## ENCLOSURE 1
## FINAL MARK-UPS FOR CHAPTER 8 AND CONFORMING CHANGES FOR FSAR REVISION

| Description of Change | Pages Affected |
|---|---|
| Section 8.3.1.3.5: "An analysis is performed to verify acceptable insulation coordination on surge arresters installed on the as-built MSUs, EATs, and NATs." | Tier 1 > Pages 2.5-112 |
| Section 8.2.2: Editorial – last sentence should read "is described in Section 8.2.2.1 through Section 8.2.2.10." | Page 8.2-4 |
| Section 8.2.2.4: Editorial – Sentence discussion degraded voltage grid setpoints links to table 3.3.1-2 in the Tech Specs. This table does not exist in Chapter 16. | Page 8.2-6 |
| EEEB staff requested inclusion of a paragraph with description of the open-phase protection and Phase Monitoring System in FSAR Section 8.3.1.1.3 for completeness of the electric circuit protection description in Section 8.3. | Page 8.3-3 |
| Section 8.3.1.1.3: "At each bus, all three phases are monitored to develop respective voltage signals. Voltage on NAT secondary windings is also monitored to verify there is an adequate transfer source available. Two-out-of-three logic (which prevents a single phase fault from initiating the system or preventing its operation) is used to initiate protection features as follows" | Page 8.3-8 |
| Section 8.3.1.1.5: "Motor minimum torque values are not less than the criteria specified in Reference 7. The pump torque requirements through the acceleration period are less than the motor starting torque provided while the motor is at minimum specified voltage." | Page 8.3-14 |
| Section 8.3.1.2.2: Editorial last sentence – should this read without the "Section 3.11", i.e., "Safety-related electrical equipment located in an environmental harsh or radiation harsh environment that require qualification are listed in Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment." | Page 8.3-26 |
| Section 8.3.1.2.4: "The EDGs continuous load rating has been established utilizing the guidance in RG 1.9. In developing EDG load rating, performance characteristics for motors were calculated based on 90 percent efficiency, and power factors of 85 percent or less." | Page 8.3-28 |
| Section 8.3.1.3.5: FSAR text states: "Acceptable coordination is achieved if PRL1 and PRL2 are equal to or greater than 1.2, and PRS is equal to or greater than 1.15." However, the technical document states: " Acceptable coordination is achieved if PRL1 and PRL2 are equal to or greater than 1 .15, and PRs is equal to or greater than 1 .2." | Page 8.3-37 |

| Description of Change | Pages Affected | |
|---|---|---|
| Table 8.3-1, Item 5 feeder breaker states the max continuous current as 2000A however, Table 4.9 of 51-9033549-005 states that this is 1200A. | Page 8.3-61 > | Table 8.3-1 |
| Table 8.3-1, Item 6 feeder breaker states the max interrupting current as 100kA for EPSS however Table 4.10 of 51-9033549-005 states that this is 85 kA for safety systems. | Page 8.3-62 > | Table 8.3-1 |
| Table 8.3-1, Item 7 EPSS MCCs state max bracing current as 100 kA however, Table 4-8 of 51-9033549-005 states that this is 85 kA for safety systems. | Page 8.3-63 > | Table 8.3-1 |
| Table 8.3-1 Item 7 for the feeder breakers – should the “max bus bracing current” be the “max interrupting current” | Page 8.3-63 > | Table 8.3-1 |
| Table 8.3-1, Item 7 EPSS feeder breaker states the max bus bracing as 100kA – Table 4-10 of 51-9033549-005 states that this is 85 kA for safety systems. | Page 8.3-64 > | Table 8.3-1 |
| Table 8.3-1 Item 7, EPSS/NPSS feeder breaker state the max continuous current as 1600 and 3200 A however, Table 4-10 states that this current is 2500A for both. | Page 8.3-64 > | Table 8.3-1 |
| Table 8.3-1 Item 8, Updated Table values | Pages 8.3-65, 8.3-66 > | Table 8.3-1 |
| Tables 8.3-4 through 8.3-7 EDG loads and sequence. | Pages 8.3-69, 8.3-70, 8.3-71, 8.3-73, 8.3-74, 8.3-75 ><br>Pages 8.3-78, 8.3-79, 8.3-80, 8.3-82, 8.3-83 ><br>Pages 8.3-87, 8.3-88, 8.3-89, 8.3-91, 8.3-92 ><br>Pages 8.3-96, 8.3-97, 8.3-99, 8.3-100, 8.3-101, 8.3-102 > | Table 8.3-4<br>Table 8.3-5<br>Table 8.3-6<br>Table 8.7-7 |
| Table 8.3-11, Item 2 the rated minimum input voltage for Divs 1 and 4 are different from Divs 2 and 3 per the SDD 15-5070039-001 (424Vac vs 413 Vac). | Page 8.3-117 > | Table 8.3-11 |
| Table 8.3-11, Items 6 and 7 – Item 6: Revised to the short-circuit calc 32-9063962-001.<br>Item 7: Revised FSAR to reflect information in Appendix A13 of the ETAP rule book and equipment sizing document (51-9033549-005) | Page 8.3-117 > | Table 8.3-11 |
| Table 8.3-11, Item 9 states the required output current is 600A however, the sizing calc 32-9029017-004 states that this is 475A.<br>Revised table 8.3-11 item 9 to indicate 475 A per 12UPS sizing document. | Page 8.3-118 > | Table 8.3-11 |
| Table 8.3-11, Item 10 states the required inverted power is 160 kVA, however the sizing calc 32-9029017-004 states that this is 126 kVA.<br>Revised table 8.3-11 item 10 to indicate 126 kVA per 12UPS sizing document | Page 8.3-118 > | Table 8.3-11 |
| Tables 8.3-13-8.3-16. Revised Tables 8.3-13 through 8.3-16 with the updated EUPS information from EUPS sizing document (32-9026879-004) Appendix B | Page 8.3-122 ><br>Page 8.3-123 ><br>Page 8.3-124 ><br>Page 8.3-125 > | Table 8.3-13<br>Table 8.3-14<br>Table 8.3-15<br>Table 8.3-16 |

| Description of Change | Pages Affected |
|---|---|
| Figure 8.3-3 (sheet 1 of 5): The cross-tie breakers between the 33BBG bus and 34BBG buses should have a "NO" as the SDD Section 4.1 (15-9028406-004) states that these are normally open. | Page 8.3-130 > Figure 8.3-3 |
| Figure 8.3-3 (sheet 2 of 5): The cross-tie breaker between 31BFE and 32BFE should have a "NO" as the SDD Section 4.1 (15-9028406-004) states that these are normally open. | Page 8.3-131 > Figure 8.3-3 |
| Figure 8.3-3 (sheet 3 of 5): The cross-tie breaker between 31BFE and 32BFE should have a "NO" as the SDD Section 4.1 (15-9028406-004) states that these are normally open. | Page 8.3-132 > Figure 8.3-3 |
| Figure 8.3-3 (sheet 4 of 5): The cross-tie breaker between the 33BBG bus and 34BBG buses should have a "NO" as the SDD Section 4.1 (15-9028406-004) states that these are normally open. | Page 8.3-133 > Figure 8.3-3 |
| Figure 8.3-3 (sheet 5 of 5): The cross-tie breaker between the 33BBG bus and 34BBG buses should have a "NO" as the SDD Section 4.1 (15-9028406-004) states that these are normally open. | Page 8.3-134 > Figure 8.3-3 |
| Section 8.4.1.3: Editorial "Non-safe" should be "Non-safety"? | Page 8.4-5 |
| EEEB staff discussed that a Chapter 16 Table (3.3.1-2, in Revision 4 FSAR) related to "Acquisition and Processing Unit Requirements Referenced from Table 3.3.1-1," has been withdrawn by the licensee in interim Rev 5 of the FSAR. This withdrawn Table 3.3.1-2 is also referenced in Chapter 8, Section 8.2.2.4 as this table contained degraded voltage/loss of voltage setpoints for EDG actuation and has not been revised accordingly. The applicant noted the discrepancy and agreed to update. The staff mentioned that a revised FSAR is required for review. | Page 8.2-6 |
| Due to reanalysis of Station Blackout cooldown, remove specific final RCS temperature 602°F. Insert statement "the RCS remains subcooled, and temperature is slowly decreasing" | Page 8.4-13 |
| Tables 8.4-1, 8.4-2<br>Reconcile SBO Diesel Loading redistribution. | Page 8.4-17 > Table 8.4-1<br>Page 8.4-18 > Table 8.4-2 |

**Table 2.5.8-1—Lightning Protection and Grounding System ITAAC
Sheet 2 of 2**

| | Commitment Wording | Inspections, Tests, Analyses | Acceptance Criteria |
|---|---|---|---|
| 2.6 | Insulation coordination is achieved on surge arrestors on MSUs, NATs, and EATs. | a. An analysis will be performed to determine the insulation ratings for MSU, NAT, and EAT surge arrestors. | a. An analysis concludes: The lightning impulse protective ratio of the chopped wave withstand to the front-of-wave protection level is equal to or greater than 1.152. The lightning impulse protective ratio of the basic lightning impulse insulation level to the lightning impulse protective level is equal to or greater than 1.152. The switching impulse protective ratio of the basic switching impulse insulation level to the switching impulse protective level is equal to or greater than 1.215. |
| | | b. An inspection will be performed to verify that the as-built insulation ratings for MSU, NAT, and EAT surge arrestors meet the approved design criteria. | b. The insulation ratings for MSU, NAT, and EAT surge arrestors meet the approved design criteria. |

Next File

The physical separation that is provided among the MSUs, NATs and EATs power feeds and control circuits includes these:

- A separate takeoff structure is provided for each preferred power circuit overhead line from the switchyard to the EAT to reduce the likelihood of simultaneous failure of both circuits.
- Power cables between the EATs and 6.9 kV Class 1E switchgear buses are physically independent (to the extent practical) to minimize the likelihood of simultaneous failure.
- Control power to each EAT is separated from each other and the PPS power circuits.
- Each phase of the main generator output is routed to the MSU in an isolated phase bus.
- MSUs and auxiliary transformers are separated from plant buildings in accordance with the guidance provided by RG 1.189.
- EATs are separated from each other and the NATs and MSUs by at least 50 feet or by a one hour rated fire barrier.

The station auxiliary transformer distribution to the EPSS and NPSS is illustrated in Figure 8.3-2—Emergency Power Supply System Single Line Drawing and Figure 8.3-3—Normal Power Supply System Single Line Drawing. Transformer ratings are included in Table 8.3-1—Onsite AC Power System Component Data Nominal Values.

[[The MSU and auxiliary transformers have a deluge fire protection system that provides a distribution spray pattern over the respective transformer for fire suppression. The deluge system is automatically actuated by a heat-sensing device located around the perimeter of the respective transformer or manually activated from the transformer valve station. Additionally, each transformer has an oil retention pit.]]

## 8.2.2 Analysis

Offsite power meets the acceptance criteria established in 10 CFR 50, Appendix A. Additionally, conformance with the regulations and the recommendations of RGs, BTPs, as well as industry codes and standards adopted by the RGs, is described in Section 8.2.2.1 through ~~Section 8.2.2.7~~ Section 8.2.2.10.

### 8.2.2.1 Compliance with GDC 2

Offsite power system components are designed in accordance with GDC 2 to withstand effects of natural phenomena (excluding seismic, hurricane, tornado, and flood) without loss of capability to perform their intended functions within the

A COL applicant that references the U.S. EPR design certification will provide a site-specific grid stability analysis. The results of the analysis will demonstrate that:

- The PPS is not degraded below a level that will activate EPSS degraded grid protection actions after any of the following single contingencies:
  - U.S. EPR turbine-generator trip.
  - Loss of the largest unit supplying the grid.
  - Loss of the largest transmission circuit or inter-tie.
  - Loss of the largest load on the grid.
- The transmission system will not subject the reactor coolant pumps to a sustained frequency decay of greater than 3.5 Hz/s as bounded by the decrease in reactor coolant system flow rate transient and accident analysis described in Section 15.3.2.

The U.S. EPR is designed to operate within a transmission system operating voltage of ± 10 percent and not initiate the degraded voltage protection actions as described in Section 8.3.1.1.3. Degraded grid setpoints are provided in Chapter 16, Specification 3.3.8~~1~~, Table 3.3.8-1~~Table 3.3.1-2~~. Regulation of the transmission system by the transmission system operator within these limits during normal operation and single contingencies provides sufficient voltage to safety-related loads during design basis events.

The PPS provides two circuits from the transmission system to the Class 1E distribution system through the station switchyard that are sized to supply the maximum expected coincident safety-related and non-safety-related loads during normal and abnormal operations as indicated in IEEE Std 308-2001 (Reference 2) and endorsed by RG 1.32.

A COL applicant that references the U.S. EPR design certification will describe essential elements of a program for the operation, setpoint determination, and surveillance testing of the Phase Monitoring System for the GDC 17 off-site power feeds to address NRC Bulletin 2012-01 (Reference 5).

### 8.2.2.5 Compliance with GDC 18

Offsite power complies with GDC 18. The offsite power system is designed to permit periodic testing and inspection of the system and components to assess its performance. A COL applicant that references the U.S. EPR design certification will provide site-specific information for the station switchyard equipment inspection and testing plan.

percent voltage. The bus voltage is maintained at the nominal 100 percent following a ± ten percent deviation in the switchyard voltage combined with bus voltage changes as a result of changes in bus loading. The EPSS connection with offsite power utilizes no intervening non-Class 1E buses and does not share a common winding from the preferred power EATs with the non-Class 1E switchgear. This minimizes the probability that transients of non-safety-related loads will adversely affect the Class 1E equipment and eliminates additional failure points between the offsite source and the Class 1E equipment. The integrity of the electrical ties between the onsite and offsite power systems is constantly monitored. The capability of the preferred power circuits to deliver power to the safety-related buses is sensed by an open phase monitoring system on the high voltage side connection to the offsite power supply as described in Section 8.2.2.4. Undervoltage and degraded voltage protection of the Class 1E buses is described in Section 8.3.1.1.3.

The EAT protection detects faults and initiates protection actions to minimize any potential damage to an EAT, while minimizing impact to the electrical distribution system by isolating the affected transformer in the event of a transformer fault. Protection devices installed for EAT protection include transformer differential, ground fault overcurrent, phase overcurrent and sudden pressure relays. An EAT related fault initiates an automatic fast transfer of the offsite power source, maintaining offsite power to all four divisions by switching the affected bus power supply to the unaffected EAT. The combined four EPSS divisions load under postulated conditions are within the ratings of each of the EATs. The fast transfer minimizes voltage decay and frequency difference to limit motor torque during the transfer, thus minimizing equipment degradation.

