating due to ambient temperature and raceway loading. The interrupting ratings of the circuit breakers and fuses are adequate for maximum available fault currents.~~

Comment [TEH9]: Moved to item #11.a.

Comment [TEH10]: Moved to item #11.b

Comment [TEH11]: Moved to item #12.

~~The MT, UATs, and RATs have their own fire deluge system, oil pit and drain system.~~

Comment [TEH12]: Moved to item #13.

~~Power feeders for the RATs, UATs, EPSs and AAC power sources are separated from each other. Power feeders for the MT and GLBS are separated from the RATs, EPSs and AAC power sources.~~

Comment [TEH13]: Moved to item #14. EPS and AAC removed as they as covered in 2.6.4 and 2.6.5 respectively.

~~The dc control power for Class 1E switchgear and load centers of each division are supplied from the same division of the dc system.~~

Comment [TEH14]: Moved to item #15. EPS and AAC removed as they as covered in 2.6.4 and 2.6.5 respectively.

~~Equipment and circuits of each Class 1E division are uniquely identified.~~

Comment [TEH15]: Moved to item #16.

Comment [TEH16]: Moved to item #17.

~~Class 1E equipment are protected from sustained degraded voltage conditions.~~

Comment [TEH17]: Moved to item #18.

~~There is no provision for automatic connection between redundant Class 1E buses.~~

Comment [TEH18]: Moved to item #19.