FENOC™
FirstEnergy Nuclear Operating Company

5501 North State Route 2
Oak Harbor, Ohio 43449

Raymond A. Lieb
Vice President, Nuclear

419-321-7676
Fax: 419-321-7582

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L-15-117

10 CFR 50.90

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Davis-Besse Nuclear Power Station
Docket No. 50-346, License No. NPF-3
License Amendment Request to Revise Emergency Diesel Generator Minimum Voltage and Frequency Surveillance Requirements

Pursuant to 10 CFR 50.90, FirstEnergy Nuclear Operating Company (FENOC) hereby requests to amend the operating license for the Davis-Besse Nuclear Power Station. The proposed amendment would revise Technical Specification 3.8.1, "AC Sources-Operating" to change certain minimum voltage and frequency acceptance criteria for emergency diesel generator surveillance testing. The changes are necessary to address non-conservatism in the subject technical specification surveillance testing acceptance criteria.

The non-conservative acceptance criteria in Technical Specification 3.8.1 are currently administratively controlled under the provisions of Nuclear Regulatory Commission Administrative Letter (AL) 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," to assure that plant safety is maintained. This license amendment request is submitted in accordance with the guidance in AL 98-10 as a required license amendment request to resolve a non-conservative technical specification. As such, this is not a "voluntary request from a licensee to change its licensing basis" and should not be subject to "forward fit" considerations.

The enclosure provides an evaluation of the proposed amendment. Attachments to the evaluation provide a copy of the existing technical specification pages and technical specification bases pages marked up to reflect the proposed amendment, re-typed technical specification pages with the proposed amendment incorporated, and information related to emergency diesel generator analyses.

Approval of the proposed license amendment is requested by April of 2016, and the amendment would be implemented within 60 days of approval. There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 1st, 2015.

Sincerely,

Raymond A. Lieb

Enclosure:
FENOC Evaluation of the Proposed Amendment

cc: NRC Region III Administrator
NRC Project Manager
NRC Resident Inspector
Executive Director, Ohio Emergency Management Agency,
State of Ohio (NRC Liaison)
Utility Radiological Safety Board

1. SUMMARY DESCRIPTION

This FirstEnergy Nuclear Operating Company (FENOC) evaluation supports a request to amend Operating License NPF-3 for the Davis-Besse Nuclear Power Station (hereafter referred to as Davis-Besse). The proposed amendment would revise Operating License NPF-3, Appendix A, Technical Specification 3.8.1, "AC Sources - Operating" by increasing the minimum voltage and frequency acceptance criteria for emergency diesel generator (EDG) testing specified in surveillance requirements 3.8.1.8.a and 3.8.1.14.a, and the minimum steady state voltage specified in surveillance requirements 3.8.1.2, 3.8.1.8.b, 3.8.1.11.c.3, 3.8.1.14.b, and 3.8.1.15.c.3.

The minimum voltage and frequency specified for EDG start testing in surveillance requirements 3.8.1.8.a and 3.8.1.14.a would change from greater than or equal to (≥) 4031 volts (V) to ≥ 4070 V, and from ≥ 58.8 Hertz (Hz) to ≥ 59.5 Hz, respectively. The minimum steady state voltage specified in surveillance requirements 3.8.1.2, 3.8.1.8.b, 3.8.1.11.c.3, 3.8.1.14.b, and 3.8.1.15.c.3 would change from ≥ 3744 V to ≥ 4088 V.

An increased minimum voltage is needed in surveillance requirements 3.8.1.8.a and 3.8.1.14.a to confirm sufficient minimum voltage is achieved to satisfy the EDG output circuit breaker closure permissive. Based in part on there being no frequency requirement for the EDG output circuit breaker closure permissive, the increased minimum frequency value proposed for surveillance requirements 3.8.1.8.a and 3.8.1.14.a was chosen so that the value is consistent with the minimum steady state frequency requirement. The increased minimum steady state voltage proposed for surveillance requirements 3.8.1.2, 3.8.1.8.b, 3.8.1.11.c.3, 3.8.1.14.b, and 3.8.1.15.c.3 would provide assurance that during emergency diesel generator loading, the voltage response recommendations of Safety Guide 9, “Selection of Diesel Generator Set Capacity for Standby Power Supplies,” dated March 10, 1971 (Accession No. ML12305A251), can be satisfied.

2. DETAILED DESCRIPTION

During a review of operating experience, FENOC identified a potentially non-conservative technical specification. A subsequent evaluation demonstrated that the minimum voltage limit in surveillance requirements 3.8.1.8.a and 3.8.1.14.a was insufficient to ensure automatic closure of the EDG output circuit breaker. It was also determined that the minimum steady state voltage specified in the EDG surveillance requirements should be increased. These findings are documented in FENOC’s corrective action program. It was also determined that the minimum required frequency for EDG operability in surveillance requirements 3.8.1.8.a and 3.8.1.14.a should be increased to be consistent with the minimum steady state frequency requirement.

The EDG minimum voltage and frequency acceptance criterion achieved in less than or equal to (≤) 10 seconds, as specified in surveillance requirements 3.8.1.8.a and 3.8.1.14.a, would be changed from ≥ 4031 V to ≥ 4070 V and from ≥ 58.8 Hz to ≥ 59.5 Hz, as shown underlined below. No change is proposed to the specified time interval of ≤ 10 seconds.

Subject: License Amendment Request to Revise Emergency Diesel Generator Voltage and Frequency Surveillance Requirements in Technical Specification 3.8.1, "AC Sources – Operating"

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Surveillance Requirement 3.8.1.8.a - Verify each EDG starts from standby condition and achieves:

a. In ≤ 10 seconds, voltage ≥ <u>4070</u> V and frequency ≥ <u>59.5</u> Hz; and

Surveillance Requirement 3.8.1.14.a - Verify each EDG starts and achieves:

a. In ≤ 10 seconds, voltage ≥ <u>4070</u> V and frequency ≥ <u>59.5</u> Hz; and

The EDG minimum steady state voltage acceptance criterion, as specified in surveillance requirements 3.8.1.2, 3.8.1.8.b, 3.8.1.11.c.3, 3.8.1.14.b, and 3.8.1.15.c.3, would be changed from ≥ 3744 V to ≥ 4088 V, as shown underlined below. No change is proposed to the specified maximum steady state voltage or steady state frequency values.

Surveillance Requirement 3.8.1.2 - Verify each EDG starts from standby condition and achieves steady state voltage ≥ <u>4088</u> V and ≤ 4400 V, and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.

Surveillance Requirement 3.8.1.8.b - Verify each EDG starts from standby condition and achieves:

b. Steady state voltage ≥ <u>4088</u> V and ≤ 4400 V,
   and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.

Surveillance Requirement 3.8.1.11.c.3 - Verify on actual or simulated loss of offsite power signal:

c. EDG auto-starts from standby condition and:

   3. Maintains steady-state voltage ≥ <u>4088</u> V and ≤ 4400 V;

Surveillance Requirement 3.8.1.14.b - Verify each EDG starts and achieves:

b. Steady state voltage ≥ <u>4088</u> V and ≤ 4400 V,
   and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.

Surveillance Requirement 3.8.1.15.c.3 - Verify on actual or simulated loss of offsite power signal in conjunction with an actual or simulated SFAS actuation signal:

c. EDG auto-starts from standby condition and:

   3. Achieves steady-state voltage ≥ <u>4088</u> V and ≤ 4400 V;

The proposed technical specification changes are shown in Attachment A. Attachment A shows deletions with a strike-through and insertions underlined, with a vertical line in the margin showing the area of change. Retyped technical specification pages are provided for information in Attachment B. Proposed Technical Specification Bases changes are shown in Attachment C, for information only.

Updated Safety Analysis Report, Subsection 8.3.1.1.4.1, “Emergency Diesel Generators,” states that two redundant EDG units, one connected to essential 4160 V bus C1 and the other connected to essential 4160 V bus D1, are provided as onsite standby power sources to supply their respective essential buses upon loss of the normal and reserve power sources.

These EDGs are each rated at 2600 kilowatts (kW) continuous, 0.8 assumed power factor, and 900 revolutions per minute (nominal). The 2,000 hour rating of each EDG is 2838 kW. The 30 minute rating of each EDG is 3035 kW. The EDGs are designed to provide alternating current (AC) power at 4160 V on the emergency bus.

The EDG is capable of attaining rated frequency and voltage approximately 10 seconds after the engine start signal is received.

Each of the two emergency diesel generators has the capability to:

- Supply continuously the sum of the loads on the essential 4160 V bus needed to be powered at any one time.
- Start and accelerate to rated speed in the required sequence its dedicated engineered safety features loads. At no time during the loading sequence, will the frequency and voltage decrease to less than 95 percent of nominal (0.95 x 60 Hz = 57 Hz) and 75 percent of nominal (0.75 x 4160 V = 3120 V), respectively, except that during the first step in the required loading sequence there may be a voltage dip below 75 percent of nominal lasting for a few cycles due to the essential unit substation transformer excitation inrush.

3. TECHNICAL EVALUATION

3.1 Minimum EDG Starting Voltage and Frequency

Accident analyses credit the loading of the EDG, following a postulated loss of offsite power coincident with a loss of coolant accident. The actual EDG start has historically been associated with the safety features actuation system activation. The EDG loading has been included in the delay time associated with each safety system component requiring EDG supplied power following a loss of offsite power. This delay time includes contributions from the EDG start, EDG loading, and component actuation. The delay times assumed in the safety analysis for the engineered safety features equipment include the 10 second EDG start delay and, if applicable, the appropriate load sequencing delay.

Surveillance requirement 3.8.1.8.a demonstrates that the EDG can start from standby conditions and achieve the required voltage and frequency within 10 seconds. Surveillance requirement 3.8.1.14.a demonstrates that the diesel engine can restart from a hot condition (such as subsequent to shutdown from normal surveillances), and achieve the required voltage and frequency within 10 seconds.

The proposed change would modify the EDG minimum voltage and frequency acceptance criteria for surveillance requirements 3.8.1.8.a and 3.8.1.14.a. The existing minimum voltage acceptance criterion of ≥ 4031 V will be increased to a more restrictive minimum voltage of ≥ 4070 V. The minimum acceptable voltage of 4070 V was determined based on the bus voltage required by the EDG output circuit breaker voltage permissive relay circuitry. That is, the voltage required for the EDG output circuit breaker to close.

The existing minimum frequency acceptance criterion in surveillance requirements 3.8.1.8.a and 3.8.1.14.a of ≥ 58.8 Hz will be increased to a more restrictive minimum frequency of ≥ 59.5 Hz. The revised minimum frequency value to be specified in surveillance requirements 3.8.1.8.a and 3.8.1.14.a was chosen so that the value is consistent with the minimum steady state frequency requirement. The minimum steady state output frequency of 59.5 Hz is the minimum EDG frequency value evaluated for plant-specific accident analyses, and is demonstrated by the EDG transient analysis to satisfy Safety Guide 9 transient frequency criteria.