The EPSS distribution switchgear and nominal bus voltages are shown in Table 8.3-2—Emergency Power Supply System Switchgear, Load Center and Motor Control Center Numbering and Nominal Voltage.

EPSS divisions are functionally independent and physically separated from the others during normal bus alignments. An alternate feed is provided between EPSS divisions 1 and 2 (first divisional pair) to provide the normal and standby source of power to required safety-related systems, safety-related support systems, or components that do not have the required redundancy when certain electrical components, including the division 1 emergency diesel generator (EDG), are out of service. A similar alternate feed provides standby power to EPSS division 2, from division 1 when certain electrical components, including the division 2 EDG are out of service. Similar alternate feeds are used between divisions 3 and 4 (second divisional pair).

The divisional pair functional independence and physical separation are in accordance with IEEE Std 603-1998 (Reference 1) for safety-related system independence. This is accomplished by the separation of safety-related components between divisional pairs. A single failure or internal hazard, or both, in one divisional pair can only affect that initiation signal permits ride-through of momentary voltage transients to prevent unnecessary separation of the offsite power supply and EDG starts.

- Once the degraded voltage setpoint is reached, two time delays are started in the PS. The first time delay is sufficient to allow bus voltage to recover from the largest motor starting inrush current and to allow a fault to clear. If the degraded voltage condition exists at the end of the first time delay, an alarm will alert the operator to the condition so that corrective action can be taken. The second time delay is sufficient to allow bus voltage to be restored by the EAT on-load tap changer. If a safety injection (SI) signal is received following the first time delay, the PS initiates a signal to separate the Class 1E switchgear from the preferred power source and start the respective division EDG. If the degraded voltage condition still exists at the completion of the second time delay, the PS separates the switchgear from the preferred power source and the respective division EDG is started and connected to the switchgear regardless of SI signal condition. Load shedding is described in Section 8.3.1.1.5. Sequencing of loads onto the EPSS following a loss of voltage is shown in Table 8.3-4—Division 1 Emergency Diesel Generator Nominal Loads, Table 8.3-5—Division 2 Emergency Diesel Generator Nominal Loads, Table 8.3-6—Division 3 Emergency Diesel Generator Nominal Loads, and Table 8.3-7—Division 4 Emergency Diesel Generator Nominal Loads for each EPSS division.

- An alarm is initiated for a degraded voltage condition related to bus high voltage.

- The EPSS undervoltage and degraded voltage protection is periodically tested to verify operation per the surveillance requirements detailed in Chapter 16. PS testing capability is described in Section 7.3.2.3.6.

~~The NPSS undervoltage scheme is used to detect a loss of voltage on the individual non-Class 1E 13.8 kV buses 31BBA, 32BBA, 33BBA, and 34BBA. At each bus, all three phases are monitored to develop respective voltage signals. Voltage on NAT secondary windings is also monitored to verify there is an adequate transfer source available. Two-out-of-three logic (which prevents a single phase fault from initiating the system or preventing its operation) is used to initiate protection features as follows:~~

- ~~Once the loss of voltage setpoint is reached and a time delay is satisfied, the respective bus load feeder breakers are tripped. The NAT secondary winding voltage monitoring verifies there is voltage on the NAT secondary and initiates a transfer of the bus to the alternate source. The undervoltage setpoint and time delay setting permits ride-through of momentary voltage transients to prevent unnecessary bus transfers.~~

- ~~An alarm is initiated for a degraded voltage condition related to high voltages.~~

A loss of voltage on any of the 13.8 kV NPSS buses 31BBA, 32BBA, 33BBA, or 34BBA is detected by the bus undervoltage scheme and the respective bus load feeder circuit breakers are tripped after a set time delay. A synch check relay is used to perform a residual voltage transfer to the alternate NAT. The load feeders on the bus are then manually re-energized once the power supply from the alternate NAT is restored.

- Excitation fault (over and under excitation).
- Reverse power during parallel (with the grid) operation.
- Generator field ground.

Each protection device listed initiates an annunciator in the MCR, RSS and locally. Alarms and instrumentation are installed in the MCR and locally so that EDG monitoring, trending, and inservice testing programs can be accomplished. The alarm system is equipped with a first-out feature that indicates which EDG trip was actuated first, along with indication of other trips that are received. Alarms are indicated locally on an alarm display on the EDG local panel. Table 8.3-8—Emergency Diesel Generator Indications and Alarms, provides a list of local and remote alarms and indications for the EDGs.

The EDG bypass or deliberately induced inoperable conditions are automatically alarmed in the MCR. The bypass and inoperable status indicators provide operators with accurate information about the status of each EDG. Disabling or bypass indicators are separated from non-disabling indicators in accordance with BTP 8-7 (Reference 28), which allows operators to clearly determine the ability of the respective EDG to respond to emergency demand.

### Performance – Emergency Diesel Generators

During normal plant operation, the EDGs remain in standby mode with the engines pre-lubricated and cooling water pre-heated for the EDG to be ready to start and accept load. The I&C PS EDG start signal is based on EPSS bus voltage, as described in Section 8.3.1.1.3, or an SI signal.

The EDGs are designed to start and accelerate to rated speed, then start and carry the loads listed on Table 8.3-4, Table 8.3-5, Table 8.3-6 and Table 8.3-7 in the sequence indicated. The EDG capacity can supply the power requirement of the safety-related and non-safety-related loads assigned to the respective EDG bus, and loads on the division that could be aligned to the EDG via the EPSS alternate feeds. ~~Motor minimum torque values are not less than the criteria specified in Reference 7. The pump torque requirements through the acceleration period are less than the motor starting torque provided while the motor is at minimum specified voltage.~~

If a LOOP occurs during EDG testing, the EPSS bus is separated from the offsite power supply. The other redundant divisional EPSS switchgear separate from the EATs due to their individual bus monitoring circuits and undervoltage protection. The remaining EDGs start and supply power to the respective EPSS divisions.

Once an EDG start signal is initiated, the EDG automatically starts and accelerates to rated speed, adjusts for proper speed and voltage, and is in a ready-to-load condition.

- Three Mile Island (TMI) action plan requirements of NUREG-0737 (Reference 14).

Conformance with recommendations of RGs as well as IEEE Standards adopted by the RGs is described in this section.

#### 8.3.1.2.1 Compliance with GDC 2

The onsite AC distribution system Class 1E components are located in Seismic Category I structures capable to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without losing their capability to perform safety-related functions. The nature and magnitude of the natural phenomena considered in the U.S. EPR design are described in Chapter 2. The U.S. EPR design criteria for wind, hurricane, tornado, flood, and earthquakes are described in Section 3.3, Section 3.4, and Section 3.7, respectively.

#### 8.3.1.2.2 Compliance with GDC 4

Class 1E onsite AC distribution system components are located in Seismic Category I structures, in rooms constructed in such a manner that any internal hazard only affects the respective division. There are no high energy lines routed through the dedicated electrical rooms containing EPSS equipment such as switchgear, LCs, MCCs and distribution transformers. These rooms are also provided conditioned air that maintains ambient environmental conditions within equipment qualifications during normal operations and DBEs. Details of the design and construction of safety-related structures are included in Chapter 3.

The environmental qualification program for electrical equipment provides reasonable assurance that equipment remains operable during and following exposure to harsh environmental conditions as a result of a design basis event. An evaluation of equipment locations will be performed to determine if any electrical equipment will have to be qualified for submerged operation. Environmental qualification is described in Section 3.11. Safety-related electrical equipment located in an environmental harsh or radiation harsh environment that require qualification are listed in ~~Section 3.11,~~ Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment.

#### 8.3.1.2.3 Compliance with GDC 5

GDC 5 is satisfied with the U.S. EPR designed as a single-unit station.

#### 8.3.1.2.4 Compliance with GDC 17

Compliance with GDC 17 is accomplished through the design of the onsite power AC distribution system capacity, capability, independence, redundancy, and meeting the application of the single failure criteria.

### Conformance with RG 1.9

The EDG mechanical and electrical design properties for starting and loading, including following light load or no load operation, have been incorporated so that they will start, accelerate to rated speed and properly sequence design loads while maintaining nominal frequency and voltage within limits specified in RG 1.9.

The EDGs continuous load rating has been established utilizing the guidance in RG 1.9; specifically it is greater than the sum of the conservatively estimated connected loads that the EDG will power at any one time. In developing EDG load rating, performance characteristics for motors were calculated based on 90 percent efficiency~~, and power factors of 85 percent or less~~. At least ten percent margin exists in each EDG to account for future load growth.

An EDG emergency start signal overrides the engine and generator protection trips that are only effective during non-emergency conditions. The emergency start signal also overrides manual shutdown initiated at the controlling station. When operating in emergency mode, bypassed conditions that would have resulted in an EDG trip are annunciated in the MCR and locally to alert the operators of the abnormal condition.

Each EDG is equipped with controls and indications to startup, shutdown and parallel the generator with the preferred power source from the MCR and RSS. Safety-related EDG components, controls, indications and control panels are classified as Seismic Category I in accordance with RG 1.29. Control power for each EDG is from the EUPS system of the same division. The EDG auxiliary support components, including the starting air system compressors, Emergency Power Generating Building Ventilation system and fuel oil transfer pumps are powered from Class 1E buses from the same EPSS division the EDG serves.

EDG design, performance and testing, including preoperational testing, is described in Section 8.3.1.1.5.

### Conformance with RG 1.32

The onsite AC power system has been designed in accordance with Reference 3, as endorsed by RG 1.32 to provide Class 1E power at the required quality which enables the safety-related systems to meet their functional requirements. The EPSS is the Class 1E onsite AC distribution system and the design and preoperational testing is described in Section 8.3.1.1.1.

### Conformance with RG 1.53

The EPSS has been designed so that safety-related systems have the necessary electrical power to perform their safety-related function in the presence of a single detectable failure, all failures caused by the single failure, and all failures caused by a

$$PR_{L1} = \frac{CWW}{FOW}$$

$$PR_{L2} = \frac{BIL}{LPL}$$

$$PR_{S} = \frac{BSL}{SPL}$$

Where:

| | |
|---|---|
| $PR_{L1}$ | Lightning impulse protective ratio |
| $PR_{L2}$ | Lightning impulse protective ratio |
| $PR_{S}$ | Switching impulse protective ratio |
| CWW | Chopped wave withstand |
| FOW | Front-of-wave protection level |
| BIL | Basic lightning impulse insulation level |
| LPL | Lightning impulse protective level |
| BSL | Basic switching impulse insulation level |
| SPL | Switching impulse protective level |

Acceptable coordination is achieved if $PR_{L1}$ and $PR_{L2}$ are equal to or greater than 1.15~~2~~, and $PR_{S}$ is equal to or greater than 1.2~~15~~. An analysis is performed to verify acceptable insulation coordination on surge arresters installed on the as-built MSUs, EATs, and NATs.

### 8.3.1.3.6 Power Quality Limits

Electrical distribution systems have been designed to provide power to the connected loads such that the effects of total harmonic distortion (THD) in the Class 1E power systems do not degrade safety-related system performance. Equipment that is susceptible to degradation due to THD includes motors, transformers and switchgear due to a combination of copper and stray flux loses, and iron losses which can increase component heating, thereby shortening the life of some insulating components and reducing the steady-state current carrying capacity. Equipment connected to the distribution system that can contribute to THD includes battery chargers and inverters, which have been designed and selected to minimize the harmonics they inject into the distribution system buses. THD is maintained within the acceptance criteria of IEEE 519-1992 (Reference 35).

Medium voltage motor protection is described in Section 8.3.1.1.3. EDG protection is described in Section 8.3.1.1.5. Main generator protection is described in Section 8.3.1.1. Protective device application is consistent with the power quality

**Table 8.3-1—Onsite AC Power System Component Data Nominal Values**
**Sheet 1 of 5**

| Component | | Nominal Ratings |
|---|---|---|
| 1. | MSUs<br>(30BAT01, 30BAT02, 30BAT03, 30BAT04) | 26 kV-(site-specific), single phase, 60 Hz<br>2100MVA (700MVA each phase)<br>Cooling Class ODAF<br>Temperature Rise 65°C |
| 2. | EATs (30BDT01, 30BDT02) | (site-specific)-6.9 kV-6.9 kV, three phase, 60 Hz<br>Rated Power 25/33.3/41.5 MVA<br>Cooling Class ONAN/ONAF/ONAF<br>Temperature Rise 65°C |
| 3. | NATs (30BBT01, 30BBT02) | (site-specific)-13.8 kV-13.8 kV, three phase, 60 Hz<br>Rated Power 140/186.2/232.4 MVA<br>Cooling Class ONAN/ONAF/ONAF<br>Temperature Rise 65°C |
| 4. | NPSS 13.8 kV Switchgear | Rated Maximum Voltage, 15 kV<br>Maximum Bus Bracing Current, 164 kA rms |
| | Feeder Circuit Breaker | Maximum Rated Interrupting Current, 63 kA<br>Maximum Rated Closing and Latching Current 164 kA (peak value) |
| | 31BBA, 32BBA, 33BBA, 34BBA | Maximum Continuous Current, 3000 A |
| | 31BBC, 32BBC, 33BBC, 34BBC<br>31BBD, 32BBD, 33BBD, 34BBD<br>31BDE, 32BDE, 33BDE, 34BDE | Maximum Continuous Current, 1200 A |
| 5. | EPSS and NPSS 6.9 kV Switchgear | Rated Maximum Voltage, 8.25 kV<br>Maximum Bus Bracing Current, 104 kA rms |
| | Feeder Circuit Breaker | Maximum Rated Interrupting Current 40 kA rms<br>Maximum Rated Closing and Latching Current 104 kA (peak value) |
| | 31BBH, 32BBH, 33BBH, 34BBH | Maximum Continuous Current, 2000 A |
| | 31BDA, 32BDA, 33BDA, 34BDA<br>31BDB, 32BDB, 33BDB, 34BDB<br>31BDD, 32BDD, 33BDD, 34BDD<br>31BDC, 34BDC, 33BBG, 34BBG | Maximum Continuous Current, 1200 A |