In summary, the proposed higher EDG minimum starting voltage and frequency acceptance criteria demonstrate operability of the EDG by confirming adequate voltage and frequency is achieved in ≤ 10 seconds. The surveillance requirements demonstrate that the EDG starts and achieves the necessary voltage for the EDG output circuit breaker to close and a frequency consistent with the minimum steady state frequency requirement.

3.2 Steady State Voltage and Frequency

Surveillance requirements 3.8.1.2 and 3.8.1.8 help to ensure the availability of the standby electrical power supply to mitigate design basis accidents and transients, and to maintain the unit in a safe shutdown condition. For the purposes of Surveillance requirements 3.8.1.2 and 3.8.1.8 testing, the EDGs are started from standby conditions. Surveillance requirement 3.8.1.11 demonstrates the as designed operation of the standby power sources during loss of the offsite source. Surveillance requirement 3.8.1.14 demonstrates that the diesel engine can restart from a hot condition, such as subsequent to shutdown from normal surveillances, and achieve the required voltage and frequency within 10 seconds. Surveillance requirement 3.8.1.15 demonstrates the EDG operation during a loss of offsite power actuation test signal in conjunction with a safety features actuation system actuation signal. For this test, the EDG loading logic includes both the load sequencer and the individual time delay relays for the makeup pumps.

The existing EDG minimum steady state voltage acceptance criteria in surveillance requirements 3.8.1.2, 3.8.1.8.b, 3.8.1.11.c.3, 3.8.1.14.b, and 3.8.1.15.c.3 would be increased to a more restrictive minimum voltage of ≥ 4088 V. The more restrictive minimum steady state voltage provides assurance that during EDG loading, the voltage response recommendations of Safety Guide 9 can be satisfied.

No changes are proposed to the maximum steady state voltage or minimum and maximum steady state frequency values specified in surveillance requirements 3.8.1.2, 3.8.1.8.b, 3.8.1.11.c.3, 3.8.1.14.b, and 3.8.1.15.c.3.

In summary, the proposed higher EDG minimum steady state voltage and current minimum steady state frequency acceptance criteria demonstrate operability of the EDG by confirming adequate steady state voltage and frequency is achieved. The surveillance requirements demonstrate that during the loading transient, the EDG achieves the minimum steady state voltage and frequency necessary to provide assurance that the voltage and frequency response recommendations of Safety Guide 9 can be satisfied.

3.3 AC Power System Analysis

The AC Power System Analysis evaluates the Davis-Besse AC power system when powered from the offsite power system via the start-up transformer(s) or via the unit auxiliary transformer. The analysis provides safety-related motor terminal voltages during steady state loading and motor starting conditions. Available system loading and bus operating voltages are also calculated. The analysis includes various plant operating conditions and system configurations for both normal and accident conditions. This analysis and its associated inputs provide the basis for equipment operating characteristics. Section 3.0, “Acceptance Criteria,” of the AC Power System Analysis (Attachment D) summarizes the acceptable operating limits for plant equipment (except motor operated valves) that are energized via the AC power system. The analysis also determines the maximum steady state loading for the EDGs.

Attachment 3, tables 1A, 1B, and 1C of the AC Power System Analysis, provide the minimum and maximum voltage requirements of equipment powered from each bus (bus voltage acceptance criteria). Minimum motor control center voltage results, minimum and maximum bus voltage results for certain load flow analyses, transient minimum bus voltage results for motor starting analyses, and maximum transformer voltage results are shown in Attachment 3 tables 2 through 10. Voltage analysis results and bus voltage acceptance criteria are presented in tables 3 through 9. Tables in Attachment 3 of the analysis are provided here as Attachment E. The impact of voltage variation on motor operated valve performance is discussed below.

3.4 EDG Frequency and Voltage

Regulatory Position C.4 of Safety Guide 9 indicates that at no time during the loading sequence should the frequency decrease to less than 95 percent of nominal [57 Hz]. This regulatory position also indicates that frequency should be restored to within 2 percent of nominal (98 percent of 60 Hz or 58.8 Hz) in less than 40 percent of each load sequence time interval. There is no frequency requirement associated with the EDG output circuit breaker closure permissive. As such, the revised Technical Specification surveillance requirements 3.8.1.8.a and 3.8.1.14.a minimum frequency acceptance criterion of 59.5 Hz was chosen to ensure Safety Guide 9 criteria will be met and to align the starting frequency requirement with the steady state frequency requirement. Surveillance requirements in 3.8.1.8.b and 3.8.1.14.b are used to demonstrate that the EDG can achieve the specified steady state voltage and frequency. A transient analysis computer model was used to analyze the voltage and frequency response of the Davis-Besse EDGs to the load sequence associated with the design basis loss of coolant accident with loss of offsite power. The transient frequency and voltage response is evaluated while the EDG frequency operates at its minimum and maximum steady state frequency setpoints (59.5 Hz and 60.5 Hz) and the EDG voltage setpoint is at its minimum allowable voltage (4088 V) to satisfy the Safety Guide 9 regulatory position regarding voltage and frequency response. The analysis showed that Davis-Besse EDGs are capable of starting their dedicated engineered safety features loads in the required sequence while meeting the minimum voltage and frequency recommendations of Safety Guide 9 for the loading sequence and each load sequence time interval.

Regulatory Position C.4 of Safety Guide 9 also indicates that voltage should be restored to within 10 percent of nominal in less than 40 percent of each load sequence time interval. Davis-Besse Technical Specification surveillance requirements currently require that the EDG achieve a minimum steady state voltage of at least 3744 V (within 10 percent of the nominal 4160 V). However, an EDG steady state voltage of 3744 V cannot be demonstrated to provide adequate voltage for starting safety-related equipment during EDG design basis event sequencing. The EDG transient response calculation shows that with a minimum voltage setpoint of 4088 V, the EDG voltage can recover to within the Safety Guide 9 design criteria of 10 percent of nominal within 40 percent of each load sequence time interval. The calculation also shows that a steady state voltage of 3744 V is sufficient to continuously operate essential equipment after a design basis event.

The AC Power System Analysis, the EDG transient analysis, and their associated inputs demonstrate that the EDG loading is within the capabilities of the EDG when pumps are running at their maximum postulated loading conditions and the EDG is operating at its minimum and maximum steady state frequency and minimum voltage limits.

The frequency and voltage variation within the limits of Safety Guide 9 criteria have been evaluated for their impact on EDG load performance (excluding motor operated valves, which are addressed separately as described below). The AC Power System Analysis determines the maximum EDG load per sequence step and accounts for loading scenarios where pumps may be operating at run-out conditions. The analysis addresses the impact of voltage variation while the postulated loads operate between 4200 V and 4250 V. The voltage variation is based on the EDG voltage regulator settings. The EDG loading analyses are performed with the voltage regulator at its maximum setting (4250 V). The analysis also addresses the impact of frequency variation on EDG loading while individual loads operate at 61.2 Hz. In the analysis, this frequency is the maximum expected recovery frequency during transient loading of the EDG.

Under-frequency and under-voltage in the AC system due to variability in the EDG start and load conditions could lead to increased motor operated valve stroke times. The frequency and voltage variation within the limits of Safety Guide 9 criteria have been evaluated for their impact on motor operated valve performance. Based on Reliance Electric Action Guide, Table A, (Attachment F) the voltage variation has a minimal impact on motor speed, so a penalty was not applied. The Davis-Besse inservice test program document, provided in Attachment G, accounts for the impact of frequency variation on stroke time for the listed motor operated valves. The title of the document is “ISTB3, Pump and Valve Basis Document, Volume III, Stroke Time Basis.”

An EDG transient loading analysis based on equipment operability limits was also performed. This analysis shows that the minimum EDG voltage setpoint (3850 V) required to maintain adequate starting and steady state voltage is lower than the voltage values proposed for Technical Specification surveillance requirements. That is, 3850 V is lower than the EDG output breaker closure permissive voltage (4070 V) and lower than the minimum voltage setpoint (4088 V) required to satisfy Safety Guide 9 criteria. In determining the minimum EDG terminal voltage required to maintain adequate starting and steady state voltage, the EDG transient loading analysis considered a conservative system frequency of 61.2 Hz, as this would result in higher motor load and a lower EDG terminal voltage. The use of the 61.2 Hz system frequency bounds the steady state frequency value of 60.5 Hz. The allowable EDG steady state frequency required for individual components shall be maintained within 0.5 Hz of 60 Hz in accordance with the Davis-Besse Technical Specifications.

The maximum steady state EDG output voltage of 4400 V specified in Davis-Besse Technical Specifications is equal to the maximum steady state operating voltage specified for 4000 V rated motors. This ensures that for a lightly loaded distribution system, the voltage at the terminals of 4000 V motors is no more than the maximum rated operating voltages. Evaluation of the maximum EDG steady state loading at the maximum voltage setpoint of 4400 V and the maximum frequency setpoint of 61.2 HZ shows that loading results are bound by the EDG steady state loading limits. Operating the EDG at the maximum steady state output voltage of 4400 V in conjunction with a large-load rejection transient results in transient voltages less than or equal to the EDG overvoltage alarm setpoint. The EDG overvoltage alarm setpoint (4550 V) is set to bound the maximum circuit breaker ratings and the maximum voltage ratings for the essential buses. The large-load rejection transient evaluation inputs and methodology are discussed in Attachment H, "Operability Limits for EDG Voltage and Frequency During Transient Loading."

Davis-Besse does not have a Technical Specification surveillance requirement for EDG full load reject testing, and the EDG is not routinely subjected to a full-load rejection transient. However, analysis shows that the transient results in voltages less than the EDG maximum test voltage (9320 V) and voltage recovers to the EDG setpoint of 4400 V within 60 seconds.

3.5 Degraded Voltage and Loss of Voltage Relays

Relays with time delays are provided on each 4160 V essential bus for the purpose of detecting a sustained under-voltage condition (degraded voltage condition). The degraded voltage relay pickup setpoint and time delays are set to ensure the offsite source supplies sufficient voltage to safety-related equipment so that they perform their function in the event of a design basis event. The degraded voltage dropout, pickup, and time delay setpoints ensure the busses are not inappropriately disconnected from the offsite source. The degraded voltage relays automatically initiate disconnection of the offsite power source whenever the voltage setpoint and time delay have been exceeded.

Relays with time delays are provided on each 4160 V essential bus for the purpose of detecting a loss of voltage condition. Disconnecting the offsite power source causes the loss of voltage relays to actuate. The loss of voltage relays automatically initiate disconnection of the offsite power source, load shed the bus, and start the diesel generator whenever the voltage setpoint and time delay have been exceeded.

The analytical limit for the degraded voltage relay dropout/trip setpoint is 3700 V. Post-accident loads are required to have adequate voltage for continuous operation while the essential (safeguards) 4160 V buses operate just above the degraded voltage relay analytical limit dropout setpoint. Once actuated, in the event of a loss of offsite power, the degraded voltage relays do not have to be manually reset to sequentially load the EDGs.