**Table 8.3-1—Onsite AC Power System Component Data Nominal Values**
**Sheet 2 of 5**

| Component | | Nominal Ratings |
|---|---|---|
| 6. | EPSS 480 Vac Load Centers | Rated Maximum Voltage, 508V<br>Maximum Bus Bracing Current, 85 kA rms |
| | 31BMB, 32BMB, 33BMB, 34BMB | Maximum Continuous Current, 3000 A |
| | 31BMD, 32BMD, 33BMD, 34BMD<br>31BMC, 34BMC | Maximum Continuous Current, 2000 A |
| | NPSS 480 Vac Load Centers | Rated Maximum Voltage, 508V<br>Maximum Bus Bracing Current, 100 kA rms |
| | 31BFD, 32BFD, 33BFD, 34BFD<br>31BFE, 32BFE, 34BFE<br>31BFF, 32BFF, 33BFF, 34BFF<br>31BFG, 32BFG, 33BFG, 34BFG<br>31BFX, 32BFX | Maximum Continuous Current, 4000 A |
| | 31BFA, 32BFA, 33BFA, 34BFA<br>31BFB, 32BFB, 31BFC, 32BFC | Maximum Continuous Current, 2000 A |
| | EPSS and NPSS 480 Vac Feeder Breaker | Rated Maximum Voltage, 508 V<br>Maximum Rated Interrupting Current 100 kA rms |
| | 31BFD, 31BFE | Maximum Continuous Current, 4000 A |
| | 32BFD, 33BFD, 34BFD, 32BFE, 34BFE, 31BFF, 32BFF, 33BFF, 34BFF, 31BFG, 32BFG, 33BFG, 34BFG, 31BFX, 32BFX, 34BMB | Maximum Continuous Current, 3200 A |
| | 31BMB | Maximum Continuous Current, 2000 A |
| | 32BMB, 33BMB, 31BMD, 32BMD, 33BMD, 34BMD, 31BMC, 34BMC, 31BFA, 32BFA, 33BFA, 34BFA<br>31BFB, 32BFB, 31BFC, 32BFC | Maximum Continuous Current, 1600 A |

## Table 8.3-1—Onsite AC Power System Component Data Nominal Values
Sheet 3 of 5

| Component | | Nominal Ratings |
|---|---|---|
| 7. | EPSS 480 Vac MCCs | Rated Maximum Voltage, 508V<br>Maximum Bus Bracing Current, 85 kA rms |
| | 32BNA02, 33BNA02 | Maximum Continuous Current, 1200 A |
| | 31BNA01, 32BNA01, 33BNA01, 34BNA01 | Maximum Continuous Current, 1000 A |
| | 31BNB01, 34BNB01, 31BNC01, 34BNC01 | Maximum Continuous Current, 800 A |
| | 32BNB01, 33BNB01, 31BNB02, 32BNB02, 33BNB02, 34BNB02, 31BNB03, 32BNB03, 33BNB03, 34BNB03, 31BND01, 32BND01, 33BND01, 34BND01 | Maximum Continuous Current, 600 A |
| | NPSS 480 Vac MCCs | Rated Maximum Voltage, 508V<br>Maximum Bus Bracing Current, 100 kA rms |
| | 31BHD01, 32BHD01, 31BHE01, 32BHE01 | Maximum Continuous Current, 2500 A |
| | 33BHD01, 34BHD01 | Maximum Continuous Current, 2000 A |
| | 31BHD02, 32BHD02, 34BHD02, 34BHE01 | Maximum Continuous Current, 1200 A |
| | 33BHD02 | Maximum Continuous Current, 1000 A |
| | 31BHB01 | Maximum Continuous Current, 800 A |
| | 31BHA01, 32BHA01, 33BHA01, 34BHA01, 31BHB02, 32BHB01, 32BHB02, 31BHC01, 32BHC01, 31BHF01, 32BHF01, 31BHX01, 32BHX01, 31BHZ01, 32BHZ01, 31BRC, 32BRC, 31BRJ, 32BRJ, 31BRB, 32BRB, 33BRB, 34BRB | Maximum Continuous Current, 600 A |

**Table 8.3-1—Onsite AC Power System Component Data Nominal Values**
**Sheet 4 of 5**

| Component | | Nominal Ratings |
|---|---|---|
| | EPSS 480 Vac MCC Feeder Breakers | Rated Maximum Voltage, 508V<br>Maximum Interrupting Current, 100 kA rms |
| | 32BNA02, 33BNA02 | Maximum Continuous Current, 1200 A |
| | 31BNA01, 32BNA01, 33BNA01, 34BNA01 | Maximum Continuous Current, 1000 A |
| | 31BNB01, 34BNB01, 31BNC01, 34BNC01, 32BNB02, 33BNB02, 34BNB02, | Maximum Continuous Current, 800 A |
| | 32BNB01, 33BNB01, 31BNB02, 31BNB03, 32BNB03, 33BNB03, 34BNB03, 31BND01, 32BND01, 33BND01, 34BND01 | Maximum Continuous Current, 600 A |
| | NPSS 480 Vac MCC Feeder Breakers | Rated Maximum Voltage, 508V<br>Maximum Interrupting Current, 100 kA rms |
| | 31BHD01, 32BHD01, 31BHE01, 32BHE01 | Maximum Continuous Current, 2500 A |
| | 33BHD01, 34BHD01 | Maximum Continuous Current, 2000 A |
| | 31BHD02, 32BHD02, 34BHD02, 34BHE01 | Maximum Continuous Current, 1200 A |
| | 33BHD02 | Maximum Continuous Current, 1000 A |
| | 31BHB01 | Maximum Continuous Current, 800 A |
| | 31BHA01, 32BHA01, 33BHA01, 34BHA01, 31BHB02, 32BHB01, 32BHB02, 31BHC01, 32BHC01, 31BHF01, 32BHF01, 31BHX01, 32BHX01, 31BHZ01, 32BHZ01, 31BRC, 32BRC, 31BRJ, 32BRJ, 31BRB, 32BRB, 33BRB, 34BRB | Maximum Continuous Current, 600 A |

**Table 8.3-1—Onsite AC Power System Component Data Nominal Values**
**Sheet 5 of 5**

| Component | | Nominal Ratings |
|---|---|---|
| 8. | EPSS Distribution Transformers: | Dry type<br>60 Hz, three phase, air cooled |
| | 31BMT02, 34BMT02 | 6.9 kV TO 480 Vac<br>2000 kVA |
| | 31BMT01, 32BMT01, 33BMT01, 34BMT01, 32BMT02, 33BMT02, 31BMT03, 32BMT03, 33BMT03, 34BMT03, 31BMT04, 32BMT04, 33BMT04, 34BMT04 | 6.9 kV TO 480 Vac<br>1500 kVA |
| | 31BNT01, 32BNT01, 33BNT01, 34BNT01 | 480 Vac to 480 Vac<br>500 kVA<br>Rated Input Voltage 460 Vac<br>Rated Output Voltage 480 Vac |

| Component | | Nominal Ratings |
|---|---|---|
| 4. | NPSS 13.8 kV Switchgear | Rated Maximum Voltage, 15 kV<br>Maximum Continuous Current, 3000 A<br>Maximum Bus Bracing Current, 164 kA rms |
| | NPSS 13.8 kV Feeder Breaker | Rate Maximum Voltage, 15 kV<br>Maximum Continuous Current, 3000 A<br>Maximum Rated Interrupting Current, 63 kA<br>Maximum Rated Closing and Latching Current 164 kA (peak value) |
| 5. | EPSS and NPSS 6.9 kV Switchgear | Rated Maximum Voltage, 8.25 kV<br>Maximum Continuous Current, 2000 A<br>Maximum Bus Bracing Current, 104 kA rms |
| | EPSS and NPSS 6.9 kV Feeder Breaker | Rated Maximum Voltage, 8.25 kV<br>Maximum Continuous Current, 2000 A<br>Maximum Rated Interrupting Current 40 kA rms<br>Maximum Rated Closing and Latching Current 104 kA (peak value) |
| 6. | EPSS and NPSS 480 Vac Load Centers | Rated Maximum Voltage, 508 V<br>Maximum Continuous Current, 4000 A<br>Maximum Bus Bracing Current, 100 kA rms |
| | EPSS and NPSS 480 Vac Feeder Breaker | Rated Maximum Voltage, 508 V<br>Maximum Continuous Current, 4000 A<br>Maximum Rated Interrupting Current 100 kA rms |

| Component | | Nominal Ratings |
|---|---|---|
| 7. | EPSS 480 Vac MCCs | Rated Maximum Voltage, 508 V<br>Maximum Continuous Current, 1600 A<br>Maximum Bus Bracing Current, 100 kA rms |
| | NPSS 480 Vac MCCs | Rated Maximum Voltage, 508 V<br>Maximum Continuous Current, 3200 A<br>Maximum Bus Bracing Current, 100 kA rms |
| | EPSS 480 Vac MCC Feeder Breaker | Rated Maximum Voltage, 508 V<br>Maximum Continuous Current, 1600 A<br>Maximum Bus Bracing Current, 100 kA rms |
| | NPSS 480 Vac MCC Feeder Breaker | Rated Maximum Voltage, 508 V<br>Maximum Continuous Current, 3200 A<br>Maximum Bus Bracing Current, 100 kA rms |
| 8. | EPSS Distribution Transformers: | Dry type<br>60 Hz, three phase, air cooled |
| | 31BMT01, 32BMT01, 33BMT01, 34BMT01, 31BMT02, 34BMT02 | 6.9 kV to 480 Vac<br>2500 kVA |
| | 32BMT02, 33BMT02, 31BMT03, 32BMT03, 33BMT03, 34BMT03, 31BMT04, 32BMT04, 33BMT04, 34BMT04 | 6.9 kV to 480 Vac<br>1500 kVA |
| | 31BNT01, 32BNT01, 33BNT01, 34BNT01 | 480 Vac to 480 Vac<br>500 kVA<br>Rated Input Voltage 460 Vac<br>Rated Output Voltage 480 Vac |

## Table 8.3-4—Division 1 Emergency Diesel Generator Nominal Loads
### Sheet 1 of 7

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| Load Step Group 1 | | | | | | |
| 0 | Start Signal | | | | | |
| 15 | EDG reaches rated speed and voltage/output breaker closes | | | | | |
| 15 | Emergency power generating building electric room supply fan | 480 | 10 Bhp | | 8.3 | 8.3 |
| 15 | Emergency power generating building fuel oil storage tank room fan | 480 | ~~13.4~~ 10 Bhp | | ~~11.1~~8.3 | ~~11.1~~8.3 |
| 15 | EDG starting air compressor | 480 | 61 Bhp | | 50.6 | 50.6 |
| 15 | EDG auxiliary loads | 480 | 9.7 kW | | 9.7 | 9.7 |
| 15 | Vent stack monitoring | 480 | 13 kW | | 13 | 13 |
| 15 | Division 1 EUPS battery charger (4) | 480 | 106 kW | | 106 | 106 |
| 15 | Annulus ventilation heating unit | 480 | 6 kW | | 4.2 (2) | 4.2 (2) |
| 15 | Annulus ventilation fan | 480 | 4.3 Bhp | | 3.6 | 3.6 |
| 15 | KAA/LAR valve room cooling fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Extra boration room cooling fan | 480 | ~~14~~5 Bhp | | 4.1~~11.6~~ | 4.1~~11.6~~ |
| 15 | Fuel pool cooling pu~~n~~mp room cooling fan | 480 | ~~7.7~~5 Bhp | | 4.1~~6.4~~ | 4.1~~6.4~~ |
| 15 | Fuel pool cooling pu~~n~~mp room cooling fan | 480 | ~~7.7~~5 Bhp | | 4.1~~6.4~~ | 4.1~~6.4~~ |
| 15 | Fuel building ventilation heating unit (7) | 480 | ~~1~~5 kW | | 0 | 0 |
| 15 | Safety chilled water pump (6) | 480 | 100 Bhp | | 82.9 | 82.9 |
| 15 | Safety chilled water pump (6) | 480 | 100 Bhp | | 82.9 | 82.9 |

## Table 8.3-4—Division 1 Emergency Diesel Generator Nominal Loads
Sheet 2 of 7

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| 15 | Safety chiller condenser fans (22) | 480 | 325 kW | | 325 | 325 |
| 15 | Main control room air conditioning fan | 480 | 27 Bhp | | 22.4 | 22.4 |
| 15 | Main control room air conditioning filtration unit heater (11) | 480 | 10 kW | | | 7 (2) |
| 15 | Main control room air conditioning iodine filtration fan (11) | 480 | 10 Bhp | | | 8.3 |
| 15 | Safeguard building ventilation heaters (7) | 480 | 210 kW | | 0 | 0 |
| 15 | Safeguard building ventilation supply fan | 480 | 78 Bhp | | 64.7 | 64.7 |
| 15 | Safeguard building ventilation return fan | 480 | 43 Bhp | | 35.6 | 35.6 |
| 15 | Main control room air conditioning fan | 480 | 27 Bhp | 22.4 | | |
| 15 | Safeguard building battery exhaust fan | 480 | 7 Bhp | | 5.8 | 5.8 |
| 15 | Emergency feed water room ventilation recirculation fan | 480 | 2 Bhp | | 1.7 | 1.7 |
| 15 | Emergency lighting panels (18) | 480 | 165.7 kW | | 165.7 | 165.7 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |

**Table 8.3-4—Division 1 Emergency Diesel Generator Nominal Loads**
**Sheet 3 of 7**

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Division 2 EUPS battery charger | 480 | 106 kW | 106 | | |
| 15 | Reactor building ventilation filtration fan | 480 | 10 Bhp | 8.3 | | |
| 15 | KAA/LAR valve room cooling fan | 480 | 5 Bhp | 4.1 | | |
| 15 | Safeguard building ventilation heaters (7) | 480 | 180 kW | 0 | | |
| 15 | Safeguard building ventilation supply fan | 480 | 72 Bhp | 59.7 | | |
| 15 | Safeguard building ventilation return fan | 480 | 43 Bhp | 35.6 | | |
| 15 | Safeguard building battery exhaust fan | 480 | 6 Bhp | 5 | | |
| 15 | Emergency feed water ventilation recirculation fan | 480 | 2 Bhp | 1.7 | | |
| 15 | KAA pump room recirculation fan | 480 | ~~2~~3 Bhp | 2.5~~1.7~~ | | |
| 15 | Emergency lighting panels (18) | 480 | 86.7 kW | 86.7 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |

**Table 8.3-4—Division 1 Emergency Diesel Generator Nominal Loads**
**Sheet 5 of 7**

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| 15 | Emergency power generating building exhaust fan 1 | 480 | 75 hp | | 62.2 | 62.2 |
| 15 | Emergency power generating building exhaust fan 2 | 480 | 75 hp | | 62.2 | 62.2 |
| 15 | Additional connected loads | 480 | 100.9 kW | | 100.9 | 100.9 |
| 15 | Load contribution from transformer and cable losses | | 160 kW | 40 | 120 | 120 |
| Subtotal Load Step Group 1 | | | | ~~469.7~~ 470.5(10) | ~~1717.0~~1702.2 | ~~1754.5~~1739.6 |
| Load Step Group 2 (17) | | | | | | |
| 20 | MHSI pump | 6.9 kV | 700 hp | | | 580 |
| Subtotal Load Step Group 2 | | | | | | 580 |
| Load Step Group 3 (17) | | | | | | |
| 25 | LHSI pump | 6.9 kV | 500 hp | | | 414 |
| Subtotal Load Step Group 3 | | | | | | 414 |
| Load Step Group 4 (14) | | | | | | |
| 30 | CCW pump | 6.9 kV | 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 4 | | | | | 1036 | 1036 |
| Load Step Group 5 (14) | | | | | | |
| 35 | ESW pump | 6.9 kV | ~~1100~~ 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 5 | | | | | 1036 | 1036 |

**Table 8.3-4—Division 1 Emergency Diesel Generator Nominal Loads**
**Sheet 6 of 7**

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| Load Step Group 6 [14] | | | | | | |
| 40 | EFW pump | 6.9 kV | 700 hp | | [5] | 580 |
| Subtotal Load Step Group 6 | | | | | [5] | 580 |
| Load Step Group 7 [14] | | | | | | |
| 45 | Division 1 safety chilled water compressor [23] | 6.9 kV | 1105 kW | | <u>1227.8</u> ~~1105~~ | <u>1227.8</u> ~~1105~~ |
| Subtotal Load Step Group 7 | | | | | <u>1227.8</u> ~~1105~~ | <u>1227.8</u> ~~1105~~ |
| Load Step Group 8 [14] | | | | | | |
| 50 | Essential service water UHS fan 1 | 480 | 250 hp | | 207.2 | 207.2 |
| 50 | Essential service water UHS fan 2 | 480 | 250 hp | | 207.2 | 207.2 |
| Subtotal Load Step Group 8 | | | | | 414.4 | 414.4 |
| Subtotal Alternate Feed Loads | | | | <u>470.5</u> ~~469.7~~ | | |
| Total Automatically Sequenced Loads without alternate feed installed | | | | | <u>5416.6</u> ~~5308.7~~ | <u>7029.0</u> ~~6921.0~~ |
| Total Automatically Sequenced Loads with alternate feed installed | | | | | <u>5887.1</u> ~~5778.4~~ | <u>7499.5</u> ~~7390.7~~ |
| Additional Manually Connected Loads | | | | | | |
| | Emergency pressurizer heaters [16] | 480 | 144 kW | | 144 | |
| | Extra boration pump | 480 | 163 Bhp | | 0 [20] | 0 [20] |
| | Fuel pool cooling pump [21] | 480 | 137 Bhp | | 113.6 | 113.6 |

## Table 8.3-4—Division 1 Emergency Diesel Generator Nominal Loads
Sheet 7 of 7

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| Total Manually Connected Loads | | | | | 257.6 | 113.6 |
| Total Division 1 EDG Loading | | | | | 6144.7<br>~~6035.9~~ | 7613.0<br>~~7504.3~~ |

**Notes:**

1. The kW rating derived from hp rating multiplied by 0.746 conversion factor. Indicated hp is considered rated. Where brake horsepower (Bhp) is indicated, this is from the system mechanical requirements.

2. A diversity factor of 0.7 is assumed in load contribution due to cyclical nature of load.

3. Motor efficiencies estimated at 90 percent.

4. One EUPS battery charger is in service with the other battery charger in standby. Contribution to EDG loading is calculated considering only one battery charger.

5. During a LOOP-only EDG loading sequence, the EFW start is prevented until load step group six, which occurs at 30 seconds. At load step six, the start inhibit is removed and the EFW pump start sequence is based on steam generator low level initiation. If a steam generator low level initiation exists, EFW pump start is given priority over subsequent load steps.
   During a LOOP/LOCA condition, the EFW pump is started at the sequence step indicated.

6. The divisional safety chilled water pumps and chiller are assumed operating for EDG loading purposes.

7. Worst case EDG loading occurs during summer operation when safety chilled water loading is highest. Area heater loads are shown, but do not contribute to overall EDG loading since operating conditions where heater operation is expected does not reflect bounding EDG loading scenario.

## Table 8.3-5—Division 2 Emergency Diesel Generator Nominal Loads
Sheet 1 of 6

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| Load Step Group 1 | | | | | | |
| 0 | Start Signal | | | | | |
| 15 | EDG reaches rated speed and voltage/output breaker closes | | | | | |
| 15 | Emergency power generating building electric room supply fan | 480 | 10 Bhp | | 8.3 | 8.3 |
| 15 | Emergency power generating building fuel oil storage tank room fan | 480 | ~~13.4~~ 10 Bhp | | 8.3~~11.1~~ | 8.3~~11.1~~ |
| 15 | EDG starting air compressor | 480 | 61 Bhp | | 50.6 | 50.6 |
| 15 | EDG auxiliary loads | 480 | 9.7 kW | | 9.7 | 9.7 |
| 15 | Main control room air conditioning fan | 480 | 27 Bhp | | 22.4 | 22.4 |
| 15 | MHSI/LHSI room recirculation fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| ~~15~~ | ~~Main control room air conditioning heaters [7]~~ | ~~480~~ | ~~21 kW~~ | | ~~0~~ | ~~0~~ |
| 15 | Division 2 EUPS battery charger [4] | 480 | 106 kW | | 106 | 106 |
| 15 | Reactor building ventilation filtration fan | 480 | 10 Bhp | | 8.3 | 8.3 |
| 15 | KAA/LAR valve room cooling fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Safety chilled water pump [6] | 480 | 100 Bhp | | 82.9 | 82.9 |
| 15 | Safety chilled water pump [6] | 480 | 100 Bhp | | 82.9 | 82.9 |
| 15 | Safeguard building ventilation heaters [7] | 480 | 180 kW | | 0 | 0 |
| 15 | Safeguard building ventilation supply fan | 480 | 72 Bhp | | 59.7 | 59.7 |
| 15 | Safeguard building ventilation return fan | 480 | 43 Bhp | | 35.6 | 35.6 |

**Table 8.3-5—Division 2 Emergency Diesel Generator Nominal Loads**
**Sheet 2 of 6**

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| 15 | Safeguard building battery exhaust fan | 480 | 6 Bhp | | 5 | 5 |
| 15 | Emergency feed water ventilation recirculation fan | 480 | 2 Bhp | | 1.7 | 1.7 |
| 15 | KAA pump room recirculation fan | 480 | 2 Bhp | | 1.7 | 1.7 |
| 15 | Emergency lighting panels (18) | 480 | 86.7 kW | | 86.7 | 86.7 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Division 1 EUPS battery charger (4) | 480 | 106 kW | 106 | | |
| 15 | Annulus ventilation heating unit | 480 | 6 kW | 4.2 (2) | | |
| 15 | Annulus ventilation fan | 480 | 4.3 Bhp | 3.6 | | |
| 15 | KAA/LAR valve room cooling fan | 480 | 5 Bhp | 4.1 | | |
| 15 | Extra boration room cooling fan | 480 | 5~~14~~ Bhp | 4.1~~11.6~~ | | |
| 15 | Fuel pool cooling pump room cooling fan | 480 | ~~7.7~~5 Bhp | 4.1~~6.4~~ | | |

## Table 8.3-5—Division 2 Emergency Diesel Generator Nominal Loads
## Sheet 3 of 6

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| 15 | Fuel pool cooling pump room cooling fan | 480 | ~~7.7~~5 Bhp | 4.1~~6.4~~ | | |
| 15 | Fuel building ventilation heating unit [7] | 480 | ~~1~~5 kW | 0 | | |
| 15 | Main control room air conditioning fan | 480 | 27 Bhp | 22.4 | | |
| 15 | Main control room air conditioning filtration unit heater [11] | 480 | 10 kW | 7 [2] | | |
| 15 | Main control room air conditioning iodine train fan [11] | 480 | 10 Bhp | 8.3 | | |
| 15 | Safeguard building ventilation heaters [7] | 480 | 210 kW | 0 | | |
| 15 | Safeguard building ventilation supply fan | 480 | 78 Bhp | 64.7 | | |
| 15 | Safeguard building ventilation return fan | 480 | 43 Bhp | 35.6 | | |
| 15 | Safeguard building battery exhaust fan | 480 | 7 Bhp | 5.8 | | |
| 15 | Emergency feed water room ventilation recirculation fan | 480 | 2 Bhp | 1.7 | | |
| 15 | Emergency lighting panels [18] | 480 | 165.7 kW | 165.7 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |

## Table 8.3-5—Division 2 Emergency Diesel Generator Nominal Loads
### Sheet 5 of 6

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| 15 | Lighting (18) | 480 | 300 kW | | 300 | 300 |
| 15 | Reserved for special use (18) | 480 | 125 kW | | 125 | 125 |
| 15 | Load contribution from transformer and cable losses | | 160 kW | 40 | 120 | 120 |
| Subtotal Load Step Group 1 | | | | ~~647.2~~ 635.2 (10) | ~~1619.0~~1616.2 | ~~1619.0~~1616.2 |
| Load Step Group 2 (17) | | | | | | |
| 20 | MHSI pump | 6.9 kV | 700 hp | | | 580 |
| Subtotal Load Step Group 2 | | | | | | 580 |
| Load Step Group 3 (17) | | | | | | |
| 25 | LHSI pump | 6.9 kV | 500 hp | | | 414 |
| Subtotal Load Step Group 3 | | | | | | 414 |
| Load Step Group 4 (14) | | | | | | |
| 30 | CCW pump | 6.9 kV | 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 4 | | | | | 1036 | 1036 |
| Load Step Group 5 (14) | | | | | | |
| 35 | ESW pump | 6.9 kV | ~~1100~~ 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 5 | | | | | 1036 | 1036 |
| Load Step Group 6 (14) | | | | | | |
| 40 | EFW pump | 6.9 kV | 700 hp | | (5) | 580 |
| Subtotal Load Step Group 6 | | | | | (5) | 580 |
| Load Step Group 7 (14) | | | | | | |

**Table 8.3-5—Division 2 Emergency Diesel Generator Nominal Loads**
**Sheet 6 of 6**

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| 45 | Division 2 safety chilled water compressor [22] | 6.9 kV | 947 kW | | 1052.2 947 | 1052.2 947 |
| Subtotal Load Step Group 7 | | | | | 1052.2 947 | 1052.2 947 |
| Load Step Group 8 [14] | | | | | | |
| 50 | Essential service water UHS fan 1 | 480 | 250 hp | | 207.2 | 207.2 |
| 50 | Essential service water UHS fan 2 | 480 | 250 hp | | 207.2 | 207.2 |
| Subtotal Load Step Group 8 | | | | | 414.4 | 414.4 |
| Subtotal Alternate Feed Loads | | | | 647.2635.2 | | |
| Total Automatically Sequenced Loads without alternate feed installed | | | | | 5155.0 5052.6 | 6729.8 6627.5 |
| Total Automatically Sequenced Loads with alternate feed installed | | | | | 5790.3 5699.9 | 7365.1 7274.8 |
| Additional Manually Connected Loads | | | | | | |
| | Extra boration pump | 480 | 163 Bhp | 0 [20] | | |
| | Fuel pool cooling pump [21] | 480 | 137 Bhp | 113.6 | | |
| | Emergency pressurizer heaters [16] | 480 | 144 kW | | 144 | |
| Total Manually Connected Loads | | | | 113.6 | 144 | |
| Total Division 2 EDG Loading | | | | | 6047.85957.4 | 7478.77388.3 |

## Table 8.3-6—Division 3 Emergency Diesel Generator Nominal Loads
Sheet 1 of 6

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| Load Step Group 1 | | | | | | |
| 0 | Start Signal | | | | | |
| 15 | EDG reaches rated speed and voltage/output breaker closes | | | | | |
| 15 | Emergency power generating building electric room supply fan | 480 | 10 Bhp | | 8.3 | 8.3 |
| 15 | Emergency power generating building fuel oil storage tank room fan | 480 | ~~13.4~~10 Bhp | | 8.3~~11.1~~ | 8.3~~11.1~~ |
| 15 | EDG starting air compressor | 480 | 61 Bhp | | 50.6 | 50.6 |
| 15 | EDG auxiliary loads | 480 | 8.7 kW | | 8.7 | 8.7 |
| 15 | Main control room air conditioning fan | 480 | 27 Bhp | | 22.4 | 22.4 |
| 15 | MHSI/LHSI room recirculation fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| ~~15~~ | ~~Main control room air conditioning heaters (7)~~ | ~~480~~ | ~~21 kW~~ | | ~~14.7(2)~~ | ~~14.7(2)~~ |
| 15 | Division 3 EUPS battery charger (4) | 480 | 106 kW | | 106 | 106 |
| 15 | KAA/LAR valve room cooling fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Safety chilled water pump (6) | 480 | 100 Bhp | | 82.9 | 82.9 |
| 15 | Safety chilled water pump (6) | 480 | 100 Bhp | | 82.9 | 82.9 |
| 15 | Safeguard building ventilation heaters | 480 | 180 kW | | 0 | 0 |
| 15 | Safeguard building ventilation supply fan | 480 | 72 Bhp | | 59.7 | 59.7 |
| 15 | Safeguard building ventilation return fan | 480 | 43 Bhp | | 35.6 | 35.6 |
| 15 | Safeguard building battery exhaust fan | 480 | 6 Bhp | | 5 | 5 |

**Table 8.3-6—Division 3 Emergency Diesel Generator Nominal Loads**
**Sheet 2 of 6**

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| 15 | Emergency feed water ventilation recirculation fan | 480 | 2 Bhp | | 1.7 | 1.7 |
| 15 | KAA pump room recirculation fan | 480 | 2 Bhp | | 1.7 | 1.7 |
| 15 | Emergency lighting panels (18) | 480 | 155.7 kW | | 155.7 | 155.7 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Division 4 EUPS battery charger (4) | 480 | 106 kW | 106 | | |
| 15 | Annulus ventilation heating unit | 480 | 6 kW | 4.2 (2) | | |
| 15 | Annulus ventilation fan | 480 | 4.3 Bhp | 3.6 | | |
| 15 | KAA/LAR valve room cooling fan | 480 | 5 Bhp | 4.1 | | |
| 15 | Extra boration room cooling fan | 480 | 5~~14~~ Bhp | 4.1~~11.6~~ | | |
| 15 | Fuel pool cooling pump room cooling fan | 480 | ~~7.7~~5 Bhp | 4.1~~6.4~~ | | |
| 15 | Fuel pool cooling pump room cooling fan | 480 | ~~7.7~~5 Bhp | 4.1~~6.4~~ | | |