4. REGULATORY EVALUATION

FirstEnergy Nuclear Operating Company proposes to amend Davis-Besse Nuclear Power Station Operating License NPF-3, Appendix A, Technical Specification 3.8.1, “AC Sources – Operating." The proposed amendment would revised certain emergency diesel generator (EDG) surveillance test acceptance criteria by increasing the minimum voltage and frequency to be achieved in less than or equal to 10 seconds, and increasing the minimum steady state voltage to be achieved.

The proposed surveillance requirement changes would address non-conservative minimum voltage acceptance criteria for EDG starting and steady state operation, which were identified during a review of operating experience and subsequent evaluation. The revised surveillance requirements help to ensure the availability of the standby electrical power supply to mitigate design basis accidents and transients, and to maintain the unit in a safe shutdown condition.

The change to the minimum voltage acceptance criterion for EDG starting confirms sufficient minimum voltage to satisfy the EDG output circuit breaker closure permissive. The minimum frequency acceptance criterion for EDG starting was chosen so that the value is consistent with the minimum steady state frequency requirement. The minimum steady state output frequency of 59.5 Hz is the minimum EDG frequency value evaluated for plant-specific accident analyses, and is demonstrated by the EDG transient analysis to satisfy Safety Guide 9 transient frequency criteria. The more restrictive minimum steady state output voltage acceptance criterion ensures that during EDG loading, the voltage response criteria of Safety Guide 9 are satisfied.

4.1 Significant Hazards Consideration

FirstEnergy Nuclear Operating Company has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below.

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

The proposed amendment would provide more restrictive acceptance criteria for certain EDG technical specification surveillance tests. The proposed acceptance criteria changes would help to ensure the EDGs are capable of carrying the electrical loading assumed in the safety analyses that take credit for the operation of the EDGs, would not affect the capability of other structures, systems, and components to perform their design function, and would not increase the likelihood of a malfunction.

Therefore, the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The proposed changes would provide more restrictive acceptance criteria to be applied to existing technical specification surveillance tests that demonstrate the capability of the facility EDGs to perform their design function. The proposed acceptance criteria changes would not create any new failure mechanisms, malfunctions, or accident initiators not considered in the design and licensing bases.

   Therefore, the possibility of a new or different kind of accident from any previously evaluated has not been created.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   Response: No.

   The proposed EDG surveillance requirement changes involve increased minimum voltage and frequency test acceptance criteria. The conduct of surveillance tests on safety related plant equipment is a means of assuring that the equipment is capable of maintaining the margin of safety established in the safety analyses for the facility. The proposed amendment does not affect EDG performance as described in the design basis analyses, including the capability for the EDG to attain and maintain required voltage and frequency for accepting and supporting plant safety loads should an EDG start signal be received. The proposed amendment does not introduce changes to limits established in the accident analysis.

   Therefore, the proposed amendment does not involve a significant reduction in a margin of safety.

Based on the above, FirstEnergy Nuclear Operating Company concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.2 Applicable Regulatory Requirements/Criteria

Changes described in the license amendment request comply with the following regulations and continue to meet the intent of the applicable General Design Criteria.

10 CFR Part 50.36, "Technical specifications," requires in paragraph 50.36(c)(2)(ii)(C) *Criterion 3* that a technical specification limiting condition for operation be established for a structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier. The alternating current electrical power sources (AC Sources - Operating) limiting condition for operation (LCO 3.8.1) satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

10 CFR Part 50.36, "Technical specifications," requires in paragraph 50.36(c)(3) that technical specifications include surveillance requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met. The technical specifications will continue to include surveillance requirements relating to emergency diesel generator testing to assure the components are maintained, facility operation will be within safety limits, and the limiting conditions for emergency diesel generator operation will be met.

10 CFR 50, Appendix A, General Design Criterion (GDC) 17, "Electric power systems," ensures an onsite electric power system is provided to permit functioning of structures, systems, and components important to safety. As required by GDC 17, the design of the alternating current electrical power system provides independence and redundancy to ensure an available source of power to the engineered safety features systems.

Safety Guide 9, "Selection of Diesel Generator Set Capacity For Standby Power Supplies," describes an acceptable basis for the selection of diesel generator sets of sufficient capacity and margin to implement General Design Criterion 17. The system electrical design as described in Updated Safety Analysis Report Subsection 8.3.1.1.4.1, "Emergency Diesel Generators," incorporates the provisions of this safety guide.

GDC 18, "Inspection and testing of electric power systems," ensures electric power systems important to safety are designed to permit appropriate periodic inspection and testing of important areas and features. The alternating current electrical systems are designed to permit testing and inspection of the operability and functional performance of the components of the system as well as the operability of the system as a whole. Essential and safety-related systems are provided with complete redundancy to permit testing of one system while the redundant system is performing the same function. This ensures no interruption of station operation.

The existing EDG transient analysis demonstrates that the EDGs are capable of starting their dedicated engineered safety features loads in the required sequence. The applicable technical specification surveillances will continue to verify the capability of the EDG to start and accelerate to the required speed and voltage within 10 seconds. Maintenance and monitoring of the EDG will be maintained in accordance with the Maintenance Rule (10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants") and the Mitigating System Performance Index Process.

4.3 Conclusions

Based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5. ENVIRONMENTAL CONSIDERATION

The proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

Attachment A

Proposed Technical Specification Changes (Mark-up)

The following is a list of the affected pages.

3.8.1-5
3.8.1-6
3.8.1-9
3.8.1-11
3.8.1-12

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	Verify correct breaker alignment and indicated power availability for each offsite circuit.	7 days
SR 3.8.1.2	------------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period and followed by a warmup period prior to loading. 2. A modified EDG start involving idling and/or gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances of SR 3.8.1.8 must be met. --- Verify each EDG starts from standby conditions and achieves steady state voltage ≥ ~~3744~~ 4088 V and ≤ 4400 V, and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.	31 days
SR 3.8.1.3	------------------------------NOTES---------------------------- 1. EDG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one EDG at a time. 4. This SR shall be preceded by and immediately follow, without shutdown, a successful performance of SR 3.8.1.2 or SR 3.8.1.8. --- Verify each EDG is synchronized and loaded and operates for ≥ 60 minutes at a load ≥ 2340 kW and ≤ 2600 kW.	31 days
SR 3.8.1.4	Verify each day tank contains ≥ 4000 gal of fuel oil.	31 days

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.5	Check for and remove accumulated water from each day tank.	31 days
SR 3.8.1.6	Verify interval between each sequenced load block is within ± 10% of design interval for each emergency load sequencer and each emergency time delay relay.	31 days
SR 3.8.1.7	Verify the fuel oil transfer system operates to transfer fuel oil from fuel oil storage tank to the day tank.	92 days
SR 3.8.1.8	------------------------------NOTE------------------------------ All EDG starts may be preceded by an engine prelube period. --- Verify each EDG starts from standby condition and achieves: a. In ≤ 10 seconds, voltage ≥ ~~4031~~ <u>4070</u> V and frequency ≥ ~~58.8~~ <u>59.5</u> Hz; and b. Steady state voltage ≥ ~~3744~~ <u>4088</u> V and ≤ 4400 V, and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.	184 days

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.11	-----------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period. 2. This Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---	
	Verify on an actual or simulated loss of offsite power signal: a. De-energization of essential buses; b. Load shedding from essential buses; and c. EDG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds; 2. Energizes auto-connected shutdown loads through individual time delay relays; 3. Maintains steady-state voltage ≥ ~~3744~~ 4088 V and ≤ 4400 V; 4. Maintains steady-state frequency ≥ 59.5 Hz and ≤ 60.5 Hz; and 5. Supplies permanently connected and auto-connected shutdown loads for ≥ 5 minutes.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.14	------------------------------NOTES---------------------------- 1. This Surveillance shall be performed within 5 minutes of shutting down the EDG after the EDG has operated ≥ 1 hour loaded ≥ 2340 kW and ≤ 2600 kW. Momentary transients outside of load range do not invalidate this test. 2. All EDG starts may be preceded by an engine prelube period. ---	
	Verify each EDG starts and achieves: a. In ≤ 10 seconds, voltage ≥ ~~4031~~ 4070 V and frequency ≥ ~~58.8~~ 59.5 Hz; and b. Steady state voltage ≥ ~~3744~~ 4088 V and ≤ 4400 V, and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.15	------------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period. 2. This Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. ---	
	Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated SFAS actuation signal: a. De-energization of essential buses; b. Load shedding from essential buses; c. EDG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds; 2. Energizes auto-connected emergency loads through load sequencer and individual time delay relays; 3. Achieves steady-state voltage ≥ ~~3744~~ 4088 V and ≤ 4400 V; 4. Achieves steady-state frequency ≥ 59.5 Hz and ≤ 60.5 Hz; and 5. Supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.	24 months

Attachment B

Proposed Technical Specification Changes (Retyped)

The following is a list of the affected pages.

3.8.1-5
3.8.1-6
3.8.1-9
3.8.1-11
3.8.1-12

Retyped page provided for information only.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.1.1	Verify correct breaker alignment and indicated power availability for each offsite circuit.	7 days
SR 3.8.1.2	------------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period and followed by a warmup period prior to loading. 2. A modified EDG start involving idling and/or gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances of SR 3.8.1.8 must be met. --- Verify each EDG starts from standby conditions and achieves steady state voltage ≥ 4088 V and ≤ 4400 V, and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.	31 days
SR 3.8.1.3	------------------------------NOTES---------------------------- 1. EDG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load range do not invalidate this test. 3. This Surveillance shall be conducted on only one EDG at a time. 4. This SR shall be preceded by and immediately follow, without shutdown, a successful performance of SR 3.8.1.2 or SR 3.8.1.8. --- Verify each EDG is synchronized and loaded and operates for ≥ 60 minutes at a load ≥ 2340 kW and ≤ 2600 kW.	31 days
SR 3.8.1.4	Verify each day tank contains ≥ 4000 gal of fuel oil.	31 days

Retyped page provided for information only.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.5	Check for and remove accumulated water from each day tank.	31 days
SR 3.8.1.6	Verify interval between each sequenced load block is within ± 10% of design interval for each emergency load sequencer and each emergency time delay relay.	31 days
SR 3.8.1.7	Verify the fuel oil transfer system operates to transfer fuel oil from fuel oil storage tank to the day tank.	92 days
SR 3.8.1.8	------------------------------NOTE------------------------------ All EDG starts may be preceded by an engine prelube period. -- Verify each EDG starts from standby condition and achieves: a. In ≤ 10 seconds, voltage ≥ 4070 V and frequency ≥ 59.5 Hz; and b. Steady state voltage ≥ 4088 V and ≤ 4400 V, and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.	 184 days

Retyped page provided for information only.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.11	------------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period. 2. This Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. --	
	Verify on an actual or simulated loss of offsite power signal: a. De-energization of essential buses; b. Load shedding from essential buses; and c. EDG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds; 2. Energizes auto-connected shutdown loads through individual time delay relays; 3. Maintains steady-state voltage ≥ 4088 V and ≤ 4400 V; 4. Maintains steady-state frequency ≥ 59.5 Hz and ≤ 60.5 Hz; and 5. Supplies permanently connected and auto-connected shutdown loads for ≥ 5 minutes.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.14	------------------------------NOTES---------------------------- 1. This Surveillance shall be performed within 5 minutes of shutting down the EDG after the EDG has operated ≥ 1 hour loaded ≥ 2340 kW and ≤ 2600 kW. Momentary transients outside of load range do not invalidate this test. 2. All EDG starts may be preceded by an engine prelube period. ---	
	Verify each EDG starts and achieves: a. In ≤ 10 seconds, voltage ≥ 4070 V and frequency ≥ 59.5 Hz; and b. Steady state voltage ≥ 4088 V and ≤ 4400 V, and frequency ≥ 59.5 Hz and ≤ 60.5 Hz.	24 months

Retyped page provided for information only.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.15	------------------------------NOTES---------------------------- 1. All EDG starts may be preceded by an engine prelube period. 2. This Surveillance shall not normally be performed in MODE 1, 2, 3, or 4. However, portions of the Surveillance may be performed to reestablish OPERABILITY provided an assessment determines the safety of the plant is maintained or enhanced. Credit may be taken for unplanned events that satisfy this SR. --	
	Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated SFAS actuation signal: a. De-energization of essential buses; b. Load shedding from essential buses; c. EDG auto-starts from standby condition and: 1. Energizes permanently connected loads in ≤ 10 seconds; 2. Energizes auto-connected emergency loads through load sequencer and individual time delay relays; 3. Achieves steady-state voltage ≥ 4088 V and ≤ 4400 V; 4. Achieves steady-state frequency ≥ 59.5 Hz and ≤ 60.5 Hz; and 5. Supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.	24 months

Attachment C

Proposed Technical Specification Bases Changes (Mark-up)

The following is a list of the affected pages.

B 3.8.1-4
B 3.8.1-12
B 3.8.1-13
B 3.8.1-14
B 3.8.1-19
B 3.8.1-23
B 3.8.2-3

BASES

LCO (continued)

through a single 345 - 13.8 kV startup transformer and a single 13.8 - 4.16 kV tie transformer. Thus, if both essential buses are being powered in this manner, both offsite circuits are inoperable. In addition, while not covered by this Specification, requirements for the switchyard are provided in Technical Requirements Manual 8.8.1.

In addition, in MODES 3 and 4, in lieu of one of the 345 - 13.8 kV startup transformers, one main transformer and one unit auxiliary transformer with the generator links removed (i.e., a backfeed alignment) may be used.

Each EDG must be capable of starting, accelerating to ~~rated~~<u>the required</u> speed and voltage <u>as specified in the Technical Specifications</u>, and connecting to its respective essential bus on detection of bus undervoltage. This will be accomplished within 10 seconds. Each EDG must also be capable of accepting required loads within the assumed times, and continue to operate until offsite power can be restored to the essential buses. These capabilities are required to be met from a variety of initial conditions, such as EDG in standby with the engine hot and EDG in standby with the engine at ambient conditions. Additional EDG capabilities must be demonstrated to meet required Surveillances, e.g., capability of the EDG to reject the single largest load. In addition, day tank fuel oil level and fuel oil transfer system requirements must be met for each EDG.

Proper sequencing of loads (which include all required individual time delay relays), including tripping of non-essential loads, is a required function for EDG OPERABILITY.

In addition, two load sequencers per train must be OPERABLE.

The AC sources in one train must be separate and independent (to the extent possible) of the AC sources in the other train. For the EDGs, separation and independence are complete.

For the offsite AC sources, separation and independence are to the extent practical. An offsite circuit may be connected to more than one essential bus, with fast-transfer capability to the other circuit OPERABLE, and not violate separation criteria. An offsite circuit that is not connected to an essential bus is required to have OPERABLE fast-transfer interlock mechanisms to one essential bus to support OPERABILITY of that circuit. The reserve source selector switches are used to ensure this capability is available. Therefore, if both reserve source selector switches are selected to the same offsite circuit (i.e., the same startup transformer), the non-selected offsite circuit is inoperable.

BASES

ACTIONS

G.1 (continued)

With one or more trains with one load sequencer inoperable, the 1 hour Completion Time provides a period of time to remove the inoperable module from the SFAS cabinet. As noted, since each train is independent from the other train, separate Condition entry is allowed for inoperable load sequencers in each train.

H.1

With one or more trains with two load sequencers inoperable, the EDG cannot be loaded in the proper sequence and therefore, cannot meet its safety function. Therefore, the EDG must be immediately declared inoperable. As noted, since each train is independent from the other train, separate Condition entry is allowed for inoperable load sequencers in each train.

I.1

Condition I corresponds to a level of degradation in which all redundancy in the AC electrical power supplies has been lost. At this severely degraded level, any further losses in the AC electrical power system will cause a loss of function. Therefore, no additional time is justified for continued operation. The unit is required by LCO 3.0.3 to commence a controlled shutdown.

SURVEILLANCE REQUIREMENTS

The AC sources are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with UFSAR, Section 8 (Ref. 9). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the EDGs are consistent with the recommendations of Regulatory Guide 1.9 (Ref. 3) and Regulatory Guide 1.137 (Ref. 10).

Text to be inserted here is provided after page B 3.8.1-13.

~~Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. The minimum steady state output voltage of 3744 V is 90% of the nominal 4160 V output voltage, and is consistent with Safety Guide 9 (Ref. 11). The specified maximum steady state output voltage of 4400 V is equal to the maximum operating voltage specified for 4000 V motors. It ensures that for a lightly loaded distribution system, the voltage at the terminals of 4000 V motors is no more than the~~

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~maximum rated operating voltages. The specified steady state minimum and maximum frequencies of the EDG are 59.5 Hz and 60.5 Hz, respectively. These values are based on plant-specific analysis values.~~

SR 3.8.1.1

This SR ensures proper circuit continuity for the offsite AC electrical power supply to the onsite distribution network and availability of offsite AC electrical power. The breaker alignment verifies that each breaker is in its correct position to ensure that distribution buses and loads are connected to their preferred power source, and that appropriate independence of offsite circuits is maintained. The 7 day Frequency is adequate since breaker position is not likely to change without the operator being aware of it and because its status is displayed in the control room.

SR 3.8.1.2 and SR 3.8.1.8

These SRs help to ensure the availability of the standby electrical power supply to mitigate DBAs and transients and to maintain the unit in a safe shutdown condition.

To minimize the wear on moving parts that do not get lubricated when the engine is not running, these SRs are modified by a Note (Note 1 for SR 3.8.1.2 and the Note for SR 3.8.1.8) to indicate that all EDG starts for these Surveillances may be preceded by an engine prelube period and followed by a warmup period prior to loading.

For the purposes of SR 3.8.1.2 and SR 3.8.1.8 testing, the EDGs are started from standby conditions. Standby conditions for an EDG means that the diesel engine coolant and oil are being continuously circulated and temperature is being maintained consistent with manufacturer recommendations.

In order to reduce stress and wear on diesel engines, some manufacturers recommend a modified start in which the starting speed of EDGs is limited, warmup is limited to this lower speed, and the EDGs are gradually accelerated to synchronous speed prior to loading. This is the intent of Note 2, which is only applicable when such modified start procedures are recommended by the manufacturer.

SR 3.8.1.8 requires that, at a 184 day Frequency, the EDG starts from standby conditions and achieves required voltage and frequency within 10 seconds. The 10 second start requirement supports the assumptions

Text To Be Inserted Starting On Page B 3.8.1-12

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. The minimum starting output voltage of 4070 V is based on the minimum voltage value required to close the EDG output circuit breaker. The minimum steady state output voltage of 4088 V is the minimum EDG voltage setpoint value evaluated in the EDG transient analysis, which demonstrates Safety Guide 9 (Ref. 11) transient voltage criteria are satisfied. The maximum steady state output voltage of 4400 V is equal to the maximum operating voltage specified for 4000 V motors. It ensures that for a lightly loaded distribution system, the voltage at the terminals of 4000 V motors is no more than the maximum rated operating voltage. The minimum starting frequency value was chosen to be consistent with the minimum steady state frequency requirements. The minimum steady state output frequency of 59.5 Hz is the minimum EDG frequency value evaluated for plant-specific accident analyses, and is demonstrated by the EDG transient analysis to satisfy Safety Guide 9 (Ref. 11) transient frequency criteria. The maximum steady state output frequency of 60.5 Hz supports plant-specific analyses values.

SURVEILLANCE REQUIREMENTS

SR 3.8.1.2 and SR 3.8.1.8 (continued)

of the design basis LOCA analysis in the UFSAR, Section 15 (Ref. 5). ~~The minimum voltage limit is based on the voltage required for EDG breaker closure and the minimum frequency limit is based on the recommendations in Safety Guide 9 (Ref. 11).~~

The 10 second start requirement is not applicable to SR 3.8.1.2 (see Note 2) when a modified start procedure as described above is used. If a modified start is not used, the 10 second start requirement of SR 3.8.1.8 applies.

Since SR 3.8.1.8 requires a 10 second start, it is more restrictive than SR 3.8.1.2, and it may be performed in lieu of SR 3.8.1.2.

In addition to the SR requirements, the time for the EDG to reach steady state operation, unless the modified EDG start method is employed, is monitored to identify degradation of governor and voltage regulator performance.

The 31 day Frequency for SR 3.8.1.2 is consistent with Regulatory Guide 1.9 (Ref. 3). The 184 day Frequency for SR 3.8.1.8 is a reduction in cold testing consistent with Generic Letter 84-15 (Ref. 7). These Frequencies provide adequate assurance of EDG OPERABILITY, while minimizing degradation resulting from testing.

SR 3.8.1.3

Consistent with Regulatory Guide 1.9 (Ref. 3), this Surveillance verifies that the EDGs are capable of synchronizing with the offsite electrical system and accepting loads 90% to 100% of the continuous rating of the EDG. A run time of 60 minutes ensures the engine temperatures are stabilized, while minimizing the time that the EDG is connected to the offsite source.

Although no power factor requirements are established by this SR, the EDG is normally operated at a lagging power factor between 0.8 and 0.95. The 0.8 value is the design rating of the machine, while the 0.95 is an administrative limitation. The load band is provided to avoid routine overloading of the EDG. Routine overloading may result in more frequent teardown inspections being required in order to maintain EDG reliability.

The 31 day Frequency for this Surveillance is consistent with Regulatory Guide 1.9 (Ref. 3).