**Table 8.3-6—Division 3 Emergency Diesel Generator Nominal Loads**
**Sheet 3 of 6**

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| 15 | Fuel building ventilation heating unit [7] | 480 | ~~1~~5 kW | 0 | | |
| 15 | Main control room air conditioning fan | 480 | 27 Bhp | 22.4 | | |
| 15 | Main control room air conditioning filtration unit heater [11] | 480 | 10 kW | 7 [2] | | |
| 15 | Main control room air conditioning iodine train fan [11] | 480 | 10 Bhp | 8.3 | | |
| 15 | Safeguard building ventilation heaters [7] | 480 | 210 kW | 0 | | |
| 15 | Safeguard building ventilation supply fan | 480 | 78 Bhp | 64.6 | | |
| 15 | Safeguard building ventilation return fan | 480 | 43 Bhp | 35.6 | | |
| 15 | Safeguard building battery exhaust fan | 480 | 7 Bhp | 5.8 | | |
| 15 | Emergency feed water room ventilation recirculation fan | 480 | 2 Bhp | 1.7 | | |
| 15 | Emergency lighting panels [18] | 480 | 178.7 kW | 178.7 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |

## Table 8.3-6—Division 3 Emergency Diesel Generator Nominal Loads
### Sheet 5 of 6

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| 15 | Load contribution from transformer and cable losses | | 160 kW | 40 | 120 | 120 |
| Subtotal Load Step Group 1 | | | | ~~689.8~~677.8 [10] | ~~1644.5~~1641.7 | ~~1644.5~~1641.7 |
| Load Step Group 2 [17] | | | | | | |
| 20 | MHSI pump | 6.9 kV | 700 hp | | | 580 |
| Subtotal Load Step Group 2 | | | | | | 580 |
| Load Step Group 3 [17] | | | | | | |
| 25 | LHSI pump | 6.9 kV | 500 hp | | | 414 |
| Subtotal Load Step Group 3 | | | | | | 414 |
| Load Step Group 4 [14] | | | | | | |
| 30 | CCW pump | 6.9 kV | 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 4 | | | | | 1036 | 1036 |
| Load Step Group 5 [14] | | | | | | |
| 35 | ESW pump | 6.9 kV | ~~1100~~ 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 5 | | | | | 1036 | 1036 |
| Load Step Group 6 [14] | | | | | | |
| 40 | EFW pump | 6.9 kV | 700 hp | | [5] | 580 |
| Subtotal Load Step Group 6 | | | | | [5] | 580 |
| Load Step Group 7 [14] | | | | | | |
| 45 | Division 3 safety chilled water compressor [22] | 6.9 kV | 947 kW | | 1052.2 ~~947~~ | 1052.2 ~~947~~ |

## Table 8.3-6—Division 3 Emergency Diesel Generator Nominal Loads
Sheet 6 of 6

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| Subtotal Load Step Group 7 | | | | | 1052.2 ~~947~~ | 1052.2 ~~947~~ |
| Load Step Group 8 (14) | | | | | | |
| 50 | Essential service water UHS fan 1 | 480 | 250 hp | | 207.2 | 207.2 |
| 50 | Essential service water UHS fan 2 | 480 | 250 hp | | 207.2 | 207.2 |
| Subtotal Load Step Group 8 | | | | | 414.4 | 414.4 |
| Subtotal Alternate Feed Loads | | | | ~~689.8~~677.8 | | |
| Total Automatically Sequenced Loads without alternate feed installed | | | | | 5180.6 ~~5078.1~~ | 6755.4 ~~6653.0~~ |
| Total Automatically Sequenced Loads with alternate feed installed | | | | | 5858.4 ~~5768.0~~ | 7433.3 ~~7342.9~~ |
| Additional Manually Connected Loads | | | | | | |
| | Extra boration pump | 480 | 163 Bhp | 0 (20) | | |
| | Fuel pool cooling pump (21) | 480 | 137 Bhp | 113.6 | | |
| | Emergency pressurizer heaters (16) | 480 | 144 kW | | 144 | |
| Total Manually Connected Loads | | | | 113.6 | 144 | |
| Total Division 3 EDG Loading | | | | | 6115.9 ~~6025.5~~ | 7546.8 ~~7456.4~~ |

**Notes:**

1. The kW rating derived from hp rating multiplied by 0.746 conversion factor. Indicated hp is considered rated. Where brake horsepower (Bhp) is indicated, this is from the system mechanical requirements.

## Table 8.3-7—Division 4 Emergency Diesel Generator Nominal Loads
### Sheet 1 of 7

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| Load Step Group 1 | | | | | | |
| 0 | Start Signal | | | | | |
| 15 | EDG reaches rated speed and voltage/output breaker closes | | | | | |
| 15 | Emergency power generating building electric room supply fan | 480 | 10 Bhp | | 8.3 | 8.3 |
| 15 | Emergency power generating building fuel oil storage tank room fan | 480 | ~~13.4~~10 Bhp | | 8.3~~11.1~~ | 8.3~~11.1~~ |
| 15 | EDG starting air compressor | 480 | 61 Bhp | | 50.6 | 50.6 |
| 15 | EDG auxiliary loads | 480 | 8.7 kW | | 8.7 | 8.7 |
| 15 | Vent stack monitoring | 480 | 13 kW | | 13 | 13 |
| 15 | Division 4 EUPS battery charger [13] | 480 | 106 kW | | 106 | 106 |
| 15 | Annulus ventilation heating unit | 480 | 6 kW | | 4.2 [2] | 4.2 [2] |
| 15 | Annulus ventilation fan | 480 | 4.3 Bhp | | 3.6 | 3.6 |
| 15 | KAA/LAR valve room cooling fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Extra boration room cooling fan | 480 | ~~14~~5 Bhp | | 4.1~~11.6~~ | 4.1~~11.6~~ |
| 15 | Fuel pool cooling pu~~n~~mp room cooling fan | 480 | ~~7.7~~5 Bhp | | 4.1~~6.4~~ | 4.1~~6.4~~ |
| 15 | Fuel pool cooling pu~~n~~mp room cooling fan | 480 | ~~7.7~~5 Bhp | | 4.1~~6.4~~ | 4.1~~6.4~~ |
| 15 | Fuel building ventilation heating unit [7] | 480 | ~~1~~5 kW | | 0 | 0 |
| 15 | Safety chilled water pump [6] | 480 | 100 Bhp | | 82.9 | 82.9 |
| 15 | Safety chilled water pump [6] | 480 | 100 Bhp | | 82.9 | 82.9 |

## Table 8.3-7—Division 4 Emergency Diesel Generator Nominal Loads
Sheet 2 of 7

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| 15 | Safety chiller condenser fans (22) | 480 | 325 kW | | 325 | 325 |
| 15 | Main control room air conditioning fan | 480 | 27 Bhp | | 22.4 | 22.4 |
| 15 | Main control room air conditioning filtration unit heater (11) | 480 | 10 kW | | | 7 (2) |
| 15 | Main control room air conditioning iodine filtration fan (11) | 480 | 10 Bhp | | | 8.3 |
| 15 | Safeguard building ventilation heaters (7) | 480 | 210 kW | | 0 | 0 |
| 15 | Safeguard building ventilation supply fan | 480 | 78 Bhp | | 64.7 | 64.7 |
| 15 | Safeguard building ventilation return fan | 480 | 43 Bhp | | 35.6 | 35.6 |
| 15 | Safeguard building battery exhaust fan | 480 | 7 Bhp | | 5.8 | 5.8 |
| 15 | Emergency feed water room ventilation recirculation fan | 480 | 2 Bhp | | 1.7 | 1.7 |
| 15 | Emergency lighting panels (18) | 480 | 178.7 kW | | 178.7 | 178.7 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | | 4.1 | 4.1 |

## Table 8.3-7—Division 4 Emergency Diesel Generator Nominal Loads
Sheet 4 of 7

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Component cooling water valve hydraulic pump | 480 | 5 Bhp | 4.1 | | |
| 15 | Additional connected alternate feed loads | 480 | 39 kW | 39 | | |
| 15 | Reactor building ventilation filtration fan | 480 | 11 Bhp | | 9.1 | 9.1 |
| 15 | Reactor building filtration heating | 480 | 25 kW | | 25 | 25 |
| 15 | Reactor building pit fan [18] | 480 | 14 Bhp | | 11.6 | 11.6 |
| 15 | Reactor building pit fan [18] | 480 | 14 Bhp | | 11.6 | 11.6 |
| 15 | MHSI/LHSI room recirculation fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | JMU/KUL sample room recirculation fan | 480 | 5 Bhp | | 4.1 | 4.1 |
| 15 | Main control room air conditioning heaters [7] | 480 | 21 kW | | 0 | 0 |
| 15 | Severe accident sampling system | 480 | 28 kW | | | 28 |
| 15 | KAA pump room recirculation fan ~~Safeguard building ventilation recirculation fan~~ | 480 | 3 Bhp | | 2.5 | 2.5 |
| 15 | Essential service water building ventilation and auxiliaries | 480 | 110 kW | | 85.6 [2] [12] | 85.6 [2] [12] |
| 15 | Essential service water building recirculation fan | 480 | 10 Bhp | | 8.3 | 8.3 |
| 15 | Safeguard building controlled-area ventilation system heating unit | 480 | 21 kW | | | 14.7 [2] |
| 15 | Safeguard building controlled-area fan | 480 | 9 Bhp | | | 7.5 |

Next File

## Table 8.3-7—Division 4 Emergency Diesel Generator Nominal Loads
Sheet 5 of 7

| Time Seq. (s) [13] | Load Description [8] [15] [19] | Volts | Rating (hp/kW) [3] | Alternate Feed Load (kW) [1] [12] | Operating Load LOOP (kW) [1] [12] | Operating Load DBA/ LOOP (kW) [1] [12] |
|---|---|---|---|---|---|---|
| 15 | Emergency power generating building supply fan 1 | 480 | 100 hp | | 82.9 | 82.9 |
| 15 | Emergency power generating building supply fan 2 | 480 | 100 hp | | 82.9 | 82.9 |
| 15 | Emergency power generating building exhaust fan 1 | 480 | 75 hp | | 62.2 | 62.2 |
| 15 | Emergency power generating building exhaust fan 2 | 480 | 75 hp | | 62.2 | 62.2 |
| 15 | Additional connected loads | 480 | 189.8 kW | | 189.8 | 189.8 |
| 15 | Load contribution from transformer and cable losses | | 160 kW | 40 | 120 | 120 |
| Subtotal Load Step Group 1 | | | | 495.7 [10] | ~~1820.4~~1805.6 | ~~1885.0~~1870.2 |
| Load Step Group 2 [17] | | | | | | |
| 20 | MHSI pump | 6.9 kV | 700 hp | | | 580 |
| Subtotal Load Step Group 2 | | | | | | 580 |
| Load Step Group 3 [17] | | | | | | |
| 25 | LHSI pump | 6.9 kV | 500 hp | | | 414 |
| Subtotal Load Step Group 3 | | | | | | 414 |
| Load Step Group 4 [14] | | | | | | |
| 30 | CCW pump | 6.9 kV | 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 4 | | | | | 1036 | 1036 |

**Table 8.3-7—Division 4 Emergency Diesel Generator Nominal Loads**
**Sheet 6 of 7**

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| Load Step Group 5 (14) | | | | | | |
| 35 | ESW pump | 6.9 kV | ~~1100~~ 1250 hp | | 1036 | 1036 |
| Subtotal Load Step Group 5 | | | | | 1036 | 1036 |
| Load Step Group 6 (14) | | | | | | |
| 40 | EFW pump | 6.9 kV | 700 hp | | (5) | 580 |
| Subtotal Load Step Group 6 | | | | | (5) | 580 |
| Load Step Group 7 (14) | | | | | | |
| 45 | Division 4 safety chilled water compressor (23) | 6.9 kV | 1105 kW | | 1227.8 ~~1105~~ | 1227.8 ~~1105~~ |
| Subtotal Load Step Group 7 | | | | | 1227.8 ~~1105~~ | 1227.8 ~~1105~~ |
| Load Step Group 8 (14) | | | | | | |
| 50 | Essential service water UHS fan 1 | 480 | 250 hp | | 207.2 | 207.2 |
| 50 | Essential service water UHS fan 2 | 480 | 250 hp | | 207.2 | 207.2 |
| Subtotal Load Step Group 8 | | | | | 414.4 | 414.4 |
| Subtotal Alternate Feed Loads | | | | 495.7 | | |
| Total Automatically Sequenced Loads without alternate feed installed | | | | | 5520.0 ~~5412.1~~ | 7159.5 ~~7051.6~~ |
| Total Automatically Sequenced Loads with alternate feed installed | | | | | 6015.7 ~~5907.8~~ | 7655.2 ~~7547.3~~ |
| Additional Manually Connected Loads | | | | | | |
| | Emergency pressurizer heaters (16) | 480 | 144 kW | | 144 | |

## Table 8.3-7—Division 4 Emergency Diesel Generator Nominal Loads
Sheet 7 of 7

| Time Seq. (s) (13) | Load Description (8) (15) (19) | Volts | Rating (hp/kW) (3) | Alternate Feed Load (kW) (1) (12) | Operating Load LOOP (kW) (1) (12) | Operating Load DBA/ LOOP (kW) (1) (12) |
|---|---|---|---|---|---|---|
| | Extra boration pump | 480 | 163 Bhp | | 0 (20) | 0 (20) |
| | Fuel pool cooling pump (21) | 480 | 137 Bhp | | 113.6 | 113.6 |
| | Severe accident heat removal pump (16) | 6.9 kV | 400 hp | | 0 (20) | 0 (20) |
| Total Manually Connected Loads | | | | | 257.6 | 113.6 |
| Total Division 4 EDG Loading | | | | | 6273.3 ~~6165.3~~ | 7768.8 ~~7660.8~~ |

**Notes:**

1. The kW rating derived from hp rating multiplied by 0.746 conversion factor. Indicated hp is considered rated. Where brake horsepower (Bhp) is indicated, this is from the system mechanical requirements.

2. A diversity factor of 0.7 is assumed in load contribution due to cyclical nature of load.

3. Motor efficiencies estimated at 90 percent.

4. One EUPS battery charger is in service with the other battery charger in standby. Contribution to EDG loading is calculated considering only one battery charger.