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.10 (continued)

design basis conditions as possible. When synchronized with offsite power, testing should be performed within the power factor limit. This power factor is representative of the actual inductive loading an EDG would see under design basis accident conditions. The power factor limit is ≤ 0.84 for EDG 1 and ≤ 0.84 for EDG 2. Under certain conditions, however, Note 2 allows the Surveillance to be conducted outside the power factor limit. These conditions occur when grid voltage is high, and the additional field excitation needed to get the power factor to within the limit results in voltages on the essential buses that are too high. Under these conditions, the power factor should be maintained as close as practicable to the limit while still maintaining acceptable voltage limits on the essential buses. In other circumstances, the grid voltage may be such that the EDG excitation levels needed to obtain a power factor within limit may not cause unacceptable voltages on the essential buses, but the excitation levels are in excess of those recommended for the EDG. In such cases, the power factor shall be maintained as close as practicable to the power factor limit without exceeding the EDG excitation limits.

SR 3.8.1.11

Consistent with Regulatory Guide 1.9 (Ref. 3), paragraph C.2.2.4, this Surveillance demonstrates the ~~as designed operation~~ operability of the standby power sources during loss of the offsite source. This test verifies all actions encountered from the loss of offsite power, including shedding of the non-essential loads and energization of the essential buses and respective loads from the EDG. It further demonstrates the capability of the EDG to automatically achieve the required voltage and frequency within the specified time.

The EDG auto-start time of 10 seconds is derived from requirements of the accident analysis to respond to a design basis large break LOCA. The Surveillance should be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability has been achieved.

The requirement to verify the connection and power supply of permanent and auto-connected loads is intended to satisfactorily show the relationship of these loads to the EDG loading logic (i.e., the individual time delay relays for the component cooling water, service water, and makeup pumps). In certain circumstances, some of these loads can not actually be connected or loaded without undue hardship or potential for undesired operation. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the EDG

BASES

SURVEILLANCE REQUIREMENTS

SR 3.8.1.13 (continued)

rating (part b), the power factor limit is ≤ 0.84 for EDG 1 and ≤ 0.84 for EDG 2. Under certain conditions, however, Note 3 allows the Surveillance to be conducted outside the power factor limit. These conditions occur when grid voltage is high, and the additional field excitation needed to get the power factor to within the limit results in voltages on the essential buses that are too high. Under these conditions, the power factor should be maintained as close as practicable to the limit while still maintaining acceptable voltage limits on the essential buses. In other circumstances, the grid voltage may be such that the EDG excitation levels needed to obtain a power factor within limit may not cause unacceptable voltages on the essential buses, but the excitation levels are in excess of those recommended for the EDG. In such cases, the power factor shall be maintained as close as practicable to the power factor limit without exceeding the EDG excitation limits.

SR 3.8.1.14

This Surveillance demonstrates that the diesel engine can restart from a hot condition, such as subsequent to shutdown from normal Surveillances, and achieve the required voltage and frequency within 10 seconds. The 10 second time is derived from the requirements of the accident analysis to respond to a design basis large break LOCA. ~~The minimum voltage limit is based on the voltage required for EDG breaker closure and the minimum frequency limit is based on the recommendations in Safety Guide 9 (Ref. 11).~~

The 24 month Frequency is based on engineering judgment and is intended to be consistent with the expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

This SR is modified by two Notes. Note 1 ensures that the test is performed with the diesel sufficiently hot. The load band is provided to avoid routine overloading of the EDG. Routine overloads may result in more frequent teardown inspections, in accordance with vendor recommendations, in order to maintain EDG OPERABILITY. The requirement that the diesel has operated for at least 1 hour at approximately full load conditions prior to performance of this Surveillance is based on achieving hot, stabilized conditions. Momentary transients due to changing bus loads do not invalidate this test. Note 2 allows all EDG starts to be preceded by an engine prelube period to minimize wear and tear on the diesel during testing.

BASES

LCO (continued)

The EDG must be capable of starting, accelerating to ~~rated~~the required speed and voltage as specified in the Technical Specifications, and connecting to its respective essential bus on detection of bus undervoltage (loss of voltage or degraded voltage). This sequence must be accomplished within 10 seconds. The EDG must be capable of accepting required shutdown loads (shutdown loads are started through individual time delay relays), and must continue to operate until offsite power can be restored to the essential buses. These capabilities are required to be met from a variety of initial conditions such as EDG in standby with the engine hot and EDG in standby at ambient conditions.

Proper sequencing of loads, including tripping of non-essential loads, is a required function for EDG OPERABILITY.

It is acceptable for trains to be cross tied during shutdown conditions, allowing a single offsite power circuit to supply all required trains.

APPLICABILITY

The AC sources required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies;

b. Systems needed to mitigate a fuel handling accident are available;

c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and

d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

The AC power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.1.

ACTIONS

LCO 3.0.3 is not applicable while in MODE 5 or 6. However, since irradiated fuel assembly movement can occur in MODE 1, 2, 3, or 4, the ACTIONS have been modified by a Note stating that LCO 3.0.3 is not applicable. If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operations. Entering LCO 3.0.3, while in MODE 1, 2, 3, or 4 would require the unit to be shutdown unnecessarily

Attachment D

**AC Power System Analysis,
Section 3, Acceptance Criteria**

(12 pages follow)

The abbreviations and acronyms listed below are used in the AC Power System Analysis, Calculation No. C-EE-015.03-008 pages provided in Attachment D.

A	ampere
Amps	amperes
ANSI	American National Standards Institute
ARTS	anticipatory reactor trip system
Att.	Attachment
CR	condition report
DIN	document index [reference] number
dc	direct current
DVR	degraded voltage relay
EDG	emergency diesel generator
e.g.	for example
ETAP	Electrical Transient Analysis Program
FLA	full load amperes
hp	horsepower
ID	identification
i.e.	that is
kV	kilo-volt
kVA	kilo-volt-ampere
kW	kilo-watt
LOCA	loss of coolant accident
LOOP	loss of offsite power
MCC	motor control center
MOV	motor operated valve
SFRCS	steam and feedwater rupture control system
V	volt
Vdc	volts direct current
%	percent
+	plus
-	minus
±	plus or minus
+/-	plus or minus
=	equals

3.0 ACCEPTANCE CRITERIA

Acceptance criteria for MOV terminal voltages are not within the scope of this calculation.

3.1 Bus Voltages

Attachment 4E contains safe operating limit voltage ranges for 345kV switchyard, 13.8kV switchgear A and B, 4.16kV switchgear C1 and D1, and 480V switchgear E1 and F1. The safe operating limit voltage ranges are more limiting than the bus voltage acceptance criteria listed in this section. The voltage ranges shown in Attachment 4E provide the proper voltages necessary to satisfy technical specification surveillance requirements in accordance with procedures DB-SC-03023 (DIN 24), DB-SC-03041 (DIN 25), and DB-SC-03042 (DIN 26). Note: The voltages provided for 4.16kV switchgear C1 and D1 in procedure DB-SC-03023 are approximate voltages only; i.e., they are only used to determine proper offsite power lineup to C1 and D1 and therefore are not required to be within the proper voltage range listed in Attachment 4E.

3.1.1 Continuous Maximum Voltages

Buses shall have continuous voltages less than the voltages shown in the following table:

Bus Nominal Voltage	Bus Maximum Voltage	Reference
13.8 kV	15.0 kV	Specification E-005Q (DIN 245)
4.16 kV	4.76 kV	Specification E-005Q (DIN 245)
480 V	600 V	VMAN E-007-142 (DIN 244)

Table 1C of Attachment 3 provides the overall maximum bus voltages which includes maximum voltage requirements of equipment powered from each bus.

3.1.2 Minimum Voltages

The minimum voltage requirement for buses is based on the minimum voltage requirement of equipment powered from that bus, which includes motors, contactors, relays, loads that support the dc system, hydramotors, radiation monitors, and SFRCS Logic Channels. The voltage requirements for the individual loads are discussed in more detail in their applicable sections below. Table 1A of Attachment 3 determines the overall minimum continuous bus voltage for select buses based on the minimum voltage requirement of the loads and control circuits powered from that bus. Table 1B of Attachment 3 determines the overall minimum bus voltage during motor starting transients.

Further discussion of the minimum required voltage for MCCs YE2 and YF2 is provided below.

3.1.2.1 Motor Control Centers YE2 and YF2

According to the minimum required voltages in Attachment 24, the minimum required steady state voltage for MCC YE2 and MCC YF2 is 209.0 V (87.08% of 240 V) and 208.3 V (86.78% of 240 V), based on relay pickup voltage requirements. The minimum required ride through voltage for MCCs YE2 and YF2 is 148.8 V (62% of 240 V) based on the voltage at SFRCS Logic Channels 3 and 4 to prevent relay drop-out and inadvertent actuation of ARTS. The bases for these steady state and transient voltage requirements are discussed in more detail below.

- **SFRCS Logic Channels 3 and 4 Steady State Voltages**
  SFRCS Logic Channels 3 and 4 are fed from MCC YE2 and MCC YF2, respectively. Calculation C-EE-017-01-008 (DIN 372) establishes a minimum voltage at MCCs YE2 and YF2 of 222.6 V (92.75% of 240 V) and 223.2 V (93.00% of 240 V), respectively. Calculation C-EE-017-01-008 performs a voltage drop analysis from the SFRCS cabinet to the corresponding MCC starting with the SFRCS system design specification minimum voltage of 108 V (90% of 120 V) per Specification E-030AQ (DIN 620). Based on the SFRCS cabinet voltage drop calculation, there is at most a 3% voltage drop from the 240 V MCC (either YE2 or YF2) to the corresponding SFRCS cabinet.

  CR 03-01242 (DIN 619) analyzes the minimum voltage requirements for the SFRCS cabinets fed from MCCs YE2 and YF2. The analysis determined that the relays in the cabinets have a pickup voltage of approximately 81% of rated voltage. Applying a 3% voltage drop from the SFRCS cabinet to the corresponding MCC, a relay pickup voltage of 81% would result in a minimum required voltage at MCCs YE2 and YF2 of approximately 84%. This is below the minimum required steady state voltage for MCCs YE2 and YF2 based on MOV contactor pickup and is therefore not the bounding steady state acceptance criterion.

- **SFRCS Logic Channels 3 and 4 Transient Voltage Dips**
  CR 03-01242 (DIN 619) also determined that 59% was a conservative upper bound for the maximum dropout voltage of the relays in the SFCRS cabinets that are fed from MCCs YE2 and YF2. The purpose for this analysis was to ensure that an inadvertent ARTS actuation (which occurs if relays in SFRCS channels 3 or 4 drop out) does not occur during degraded voltage conditions.