5. During a LOOP-only EDG loading sequence, the EFW start is prevented until load step group six, which occurs at 30 seconds. At load step six, the start inhibit is removed and the EFW pump start sequence is based on steam generator low level initiation. If a steam generator low level initiation exists, EFW pump start is given priority over subsequent load steps.
During a LOOP/LOCA condition, the EFW pump is started at the sequence step indicated.

6. The divisional safety chilled water pumps and chiller are assumed operating for EDG loading purposes.

## Table 8.3-11—Onsite DC Power System Component Data Nominal Values Sheet 1 of 2

| Component | Division/Train | Nominal Value |
|---|---|---|
| 1. EUPS Batteries: | Each EUPS Battery | 120 cells<br>2400 AH at eight hour rate to 1.75 V/cell at 77°F [1]<br>2.22 V/cell nominal float voltage<br>2.33 V/cell equalize voltage<br>1.215 nominal specific gravity at 77°F |
| | ~~Divisions 1 and 4~~ | ~~240 cells~~<br>~~1800 AH at eight hour rate to 1.75 V/cell at 77°F [1]~~ |
| | ~~Divisions 2 and 3~~ | ~~120 cells~~<br>~~2147 AH at eight hour rate to 1.75 V/cell at 77°F [1]~~ |
| 2. EUPS Battery Chargers | Divisions 1 and 4 & Divisions 2 and 3 | Rated nominal input voltage 480 Vac, 3 phase<br>Rated maximum input voltage 508 Vac<br>Rated minimum input voltage ~~413~~ 424 Vac<br>Rated nominal AC supply frequency 57 to 63 Hz<br>Rated nominal output voltage 250 Vdc |
| | Divisions 1 and 4 | Required output current ~~382~~ 377 A [2] |
| | Divisions 2 and 3 | Required output current ~~333~~ 300 A [2] |
| 3. EUPS Inverters | Divisions 1 and 4 & Divisions 2 and 3 | Rated nominal input voltage 250 Vdc<br>Rated maximum input voltage 280 Vdc<br>Rated minimum input voltage 200 Vdc<br>Rated nominal output voltage 480 Vac 3 phase<br>Rated power regulation ± 2%<br>Rated nominal output frequency 60 Hz ± ½%<br>Total harmonic distortion less than 5% total voltage distortion, less than 3% individual voltage distortion |
| | Divisions 1 and 4 | Rated power ~~450~~ 300 kVA |
| | Divisions 2 and 3 | Rated power ~~300~~ 200 kVA |
| 4. EUPS AC/DC Converters | Divisions 1 and 4 & Divisions 2 and 3 | Rated Nominal input voltage 480 Vac<br>Rated nominal output voltage 24 Vdc |
| 5. EUPS DC/DC Converters | Divisions 1 and 4 & Divisions 2 and 3 | Rated nominal input voltage 250 Vdc<br>Rated maximum input voltage 280 Vdc<br>Rated minimum input voltage 200 Vdc<br>Rated nominal output voltage 24 Vdc |
| 6. EUPS DC Distribution Switchboard | Divisions 1 and 4 | Rated Continuous Current 2500 A<br>Rated Short Circuit Current ~~39~~ 45 kA |
| | Divisions 2 and 3 | Rated Continuous Current 2000 A<br>Rated Short Circuit Current ~~30~~ 34 kA |
| 7. EUPS AC Distribution MCC | Divisions 1 and 4 & Divisions 2 and 3 | Rated Maximum Voltage, 508 V<br>Maximum Continuous Current, ~~2000~~ 600 A<br>Maximum Bus Bracing Current, ~~100~~ 85 kA rms |

## Table 8.3-11—Onsite DC Power System Component Data Nominal Values
## Sheet 2 of 2

| Component | Division/Train | Nominal Value |
|---|---|---|
| 8. 12UPS Batteries | Trains 1 and 2 | 120 cells<br>2.22 V/cell nominal float voltage<br>2.33 V/cell equalize voltage<br>2400 AH at 12 hour rate to 1.81 V/cell at 77°F (1)<br>1.215 nominal specific gravity at 77°F |
| 9. 12UPS Battery Chargers | Trains 1 and 2 | Rated nominal input voltage 480 Vac, 3 phase<br>Rated maximum input voltage 508 Vac<br>Rated minimum input voltage 424 Vac<br>Rated nominal AC supply frequency 57 to 63 Hz<br>Rated nominal output voltage 250 Vdc<br>Required output current ~~600~~ 475 A (2) |
| 10. 12UPS System Inverters | Trains 1 and 2 | Rated nominal input voltage 250 Vdc<br>Rated maximum input voltage 280 Vdc<br>Rated minimum input voltage 210 Vdc<br>Rated nominal output voltage 480 Vac 3 phase<br>Rated power regulation ± 2%<br>Rated power ~~160~~ 126 kVA<br>Rated nominal output frequency 60 ± ½% |
| 11. 12UPS AC/DC Converters | Trains 1, 2, 3, and 4 | Rated Nominal input voltage 480 Vac ± 2%<br>Rated input frequency 60 Hz ± ½%<br>Rated nominal output voltage 24 Vdc |
| 12. 12UPS DC/DC Converters | Trains 1, 2, 3, and 4 | Rated nominal input voltage 250 Vdc<br>Rated maximum input voltage 280 Vdc<br>Rated minimum input voltage 210 Vdc<br>Rated nominal output voltage 24 Vdc |

**Notes:**

1. Battery amp-hour rating for different discharge rates are in accordance with vendor specific performance characteristic curves.

2. Battery charger current limiter will limit output current to below 150 percent of the full load output current rating.

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## Table 8.3-13—Division 1 Class 1E Uninterruptible Power Supply Nominal Loads

| Load Description | Load Requirement (kW) | | | |
|---|---|---|---|---|
| | Momentary (1) | | Random(2) | Continuous |
| | 0-1 Min | 119-120 Min | 0-1 Min Duration | 0-120 Min |
| Inverter Load (MCC 31BRA) | | | | |
| • ~~Motor Operated~~ Containment Isolation Valves | ~~175.2~~39 | 0 | 0~~138.8~~ | 0~~2.8 (5)~~ |
| • Solenoid Valves | 0~~.1~~ | 0~~.1~~ | 0 | 2.3~~3.3~~ |
| • Valves and Dampers | 98.6~~0~~ | 0 | 165.9~~44.8~~ | 0 |
| • AC/DC Converters | 0 | 0 | 0 | ~~31.3~~31.4 |
| • I&C Systems | 0 | 0 | 0 | ~~10.5~~10.2 |
| • 31BRA Control Power | 0~~2~~ | 0 | 1.6~~2~~ | 0.3 |
| • Main Steam Relief Control Valve | 0 | 0 | 0 | 2.8 |
| Total Inverter Loads | 137.6~~177.3~~ | 0~~.1~~ | 167.5~~185.6~~ | 47~~48.2~~ |
| 250 Vdc Loads (switchgear 31BUC) | | | | |
| • Control Power | ~~18.5~~17.7 | 0 | 0 | 1.2 |
| • DC/DC Converters (3) | 0 | 0 | 0 | 0 |
| • Inverter Load (4) | 158.2~~203.8~~ | 0~~.1~~ | 192.5~~213.3~~ | 54~~5.4~~ |
| • EDG Auxiliaries | 1.4~~14.3~~ | 1.4~~3.3~~ | 0 | 0.8 |
| Total Division 1 EUPS Nominal Loads | 177.3~~236.6~~ | 1.4~~3.4~~ | 192.5~~213.3~~ | 56~~57.4~~ |

**Notes:**

1. Maximum load occurring during the one minute momentary load duration is assumed for the entire one minute duration as described in IEEE Std 485-1997.

2. Random load assumed to occur at the most critical time of the duty cycle. Maximum load occurring during the one minute random load duration is assumed for the entire one minute duration.

3. AC/DC and DC/DC converters operate in parallel. Total load contribution from converters is shown as inverter load to include efficiency factor.

4. EUPS Battery load includes inverter efficiency factor of 87 percent.

5. ~~Load contribution from modulating valves in continuous use.~~

## Table 8.3-14—Division 2 Class 1E Uninterruptible Power Supply Nominal Loads

| Load Description | Load Requirement (kW) | | | |
|---|---|---|---|---|
| | Momentary (1) | | Random(2) | Continuous |
| | 0-1 Min | 119-120 Min | 0-1 Min Duration | 0-120 Min |
| Inverter Load (MCC 32BRA) | | | | |
| • Motor Operated Containment Isolation Valves | 85.617.9 | 0 | 0120.9 | 02.8 (5) |
| • Solenoid Valves | 0.1 | 0.1 | 0 | 2.7 |
| • Valves and Dampers | 0120.9 | 0 | 103.122.4 | 0 |
| • Special Emergency Lighting | 0 | 0 | 0 | 4 |
| • AC/DC Converters | 0 | 0 | 0 | 27.5 |
| • I&C Systems | 0 | 0 | 0 | 7.66.6 |
| • 32BRA Control Power | 0.6 | 0 | 0.81.3 | 0.2 |
| • Main Steam Relief Control Valve | 0 | 0 | 0 | 2.8 |
| • Communications | 0 | 0 | 0 | 0.3 |
| Total Inverter Loads | 138.886.3 | 0.1 | 103.9144.6 | 44.844.1 |
| 250 Vdc Loads (switchgear 32BUC) | | | | |
| • Control Power | 12.615 | 1.20 | 0 | 1 |
| • DC/DC Converters (3) | 0 | 0 | 0 | 0 |
| • Inverter Load (4) | 159.599.2 | 0.1 | 119.4166.2 | 51.550.7 |
| • EDG Auxiliaries | 14.31.4 | 1.43.3 | 0 | 0.8 |
| Total Division 2 EUPS Nominal Loads | 126.1175.9 | 2.63.4 | 119.4166.2 | 53.352.5 |

**Notes:**

1. Maximum load occurring during the one minute momentary load duration is assumed for the entire one minute duration as described in IEEE Std 485-1997.
2. Random load assumed to occur at the most critical time of the duty cycle. Maximum load occurring during the one minute random load duration is assumed for the entire one minute duration.
3. AC/DC and DC/DC converters operate in parallel. Total load contribution from converters is shown as inverter load to include efficiency factor.
4. EUPS Battery load includes inverter efficiency factor of 87 percent.
5. Load contribution from modulating valves in continuous use.

## Table 8.3-15—Division 3 Class 1E Uninterruptible Power Supply Nominal Loads

| Load Description | Load Requirement (kW) | | | |
|---|---|---|---|---|
| | Momentary (1) | | Random(2) | Continuous |
| | 0-1 Min | 119-120 Min | 0-1 Min Duration | 0-120 Min |
| Inverter Load (MCC 33BRA) | | | | |
| • Motor Operated Containment Isolation Valves | 85.617.9 | 0 | 0120.9 | 02.8 (5) |
| • Solenoid Valves | 0.1 | 0.1 | 0 | 2.7 |
| • Valves and Dampers | 0120.9 | 0 | 103.122.4 | 0 |
| • Special Emergency Lighting | 0 | 0 | 0 | 4 |
| • AC/DC Converters | 0 | 0 | 0 | 27.5 |
| • I&C Systems | 0 | 0 | 0 | 7.66.6 |
| • 33BRA Control Power | 0.6 | 0 | 0.81.3 | 0.2 |
| • Main Steam Relief Control Valve | 0 | 0 | 0 | 2.8 |
| • Communications | 0 | 0 | 0 | 0.3 |
| Total Inverter Loads | 138.886.3 | 0.1 | 103.9144.6 | 44.844.1 |
| 250 Vdc Loads (switchgear 33BUC) | | | | |
| • Control Power | 12.615 | 1.20 | 0 | 1 |
| • DC/DC Converters (3) | 0 | 0 | 0 | 0 |
| • Inverter Load (4) | 159.599.2 | 0.1 | 119.4166.2 | 51.550.7 |
| • EDG Auxiliaries | 14.31.4 | 1.43.3 | 0 | 0.8 |
| Total Division 3 EUPS Nominal Loads | 126.1175.9 | 2.63.4 | 119.4166.2 | 53.352.5 |

**Notes:**

1. Maximum load occurring during the one minute momentary load duration is assumed for the entire one minute duration as described in IEEE Std 485-1997.

2. Random load assumed to occur at the most critical time of the duty cycle. Maximum load occurring during the one minute random load duration is assumed for the entire one minute duration.

3. AC/DC and DC/DC converters operate in parallel. Total load contribution from converters is shown as inverter load to include efficiency factor.