  Applying a 3% voltage drop from the SFCRS cabinet to the corresponding MCC, a dropout voltage of 59% results in a minimum required holding voltage at MCCs YE2 and YF2 of 62% of rated voltage. This value is above the required bus holding voltages of 58.52% and 58.51% for MCC YE2 and MCC YF2, respectively, per Attachment 24. Therefore, the minimum required ride-through voltage for both MCCs YE2 and YF2 during motor starting transients is 148.8 V (62% of 240 V). This will ensure SFRCS Logic Channels 3 and 4 remain energized, and prevent an inadvertent ARTS actuation.

3.2 Transformers

3.2.1 Maximum Loading

Transformer output kVA shall not exceed the maximum transformer kVA rating per ANSI Standard C57.12.00 (DIN 421). The rated transformer kVA is the continuous output that the transformer can deliver at rated secondary voltage and frequency without exceeding the temperature-rise limitations. Transformer operations at a load greater than rated kVA could result in reduction of equipment life.

3.2.2 Maximum Voltages

The voltage on the transformer low voltage winding shall not exceed 105% of the nominal winding rated voltage at full load, nor 110% at no load (DIN 421).

3.3 Induction Motors

3.3.1 Continuous Running Voltages

Motor terminal continuous running voltage shall be within ±10% of the motor rated voltage per Davis Besse Design Criteria Manual Part III.D Section 4.5 (DIN 4). An exception to this is the running voltage for essential fan motors (see discussion in Section 3.3.1.1 below).

3.3.1.1 Essential Fan Motors 10 hp or Smaller

The acceptance criteria established for the minimum terminal voltage of essential fan motors 10 hp or smaller is 90% of nominal 460 V (or 414 V) with the following exception: during design basis accident loading conditions with off-site voltage degraded below 98.3% of 345 kV, it is acceptable for essential fan motors 10 hp or smaller to be less than 90% of nominal provide: (1) the voltage remains above 87% of nominal 460 V (or 400.2 V), (2) the motor has a service factor of at least 1.15, (3) operation at reduced voltage would not cause the motor's thermal overload (if installed) to trip, and (4) the motor continues to operate above rated speed at reduced voltage. This exception is based on the following justification:

1. Motor starting analyses demonstrate that there is sufficient voltage for these fans to start and run (within the acceptance criteria from their design specifications) following a design basis accident coincident with off-site power degraded to 98.3% of 345 kV. This capability is demonstrated by the accident block loading ST1 analysis case series. Per Attachment 4C, the 2003 summer voltage assessment shows that the probability of the off-site power voltage being lower than 98.3% of 345 kV is less than 1 day in 1000 years. The assessment of the system for the summer 2005 conditions indicates an overall probability of experiencing off-site power voltage below 98.3% of 345 kV is 1 day in 900,000 years. Combined with the chance of occurrence of a design basis accident, the likelihood that the essential fan motors would be required to operate under these plant conditions is very small. Addationally, voltages for assments performed in 2010, 2011,

2012 and 2013 all show higher minimum voltages than assments performed in 2001, 2003 and 2005, see section 1.11.1.1 for details. Therefore, loss of equipment life caused by long term operation of the essential fan motors outside of the voltage design specifications is not a concern.

2. The actual current draw for the essential fan motors is expected to be less than the modeled current draw. Seven essential fan motors that are 10 hp or smaller and whose terminal voltage was less than 90% of nominal in the degraded voltage analytical limit analysis (ST4 case series) have been tested in-situ. The "WinVis" motor test data was obtained via procedure DB-PF-05064 (DIN 29), and has been included as Attachment 9 Item No. 30. The following table summarizes the results of the most recent test data provided for each motor:

Motor ID	Full Load Amps (From Att. 18)	Measured Current (A)	Measured Voltage (V)	Measured Current at 460V (A)	Margin to FLA (A)	Margin to FLA (%)
MC21-1	7.10	5.82	471.44	5.96	1.14	16%
MC31-1	10.80	7.91	477.47	8.21	2.59	24%
MC31-2	11.80	9.49	472.78	9.75	2.05	17%
MC31-4	11.80	9.06	468.58	9.23	2.57	22%
MC31-5	11.80	10.06	477.43	10.44	1.36	12%
MS61-2	10.80	6.17	484.02	6.49	4.31	40%
MC73-2	10.10	7.80	480.95	8.16	1.94	19%
MC75-1	9.90	7.85	473.42	8.08	1.82	18%

The measured current was converted to 460V in order to provide a direct comparison with the full load amps rating of the motor, which is specified at 460V. To convert the current eto a different voltage, the fans were modeled as constant power devices, which is standard industry practice for steady state induction motors. This gives the following conversion:

$$I_{460V} = I_{Measured} \times (V_{Measured} / 460V)$$

Where:

I_{460V} = Measured current at 460V (Amps)

$I_{Measured}$ = Meaured current (Amps)

$V_{Measured}$ = Measured voltage corresponding to measured current (Volts)

The results show that there is significant margin between the actual running current measured and the rated full load current modeled in ETAP for these seven motors. Each motor has greater than 10% margin between measured and modeled current.

3. A service factor of 1.15 means the induction motor can be operated continuously at 115% of its nameplate rating, which corresponds to 115% rated full load amps at nominal voltage. Since induction motors act like constant power devices during continuous operations, an induction motor operating at 100% rated load and 87% rated voltage would be operating at approximately 115% (=100%/87%) of its nameplate full load amps. Since a service factor of 1.15 is part of the acceptance criteria for these fan motors, operating the fan motor at 87% rated terminal voltage would not cause the motor to have a running current above design specification. Therefore, the additional thermal heating caused by the higher current draw at 87% rated voltage is determined to be acceptable.

4. For essential fan motors operating below 90% of rated 460V, an evaluation was performed to ensure the increase in current draw due to operating at reduced voltage would not cause the motor's thermal overload to trip (see Section 5.8.2.1).

5. For essential fan motors operating below 90% of rated 460V, an evaluation was performed to ensure the motors operate above rated speed at reduced terminal voltage (see computation Section 4.4 and results Section 5.8.2.1).

3.3.2 Ride Through Voltages

The minimum ride through terminal voltage for safety-related 4 kV and 460 V motors during starting transients is 65% of nominal per specifications 7749-E-37 (DIN 247) and EA-002 (DIN 430), respectively. This criterion ensures safety-related motors will not stall during momentary voltage dips.

3.3.3 Starting Voltages

3.3.3.1 Safety Related Motors

The minimum starting terminal voltage for Safety Related motors shall be 70% of motor rated voltage per Davis Besse Design Criteria Manual Part III.D Section 4.5 (DIN 4).

3.3.3.2 Non-Safety Related Motors

The minimum starting terminal voltage for Non-Safety Related motors shall be 80% of motor rated voltage per Davis Besse Design Criteria Manual Part III.D Section 4.5 (DIN 4).

3.4 Non-Motor Loads

3.4.1 Battery Chargers

3.4.1.1 Continuous Running Voltages

Battery Chargers DBC2PN, DBC1PN, DBC1N, DBC1P, DBC2N, and DBC2P shall have a steady state terminal voltage between -18% to +10% of rated 480 V (393.6 to 528 V) (DIN 431).

3.4.1.2 Ride Through Voltages

There is no acceptance criterion for the ride-through voltage of the battery chargers during a motor starting transient. When a battery charger dips below its minimum required voltage, the corresponding station battery may be required to assume the burden of the dc system. The longest dip from a motor starting transient is at most 15.5 seconds (from starting a Reactor Coolant Pump). This means that the station battery would have to carry the dc system burden for at most 15.5 seconds at any one time during a motor starting transient. A 15.5 second load on a station battery is a negligible amount of Amp-hours discharged from the battery (much less than one Amp-hour removed). In addition, dc system calculation C-EE-002.01-010 (DIN 281) shows each battery can support design basis accident loading on the dc system for up to one hour and takes no credit for alternate ac power sources.

3.4.2 Constant Voltage Transformers

3.4.2.1 Continuous Running Voltages

Constant Voltage (Ferroresonant Isolomiter) Transformers XY1, XY2, XY3, and XY4 shall have a steady state terminal voltage between -15% to +10% of rated 480 V (408 to 528 V) (DIN 232). The constant voltage transformers are operating at no load under all scenarios analyzed (see discussion in Attachment 5). Therefore, the minimum voltage requirement is based on continuous operation of the transformers within design specifications, and is not based on providing adequate voltage to downstream equipment.

3.4.2.2 Ride Through Voltages

There is no acceptance criterion for the ride-through voltage of the constant voltage transformers since there are no downstream components that would be affected by a momentary dip in the output voltage of the transformers.

3.4.3 Regulated Rectifiers

3.4.3.1 Continuous Running Voltages

Regulated Rectifiers YRF1, YRF2, YFR3, and YRF4 shall have a steady state terminal voltage between ±10% of rated voltage 480 V (432 to 528 V), except under the specific plant conditions discussed below. A terminal voltage of ±10% of rated 480 V is the design specification and ensures the regulated rectifiers can supply 144 Vdc to the dc system per Specification 12501-E-854Q (DIN 432), which is above the normal dc system voltage. An output voltage of 140 Vdc bounds the nominal battery charger float voltage of 132 Vdc per Section 8.3.2.1.2 of the USAR (DIN 1) and a battery charger equalizing voltage of 142 Vdc per battery charger specification E-20Q (DIN 246).

- **Exception to Steady State Voltage Requirement for Regulated Rectifiers**

Following a design basis accident with off-site power degraded below 98.3% of 345 kV, the regulated rectifiers shall have a minimum steady state terminal voltage of -15% of rated 480 V (or 408 V). At -15% of rated voltage, the regulated rectifiers will supply approximately 136.6 Vdc to the dc system (DIN 444). This is above the 132 Vdc nominal dc system supply voltage expected during operations with the battery on a float with the battery charger. However, during conditions with the battery charger in equalize mode, the dc system voltage may be above a regulated rectifier output of 136.6 Vdc. In this case, the dc system may be required to provide steady-state voltage to the essential inverters in lieu of the regulated rectifiers. This is acceptable for reasons discussed below:

1. Since the battery chargers would be available to supply power to the essential inverters, a drop in regulated rectifier dc output voltage below the dc system voltage would result in a transfer of load from the regulated rectifier to the corresponding battery charger. Therefore, operation of the regulated rectifiers at a dc output voltage below dc system voltage is not a concern regarding the operability of the essential inverters. Instead, it is an undesirable condition based on continuous operation of the regulated rectifiers outside of design specification 12501-E-854Q (DIN 432).

2. Per Attachment 4C, the 2003 summer voltage assessment shows that the probability of the offsite power voltage being lower than 98.3% of 345 kV is less than 1 day in 1000 years. The assessment of the system for the summer 2005 conditions indicates an overall probability of experiencing off-site power voltage below 98.3% of 345 kV is 1 day in 900,000 years. Combining this probability with the likelihood of a design basis accident and a battery charger in equalize mode results in a much lower probability from three independent plant conditions that are extremely unlikely to occur simultaneously. In addition, if this combination of events were to occur, the specific set of plant conditions is likely to be of short duration while the plant restores ac system voltage (e.g., by operating the EDGs) or returns dc system voltages to normal (e.g., by placing the battery charger in float mode instead of equalize mode).

3.4.3.2 Ride Through Voltages

There is no acceptance criterion for the ride-through voltage of the regulated rectifiers during a motor starting transient. The dc output voltage from regulated rectifiers YRF1, YRF2, YFR3, and YRF4 is auctioneered with the dc voltage supplied via the station battery (or battery charger) to provide power to essential inverters YV1, YV2, YV3 and YV4, respectively. The longest dip from a motor starting transient is at most 15.5 seconds (from starting a Reactor Coolant Pump). This means that the station battery would have to carry the burden of inverters YV1, YV2, YV3, and YV4 for at most 15.5 seconds at any one time during a motor starting transient. A 15.5 second load on a station battery is a negligible amount of Amp-hours discharged from the battery (much less than one Amp-hour). Moreover, the dc system calculation C-EE-002.01-010 (DIN 281) shows the battery can support design basis accident loading on the dc system for up to one hour, and does not take credit for the regulated rectifiers.

3.4.4 Radiation Monitors

Per PIN 30 to Revision 5 of this calculation (DIN 793), Revision 1 of C-EE-006.01-032 will establish the minimum steady state voltages at the following MCCs due to requirements of the radiation monitors:

MCC	Motor for Electrotechnical Unit	V_{NEEDED} at MCC [Volts]	$V_{ADJUSTED, PU}$ at MCC
E16B	DB-C3841	416.6	0.868
F16B	DB-C3743	417.6	0.870
E16A	DB-C5306	414.2	0.863
F16A	DB-C5308	413.3	0.861

3.4.5 Hydramotors

3.4.5.1 Continuous Running Voltages

The hydramotors which are modeled explicitly in ETAP have an acceptable operating voltage down to 85% of rated voltage during steady-state running conditions at the terminals of the hydramotors (DIN 373).

For hydramotors fed from 240V MCCs YE2 and YF2 or 480V-120V transformers YE1 and YF1 (which are not modeled explicitly in ETAP), the hydramotor steady-state terminal voltage is considered acceptable if the MCC or transformer supply-side voltage do not fall below the minimum required voltage specified in the following table (per DIN 373):

MCC / Transformer	Rated Voltage	Minimum Required Voltage	Percent Rated Voltage
YE2	240 V	201.6 V	84.0 %
YF2	240 V	197.8 V	82.4 %
YE1	480 V	394.0 V	82.1 %
YF1	480 V	391.6 V	81.6 %

3.4.5.2 Starting Voltages

The minimum starting terminal voltage for safety related hydramotors is 70% of rated voltage per Davis Besse Design Criteria Manual Part III.D Section 4.5 (DIN 4).

3.4.5.3 Ride Through Voltages

Safety-related hydramotors 460 V and below motors shall not stall during momentary voltage dips provided that their terminal voltage is greater than 65% of rated voltage (DIN 430).

3.5 Motor/Load Contactors

Attachment 24 provides a list of minimum required MCC voltages based on control circuit pickup and holding voltage requirements per correspondence letter DBE 07-00145 (DIN 626) and Table 5-1 of NSS-03-00060 (DIN 399). The acceptance criteria for control circuit pickup and holding voltage requirements are based on the specific type of analysis being performed (i.e., load flow or motor starting) and are defined in Sections 3.5.1 and 3.5.2 below.

When evaluating contactor pickup and dropout voltage limits, the following loads were not considered limiting per CR No. 03-05010 (DIN 429):

- MP0411 on bus E11C MCC, Primary Water Transfer Pump - This pump has been spared and is therefore not modeled in ETAP.
- X39D1 on bus E11C MCC, Containment Lighting Transformer - This load serves no safety function.
- MC56-1 on bus E11B MCC, Containment Recirculation Fan 1 - The only safety function is Electrical Circuit Integrity (no short-circuits allowed), not an operational function.
- MC56-2 on bus F11A MCC, Containment Recirculation Fan 2 - This load serves no safety function.

3.5.1 Control Circuit Pickup Voltage

For steady-state load flow analyses, MCC bus voltages must remain above the bus required pickup voltage listed in Attachment 24. For motor starting analyses, the minimum MCC voltage before the accident load block starts (case series ST1, ST4, ST5) or before the reactor coolant pump/condensate pump motor starts (case series ST2 and ST3) must remain above the bus required pickup voltage listed in Attachment 24. Therefore, the bus required pickup voltage from Attachment 24 is used as the MCC voltage acceptance criteria in Table 1A of Attachment 3.

3.5.2 Control Circuit Holding Voltage

For motor starting analyses, the MCC bus voltages must remain above the bus required hold voltage listed in Attachment 24 at all times during the motor starting event. This ensures MCC contactors that have picked up do not drop out during voltage transients. Therefore, the bus required hold voltage from Attachment 24 is used as the MCC voltage acceptance criteria in Table 1B of Attachment 3.

3.6 Degraded Voltage Relays

C-EE-004.01-049 (DIN 308) establishes the Analytical Limits, Allowable Values and Set points for the upper and lower ranges of the Degraded Voltage Relays in support of LAR 03-0014 (DIN 469) and is used as input for this calculation.

3.6.1 Analytical Limit Pickup (Reset)

The voltage at 4.16 kV Switchgear C1 and D1 must remain above the Analytical Limit for Degraded Voltage Relay Pickup (reset) setting of 3786 V (91.01% of 4.16 kV) during steady-state operating conditions (LF1 through LF6 and LF12 series load flow analyses). The Analytical Limit for Degraded Voltage Relay Pickup (reset), as provided in Calculation C-EE-004.01-049 (DIN 308), is used as acceptance criteria for the minimum allowable voltage at 4.16 kV Switchgear C1and D1 during steady state conditions, as opposed to the setpoint for relay dropout (3734 +/- 7 V) because, in the event of a motor start, use of the relay dropout setpoint may cause the bus voltage to drop below the dropout trip setpoint and never recover to above the Analytical Limit for Degraded Voltage Relay reset (reference DIN 470). Use of the Analytical Limit for Degraded Voltage Relay reset in this analysis will ensure that the bus voltage will recover above the Allowable Value for Degraded Voltage Relay Pickup (3771 V).

In addition, for motor starting transients which reduce the voltage at 4.16 kV Switchgear C1 or D1 voltage below the DVR dropout (trip) setpoint, the bus voltage must recover to higher than the Analytical Limit for Degraded Voltage Relay reset within the DVR Dropout Time Delay setting Lower Analytical Limit of 6.4 seconds (DIN 308). This criterion ensures that premature transfer to the Diesel generators during SFAS load sequencing or any other short duration voltage transients (i.e. bus transfers etc.) does not occur. To meet this acceptance criterion, the 4.16 kV Switchgear C1 and D1 voltages must be at or above the Analytical Limit for Degraded Voltage Relay reset (3786 V) at modeling event T=1 for motor starting analysis cases ST1 and ST5. The T=1 time step represents the longest 4 kV motor acceleration time at reduced voltage (see discussion in Section 1.2.4.1), which is less than 6.4 seconds (as seen in Attachment 13).

3.6.2 Analytical Limit Dropout (Trip)

The Analytical Limit for Degraded Voltage Relay Dropout (trip) is 3700V (88.942% of 4.16kV). When the voltage at 4.16 kV Switchgear C1 and D1 is set at the Analytical Limit for Degraded Voltage Relay Dropout value of 3700 V in ETAP Analysis cases ST4a4, ST4a5, and ST4b, motor terminal voltages shall be equal or greater than 90% of the motor nameplate ratings at modeling event T=5 (steady-state).

3.6.3 Degraded Voltage Relay Bypass

During a reactor coolant pump or circulating water pump start, voltages at 4.16 kV essential Switchgear C1 or D1 may drop below the DVR trip setpoint. Reactor coolant pumps may take up to 15.5 seconds to start at 80% voltage (see Attachment 13), which is greater than the 6.4 second time delay of the degraded voltage relay reset. In order to block a low voltage trip of 4.16 kV essential Switchgear C1 or D1, a pushbutton bypass allows the degraded voltage relays to be bypassed for up to one minute during a Reactor Coolant Pump or Circulating Water Pump motor start (DIN 1, Section 8.3.1.1.3).

In the Large Motor Starting Transient analysis series (ST2 and ST3), the effects of starting a 13.2 kV reactor coolant pump (which bounds the starting of a circulating water pump) and a 4 kV condensate pump are examined. Based on the discussion in the preceding paragraph, the operator is expected to bypass the DVR during a reactor coolant pump start. In addition, the condensate pumps can start within 3.5 seconds at 80% voltage (see Attachment 13), and would be finished accelerating prior to the expiration of the DVR time delay. Therefore, the DVR acceptance criteria for motor starting analysis series ST2 and ST3 is that bus voltages must recover to above the DVR reset of 3786 V at the end of each motor starting transient.

3.7 Emergency Diesel Generators

See Section 1.11.2.1 for a complete list of the EDG load ratings. The effects of EDG cold start derating are evaluated in the EDG Transient Analysis calculation and therefore are not included in this calculation.

3.7.1 Design Basis Accident Loading

The emergency diesel generator continuous loading shall not exceed 2730 kW following a loss of offsite power with or without a design basis accident. This requirement is based on DIN 435, which states the loading on the EDGs should not exceed the smaller of the 2000-hr rating (2838 kW) or 90% of the 30-minute rating (2731.5 kW) of the diesel-generator set. In addition, an endurance run is performed on the EDGs every 24 months per Technical Specification SR 3.8.1.13.a (DIN 2), during which the EDG is loaded to between 2730 kW and 2860 kW for the first 2 hours of the test. Ensuring the EDG loading does not exceed the minimum endurance test load value of 2730 kW guarantees the test load bounds the maximum expected load on the EDG following a loss of offsite power with or without a design basis accident.

3.7.2 Appendix R Loading

Per Report MPR-2559 (DIN 434) for Appendix R fire scenarios, the EDG load could exceed the 2000-hour rating since there are required loads that are not auto-connected. However, the potential maintenance impact on the EDGs would need to be considered. Therefore, for the purposes of this calculation, the EDG loading in the Appendix R scenario should not exceed the EDG 2000-hour rating (2838 kW).

3.7.3 Automatic EDG Loading

Per Addendum 02 to C-NSA-016.04-006 Revision 1 (DIN 784) load during automatic EDG sequencing shall not excced 2600kW during a LOOP or LOOP/LOCA scenarios.

Attachment E

**AC Power System Analysis,
Attachment 3, Bus Voltage Acceptance Criteria
and Summary Result Tables**

(35 pages follow)

The abbreviations and acronyms listed below are used in the AC Power System Analysis, Calculation No. C-EE-015.03-008 pages provided in Attachment E.