4. EUPS Battery load includes inverter efficiency factor of 87 percent.

5. Load contribution from modulating valves in continuous use.

## Table 8.3-16—Division 4 Class 1E Uninterruptible Power Supply Nominal Loads

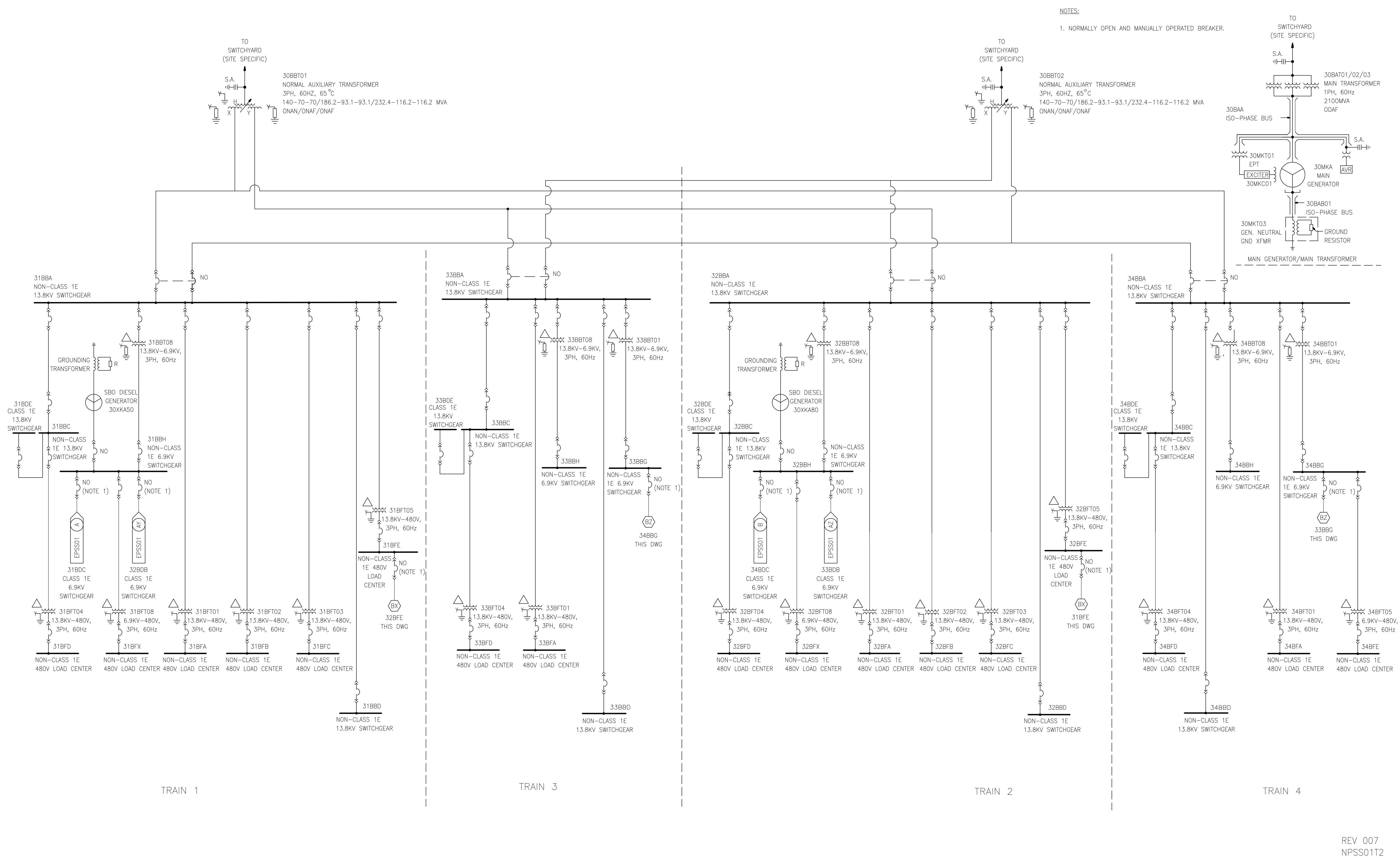
| Load Description | Load Requirement (kW) | | | |
|---|---|---|---|---|
| | Momentary (1) | | Random(2) | Continuous |
| | 0-1 Min | 119-120 Min | 0-1 Min Duration | 0-120 Min |
| Inverter Load (MCC 34BRA) | | | | |
| • Motor Operated Containment Isolation Valves | 175.232.1 | 0 | 0138.8 | 02.8 (5) |
| • Solenoid Valves | 0.1 | 0.1 | 0 | 1.43.3 |
| • Valves and Dampers | 98.60 | 0 | 16644.8 | 0 |
| • AC/DC Converters | 0 | 0 | 0 | 32.531.3 |
| • I&C Systems | 0 | 0 | 0 | 12.610.5 |
| • 34BRA Control Power | 02 | 0 | 1.62 | 0.3 |
| • Main Steam Relief Control Valve | 0 | 0 | 0 | 2.8 |
| Total Inverter Loads | 130.7177.3 | 0.1 | 167.6185.6 | 48.249.6 |
| 250 Vdc Loads (switchgear 34BUC) | | | | |
| • Control Power | 17.78.5 | 0 | 0 | 1.21.3 |
| • DC/DC Converters (3) | 0 | 0 | 0 | 0 |
| • Inverter Load (4) | 150.2203.8 | 0.1 | 192.6213.3 | 55.457 |
| • EDG Auxiliaries | 14.31.4 | 1.43.3 | 0 | 0.8 |
| Total Division 4 EUPS Nominal Loads | 169.3236.6 | 3.41.4 | 192.6213.3 | 57.459.1 |

**Notes:**

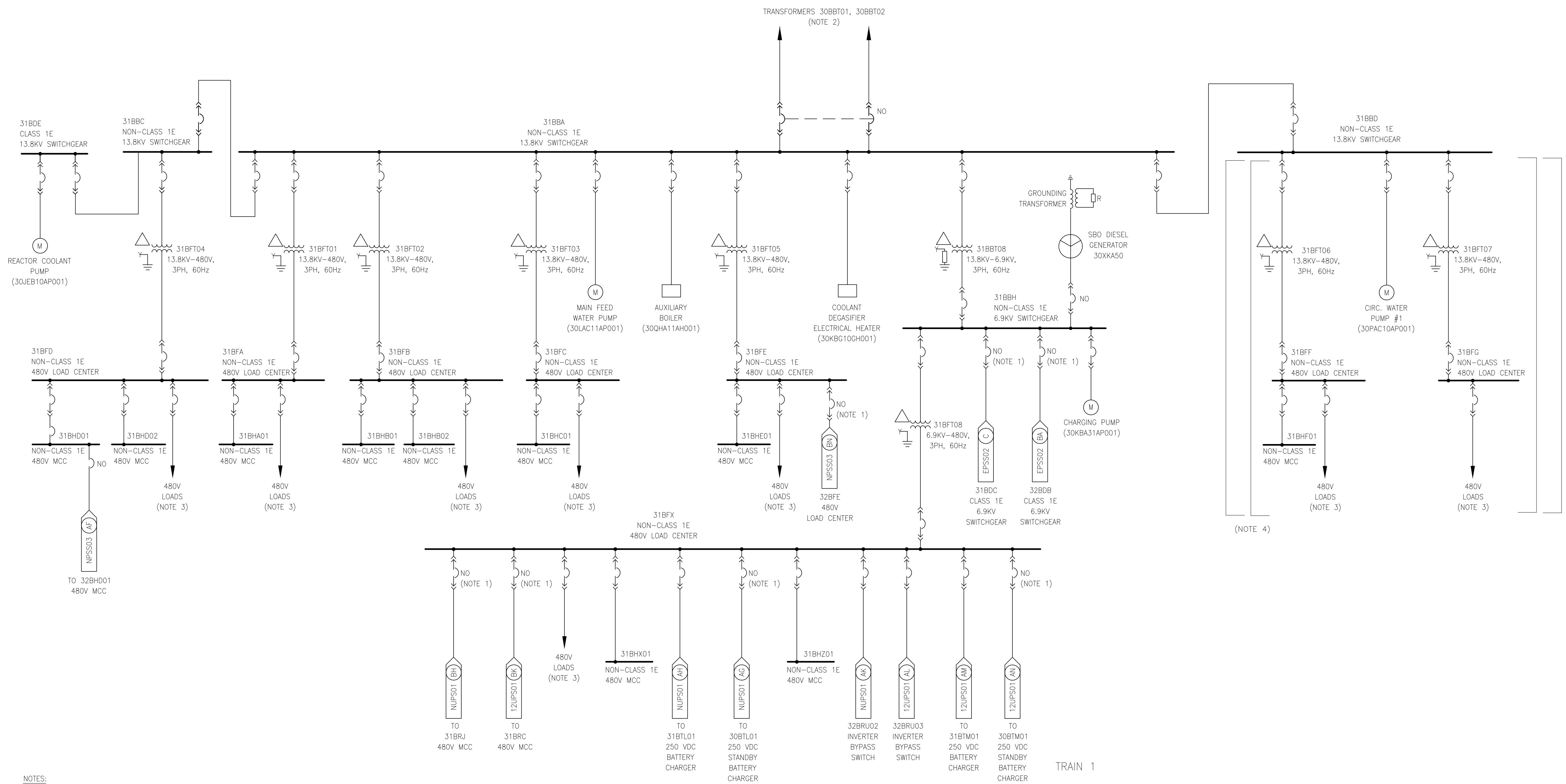
1. Maximum load occurring during the one minute momentary load duration is assumed for the entire one minute duration as described in IEEE Std 485-1997.
2. Random load assumed to occur at the most critical time of the duty cycle. Maximum load occurring during the one minute random load duration is assumed for the entire one minute duration.
3. AC/DC and DC/DC converters operate in parallel. Total load contribution from converters is shown as inverter load to include efficiency factor.
4. EUPS Battery load includes inverter efficiency factor of 87 percent.
5. Load contribution from modulating valves in continuous use.

Next File

**Figure 8.3-3—Normal Power Supply System Single Line Drawing**
**Sheet 1 of 5**



## Figure 8.3-3—Normal Power Supply System Single Line Drawing
## Sheet 2 of 5

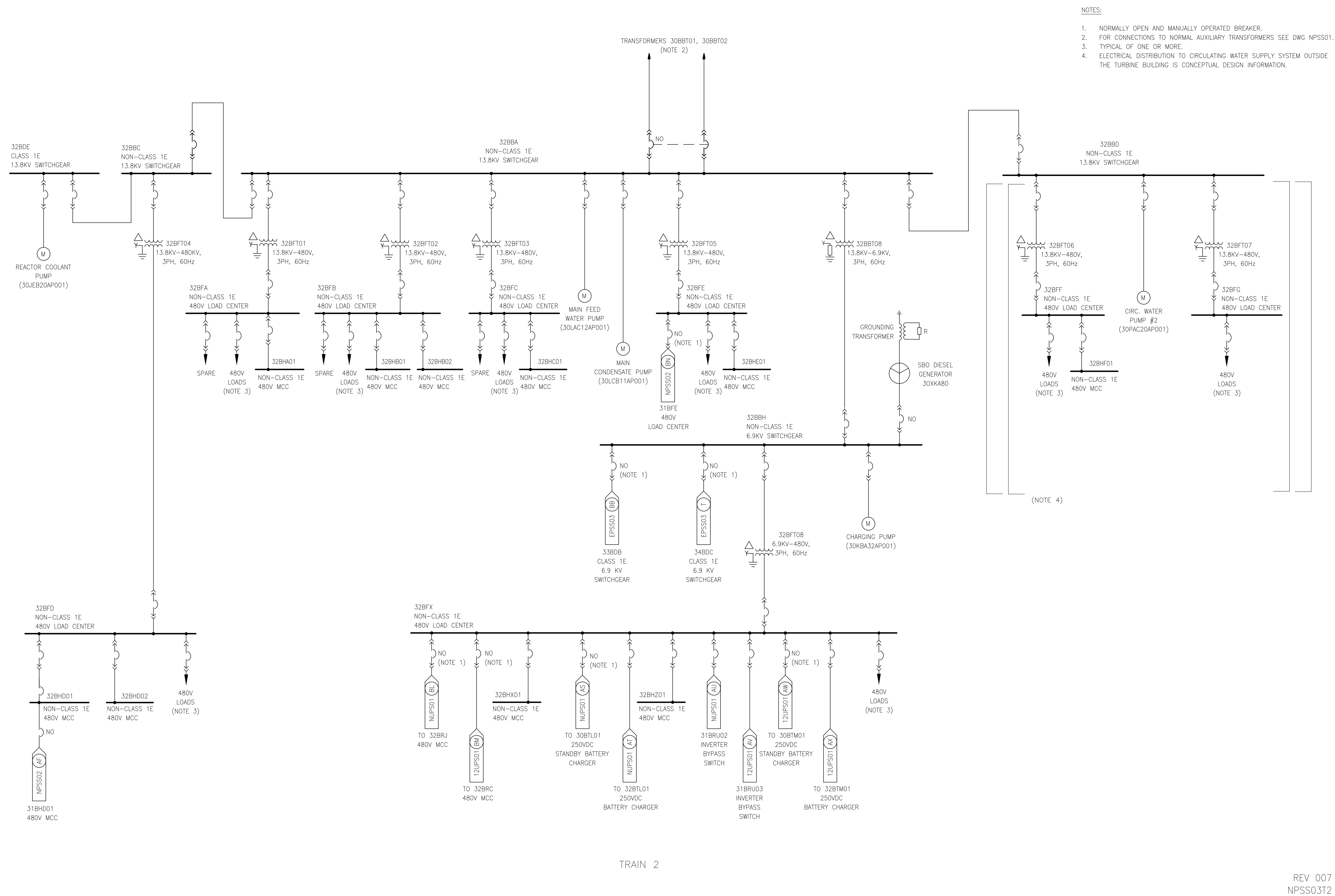



NOTES:

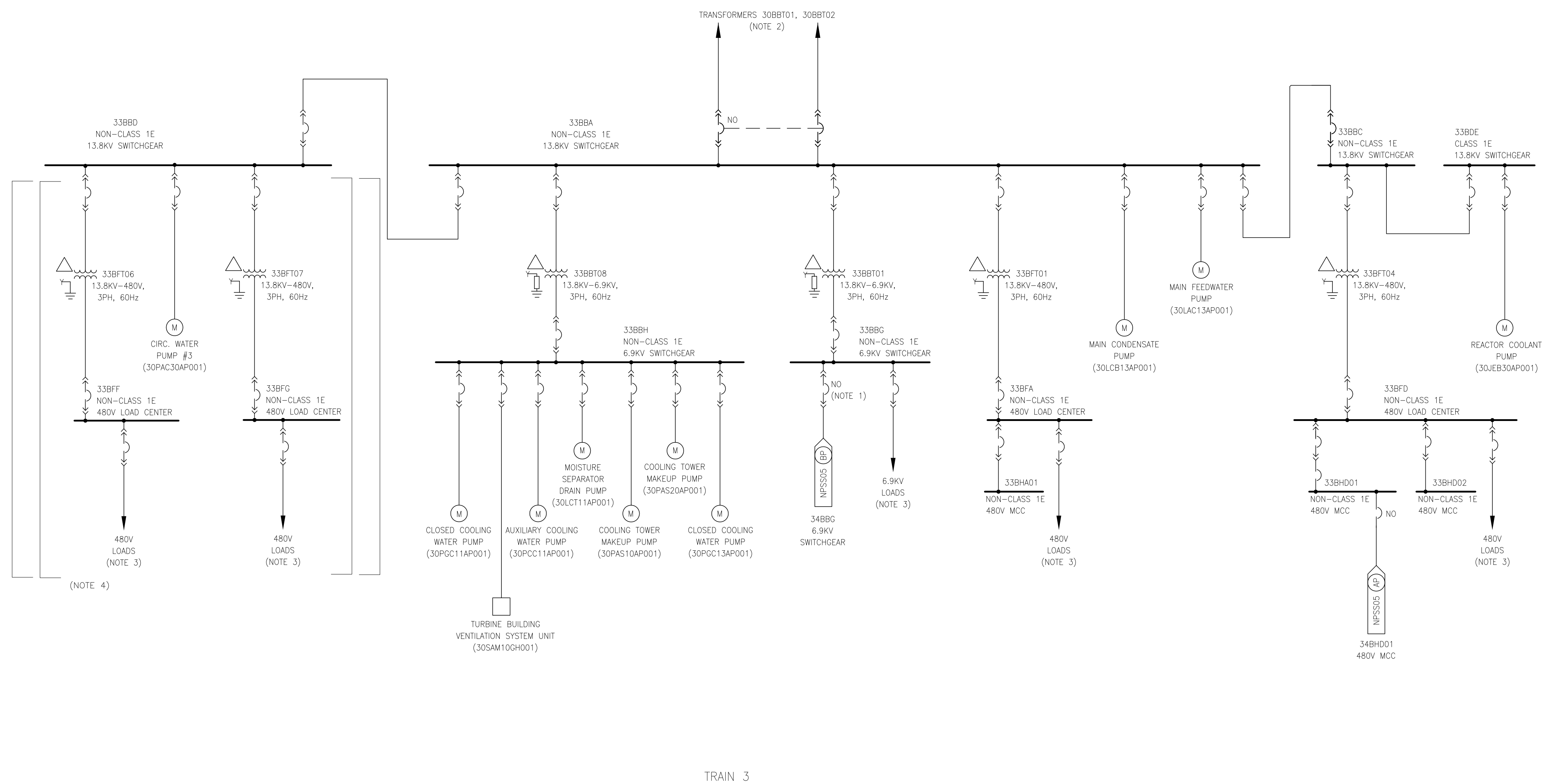
1. NORMALLY OPEN AND MANUALLY OPERATED BREAKER.
2. FOR CONNECTIONS TO NORMAL AUXILIARY TRANSFORMERS SEE DWG NPSS01.
3. TYPICAL OF ONE OR MORE.
4. ELECTRICAL DISTRIBUTION TO CIRCULATING WATER SUPPLY SYSTEM OUTSIDE THE TURBINE BUILDING IS CONCEPTUAL DESIGN INFORMATION.

REV 007
NPSS02T2

**Figure 8.3-3—Normal Power Supply System Single Line Drawing**
**Sheet 3 of 5**



## Figure 8.3-3—Normal Power Supply System Single Line Drawing
## Sheet 4 of 5




NOTES:

1. NORMALLY OPEN AND MANUALLY OPERATED BREAKER.
2. FOR CONNECTIONS TO NORMAL AUXILIARY TRANSFORMERS SEE DWG NPSS01.
3. TYPICAL OF ONE OR MORE.
4. ELECTRICAL DISTRIBUTION TO CIRCULATING WATER SUPPLY SYSTEM OUTSIDE THE TURBINE BUILDING IS CONCEPTUAL DESIGN INFORMATION.

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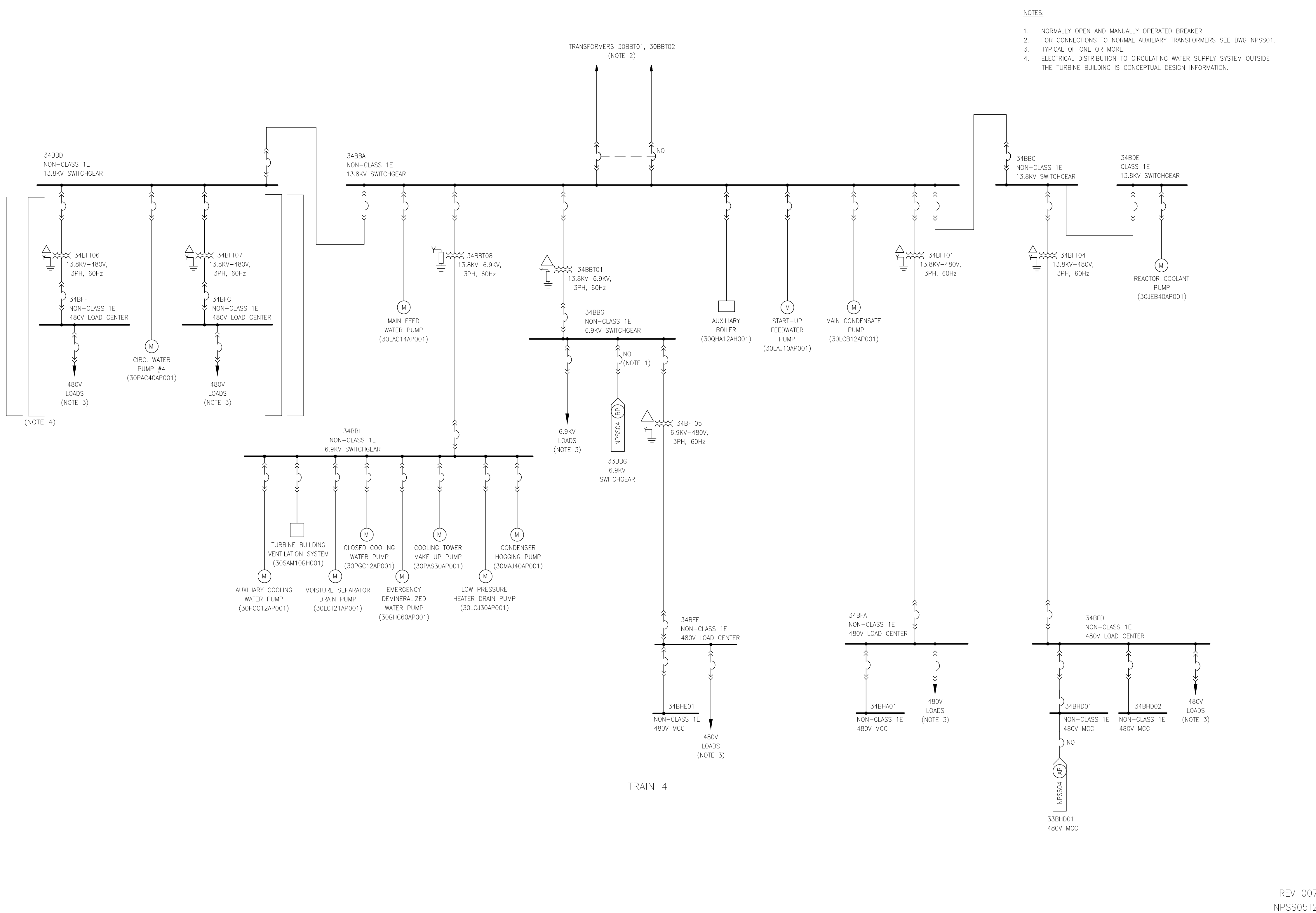
NPSS04T2

## Figure 8.3-3—Normal Power Supply System Single Line Drawing
## Sheet 5 of 5



- Grounding for personnel protection and generator neutral grounding is consistent with the overall plant grounding requirements.

Each SBODG and its power distribution equipment are sized to provide the voltage and frequency needed for proper operation of their connected loads. The highest expected continuous loading was calculated using conservative estimates of load characteristics. Uncertainties associated with SBODG loading are addressed by maintaining a margin of at least five percent.

### 8.4.1.3 Alternate AC Power System Performance

During normal plant operation each SBODG remains in standby with the diesel engines ready to be started and loaded. Each diesel engine is prelubricated and its cooling water is preheated. The SBODGs are not normally connected to the preferred or the onsite emergency alternating current (EAC) power system and are separated from the assigned Class 1E bus through two normally open circuit breakers. The circuit breaker located at the Class 1E bus is a Class 1E breaker.

At the start of an SBO event, two-hour rated safety-related batteries supply DC power to safety-related inverters and their critical loads, including I&C power and DC control power. A combination of two-hour rated and twelve-hour rated non-safety-related batteries supply various non-safety-related 250 Vdc switchboards.

When power is lost to the normal power supply system (NPSS) 6.9 kV switchgear, selected NPSS switchgear load breakers will open on undervoltage. Non-safe shutdown loads are stripped below the machine rating for immediately connected load (typically 25 to 30 percent of the machine continuous rating). The SBODGs will automatically start on a loss of voltage on their associated non-safety-related buses. If the EDGs fail to re-energize the Class 1E buses, the EPSS preferred and emergency power source feeder breakers are opened. Opening these breakers prevents inadvertent paralleling out of phase if the preferred or emergency power supply is restored during SBODG operation. Sufficient controls and indications are available in the MCR and at the local control panel to start the SBODGs from either of those locations. Both SBODGs are started and manually aligned to their respective EPSS buses from the MCR within ten minutes from the beginning of the SBO event. The undervoltage signal causes all loads to be stripped from the associated Class 1E and non-Class 1E buses. Non-Class 1E loads are stripped to the extent that the remaining load is less than the SBODG rating for immediately connected loads. This prepares the SBODG bus for loading by the MCR operators.

In Table 8.4-3—Station Blackout Diesel Generator Indications and Alarms, a list of alarms and indications are provided for the SBODG. Engine trip functions are based on manufacturer recommendations for commercial service.

design specifications limit the seal leakage after a seal failure to 25 gpm per seal or 100 gpm total. Total RCS leakage rises to 111 gpm or less.

4. Ten minutes or less into the event, the SBODGs are available for manual loading of safe shutdown equipment. EUPS two-hour batteries and battery chargers are loaded onto the SBODGs. Thus, their supplied loads are available during the entire SBO period. The HVAC equipment in divisions 1 and 4 can be restored. Some Safeguard Building areas may briefly exceed 122°F before HVAC is restored.

5. Fifteen minutes into the event, the standstill seal system terminates RCP seal leakage. Standstill seal system leakage is 0.5 gpm per standstill seal. Total RCS leakage drops to 13 gpm or less; this leakage continues for the duration of the event.

6. Thirty minutes into the event, two EFW pumps are started and begin feeding four SGs. The SG levels in the fed SGs recover from their low of 40 percent wide range (WR) to the normal post trip value of 82.2 percent WR.

7. After eight hours, the SGs are maintained at their normal post-trip level, pressurizer level is on scale, the RCS remains subcooled, and temperature is slowly decreasing. ~~and core exit temperature is 602°F and decreasing slowly.~~ Ambient air temperatures in the division 2 and division 3 equipment areas are within limits.

#### 8.4.2.6.3 RG 1.155 C.3.3 – Modifications to Cope with Station Blackout – AAC Power Sources

Consistent with SECY-90-016 (Reference 6), "Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements," the U.S. EPR design provides two full capacity AAC power sources of diverse design, capable of powering at least one complete set of normal safe shutdown loads.

As required by RG 1.155 for AAC power sources selected specifically for satisfying the requirements of SBO, the design meets the following criteria:

- The AAC power sources are not normally directly connected to the preferred or blacked-out unit onsite emergency power system. The SBODGs are normally not running. Two breakers exist between each SBODG and the nearest Class 1E bus.

- There is a minimum potential for common cause failure with the preferred or the blacked-out unit onsite EAC power sources. No single-point vulnerability exists whereby a weather-related event or single active failure could disable any portion of the blacked-out unit's onsite sources and simultaneously fail the AAC power sources. This is also accomplished by specifying and selecting equipment, including the engine, generator, and primary support equipment, that is different from the corresponding EDG equipment.

- Including the time required to prepare the SBODG bus, the AAC power sources can be connected to their associated EPSS buses within ten minutes after the onset

**Table 8.4-1—Station Blackout Continuous Loading – Train 1 Estimated**

| Function | Power | Notes |
|---|---|---|
| Safety Chilled Water Compressor - Division 1 | 715 kW | Division 1 is air cooled, which consists of four 25 percent compressors and eight 12.5 percent condenser fans; contribution to SBODG loading is calculated considering 50 percent of the rated capacity running continuously. |
| Emergency Feedwater Pump | 580 kW | Nominal load adjusted higher for possible efficiency losses. No credit has been taken for the reduced flow rate and hydraulic load expected during SBO. The value listed is conservative. |
| Class 1E Battery Chargers | ~~200~~223 kW | Includes Division 1 and Division 2. |
| Class 1E 480 V Loads Except Battery Chargers -Division 1 | ~~820~~ 527 kW | Includes 480 V loads powered from load centers 31BMB and 31BMC and MCCs 31BNB01, 31BNB02, 31BNB03, and 31BNC01. |
| Class 1E 480 V Loads Except Battery Chargers - Division 2 | ~~520~~ 248 kW | Includes 480 V loads powered from load center 32BMB and MCCs 32BNB01, 32BNB02, and 32BNB03. |
| SBO DG Auxiliaries | ~~230~~ 499 kW | |
| Non-Class 1E Battery Chargers | ~~320~~ 651 kW | Non-Class 1E chargers may be turned off during SBO as needed to maintain load below SBODG continuous rating. |
| Provision for Site-Specific Non-Class 1E Loads | 450 kW | |
| Total SBO Load | ~~3835~~ 3893 kW | |
| Asset Protection | 940 kW | Load present during LOOP without SBO. Individual loads removed during SBO as needed to maintain load below SBODG continuous rating |

## Table 8.4-2—Station Blackout Loading – Train 2 Estimated

| Function | Power | Notes |
|---|---|---|
| Safety Chilled Water Compressor - Division 4 | 715 kW | Division 4 is air cooled, which consists of four 25 percent compressors and eight 12.5 percent condenser fans; contribution to SBODG loading is calculated considering 50 percent of the rated capacity running continuously. |
| Emergency Feedwater Pump | 580 kW | Nominal load adjusted higher for possible efficiency losses. No credit has been taken for the reduced flow rate and hydraulic load expected during SBO. The value listed is conservative. |
| Class 1E Battery Chargers | ~~200~~ 223 kW | Includes Division 3 and Division 4. |
| Class 1E 480 V Loads Except Battery Chargers - Division 4 | ~~1000~~ 578 kW | Includes 480 V loads powered from load centers 34BMB and 34BMC and MCCs 34BNB01, 34BNB02, 34BNB03, and 34BNC01. |
| Class 1E 480 V Loads Except Battery Chargers - Division 3 | ~~550~~ 318 kW | Includes 480 V loads powered from load center 33BMB and MCCs 33BNB01, 33BNB02, and 33BNB03. |
| SBO DG Auxiliaries | ~~210~~ 491 kW | Differs slightly from train 1 due to consideration of loads from the associated 480 V buses. |
| Non-Class 1E Battery Chargers | ~~320~~ 651 kW | Non-Class 1E chargers may be turned off during SBO as needed to maintain load below SBODG continuous rating. |
| Provision for Site-Specific Non-Class 1E Loads | 450 kW | |
| Total SBO Load | ~~4025~~ 4006 kW | |
| Asset Protection | 30 kW | Differs from train 1 because most turbine-generator loads are on train 1. Load present during LOOP without SBO. Individual loads removed during SBO as needed to maintain load below SBODG continuous rating. |