CVT	constant voltage transformer
DVR	degraded voltage relay
ETAP	Electrical Transient Analysis Program
kV	kilo-volt
Max	maximum
MCC	motor control center
Min	minimum
MOV	motor operated valve
Nom	nominal
SFRCS	steam and feedwater rupture control system
T	time
V	volt
%	percent

BUS VOLTAGE ACCEPTANCE CRITERIA AND SUMMARY RESULT TABLES

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**Table 1A. Minimum Continuous Bus Voltage
Acceptance Criteria (%V)**

Bus	Nominal Bus Voltage	Continuous Motor Running Voltage (rated Volt*)	DVR Reset Analytical Limit	Contactor Required Pickup Voltage (480V)	Battery Chargers (Rated 480V)	CVT (Rated 480V)	Regulated Rectifier (Rated 480V**)	SFRCS Logic	Hydra motors	Radiation Monitors (Rated 480V)	Minimum Required Continuous Bus Voltage
A	13800	86.090									86.090
B	13800	86.090									86.090
C1	4160	86.540	91.010								91.010
CD	4160	86.540									86.540
D1	4160	86.540	91.010								91.010
E1	480	86.250									86.250
E11A	480	86.250		87.100							87.100
E11B	480	86.250		87.100							87.100
E11C	480	86.250		87.100							87.100
E11D	480	86.250		86.770	82.000						86.770
E11E	480	86.250		87.100					85.000		87.100
E12A	480	86.250		87.100	82.000		90.000		85.000		90.000
E12B	480	86.250		87.100							87.100
E12C	480	86.250		87.100							87.100
E12D	480	86.250		78.520							86.250
E12E	480	86.250		87.100							87.100
E12F	480	86.250		78.150							86.250
E14	480	86.250		78.150							86.250
E15	480	86.250		78.150							86.250
E16A	480	86.250				85.000				89.8	89.800
E16B	480	86.250		78.150						90.3	90.300
EF12C	480	86.250		82.170							86.250
EF12D	480	86.250									86.250
F1	480	86.250									86.250
F11A	480	86.250		87.100					85.000		87.100
F11B	480	86.250		87.100							87.100
F11C	480	86.250		87.100							87.100
F11D	480	86.250		87.100	82.000						87.100
F11E	480	86.250		86.230							86.250
F12A	480	86.250		87.100	82.000		90.000		85.000		90.000
F12B	480	86.250		87.100							87.100
F12C	480	86.250		87.100							87.100
F12D	480	86.250		78.150							86.250
F13	480	86.250									86.250
F14	480	86.250		78.150							86.250
F15	480	86.250		78.150							86.250
F16A	480	86.250		78.150		85.000				89.7	89.700
F16B	480	86.250								90.5	90.500
EF15	480	86.250									86.250
XYE2	480	86.250									86.250
YE1	120			73.780					82.100		82.100
YE2	240	86.250		87.080				84.000	84.000		87.080
YF1	120			73.380					81.600		81.600
YF2	240	86.250		86.780				84.000	82.400		86.780

* See Motor Ratings Below
1) 13.2kV rated motors are connected to 13.8kV Bus
2) 4.0kV rated motors are connected to 4.16kV Bus
3) 460V rated motors are connected to 480V Bus
4) 230V rated motors are connected to 240V Bus
** Regulated Rectifiers continuous minimum voltage is 85% for scenario ST4

Table 1B. Minimum Starting/Ride Through Bus Voltage Acceptance Criteria (%V)

Bus	Nominal Bus Voltage	Motor Starting Voltage (rated Volt*)	Contactor Required Holding Voltage (480V)	SFRCS Logic	Hydramotors (Not Modeled in ETAP)	Hydramotors (Modeled in ETAP)	Minimum Required Starting Bus Voltage
A	13800	76.530					76.530
B	13800	76.530					76.530
C1	4160	67.310					67.310
CD	4160	67.310					67.310
D1	4160	67.310					67.310
E1	480	67.090					67.090
E11A	480	67.090	60.200				67.090
E11B	480	67.090	59.070				67.090
E11C	480	67.090	60.350				67.090
E11D	480	67.090	58.880				67.090
E11E	480	67.090	58.660			67.090	67.090
E12A	480	67.090	60.740			67.090	67.090
E12B	480	67.090	60.310				67.090
E12C	480	67.090	58.500				67.090
E12D	480	67.090	57.150				67.090
E12E	480	67.090	58.610				67.090
E12F	480	67.090	59.040				67.090
E14	480	67.090	58.330				67.090
E15	480	67.090	58.330				67.090
E16A	480	67.090					67.090
E16B	480	67.090	58.850				67.090
EF12C	480	67.090	58.560				67.090
EF12D	480	67.090					67.090
F1	480	67.090					67.090
F11A	480	67.090	60.370			67.090	67.090
F11B	480	67.090	60.320				67.090
F11C	480	67.090	60.740				67.090
F11D	480	67.090	58.640				67.090
F11E	480	67.090	58.520				67.090
F12A	480	67.090	59.760			67.090	67.090
F12B	480	67.090	58.810				67.090
F12C	480	67.090	60.220				67.090
F12D	480	67.090	58.790				67.090
F13	480	67.090					67.090
F14	480	67.090	58.330				67.090
F15	480	67.090	59.020				67.090
F16A	480	67.090	59.150				67.090
F16B	480	67.090					67.090
EF15	480	67.090					67.090
XYE2	480	67.090					67.090
YE1	120		60.100		65.000		65.000
YE2	240	67.090	58.520	62.000	65.000	67.090	67.090
YF1	120		60.080		65.000		65.000
YF2	240	67.090	58.510	62.000	65.000	67.090	67.090

* See Motor Ratings Below
1) 13.2kV rated motors are connected to 13.8kV Bus
2) 4.0kV rated motors are connected to 4.16kV Bus
3) 460V rated motors are connected to 480V Bus
4) 230V rated motors are connected to 240V Bus

Table 1C. Maximum Continuous Bus Voltage Acceptance Criteria (%V)

Bus	Nominal Bus Voltage	Maximum Bus Voltages	Motor Starting Voltage (rated Volt*)	Battery Chargers (Rated 480V)	CVT (Rated 480V)	Regulated Rectifier (Rated 480V)	SFRCS Logic	Maximum Continuous Bus Voltage
A	13800	108.690	105.210					105.210
B	13800	108.690	105.210					105.210
C1	4160	114.420	105.760					105.760
CD	4160	114.420	105.760					105.760
D1	4160	114.420	105.760					105.760
E1	480	125.000	105.410					105.410
E11A	480	125.000	105.410					105.410
E11B	480	125.000	105.410					105.410
E11C	480	125.000	105.410					105.410
E11D	480	125.000	105.410	110.000				105.410
E11E	480	125.000	105.410					105.410
E12A	480	125.000	105.410	110.000		110.000		105.410
E12B	480	125.000	105.410					105.410
E12C	480	125.000	105.410					105.410
E12D	480	125.000	105.410					105.410
E12E	480	125.000	105.410					105.410
E12F	480	125.000	105.410					105.410
E14	480	125.000	105.410					105.410
E15	480	125.000	105.410					105.410
E16A	480	125.000	105.410		110.000			105.410
E16B	480	125.000	105.410					105.410
EF12C	480	125.000	105.410					105.410
EF12D	480	125.000	105.410					105.410
F1	480	125.000	105.410					105.410
F11A	480	125.000	105.410					105.410
F11B	480	125.000	105.410					105.410
F11C	480	125.000	105.410					105.410
F11D	480	125.000	105.410	110.000				105.410
F11E	480	125.000	105.410					105.410
F12A	480	125.000	105.410	110.000		110.000		105.410
F12B	480	125.000	105.410					105.410
F12C	480	125.000	105.410					105.410
F12D	480	125.000	105.410					105.410
F13	480	125.000	105.410					105.410
F14	480	125.000	105.410					105.410
F15	480	125.000	105.410					105.410
F16A	480	125.000	105.410		110.000			105.410
F16B	480	125.000	105.410					105.410
EF15	480	125.000	105.410					105.410
XYE2	480	125.000	105.410					105.410
YE2	240						105.410	105.410
YF2	240						105.410	105.410

* See Motor Ratings Below
1) 13.2kV rated motors are connected to 13.8kV Bus
2) 4.0kV rated motors are connected to 4.16kV Bus
3) 460V rated motors are connected to 480V Bus
4) 230V rated motors are connected to 240V Bus

Table 2. Minimum MCC Voltages
(Input to MOV Voltage Drop Calculations)

MCC	Nominal Voltage	ST1k		ST1k1		ST1k2		ST4a4		ST4a5		ST4b		**Minimum MCC Voltage**
		Volts	%Rating	Volts	%Rating	Volts	%Rating	Volts	%Rating	Volts	%Rating	Volts	%Rating	
		T=1		T=1		T=1		T=0		T=0		T=0		
E11A	480	**410.428**	85.506%	411.381	85.704%	421.400	87.792%	413.960	86.242%					410.428
E11B [2]	480	**409.986**	85.414%	410.940	85.613%	420.852	87.678%	413.433	86.132%					409.986
E11C[1]	480	**408.582**	85.121%	409.532	85.319%	421.200	87.750%	413.916	86.233%					408.582
E11D	480	**410.390**	85.498%	411.381	85.704%	421.275	87.766%	412.433	85.924%					410.390
E11E	480	**406.877**	84.766%	407.823	84.963%	421.103	87.730%	413.895	86.228%					406.877
E12A	480	418.198	87.125%	419.139	87.321%	424.082	88.350%	**416.869**	86.848%					416.869
E12B	480	**414.761**	86.409%	415.695	86.603%	421.180	87.746%	416.049	86.677%					414.761
E12C	480	415.538	86.570%	416.482	86.767%	421.447	87.801%	**414.638**	86.383%					414.638
E12D	480	415.409	86.544%	416.354	86.740%	421.320	87.775%	**414.510**	86.356%					414.510
E12E	480	416.672	86.807%	417.610	87.002%	423.257	88.179%	**414.945**	86.447%					414.945
E12F	480	**414.076**	86.266%	415.012	86.461%	420.506	87.605%	415.949	86.656%					414.076
E14	480	**416.695**	86.811%	417.631	87.006%	422.529	88.027%	416.968	86.868%					416.695
E15	480	418.932	87.278%	419.873	87.474%	424.798	88.500%	**417.518**	86.983%					417.518
E16A	480	418.338	87.154%	419.278	87.350%	424.198	88.375%	**416.833**	86.840%					416.833
E16B	480	418.264	87.138%	419.204	87.334%	424.123	88.359%	**416.118**	86.691%					416.118
E22A	480	423.796	88.291%	424.131	88.361%	424.529	88.444%					**406.190**	84.623%	406.190
EF12C	480	415.344	86.530%	416.289	86.727%	421.256	87.762%	**414.445**	86.343%					414.445
EF12D	480	418.198	87.125%	419.139	87.321%	424.082	88.350%	**416.869**	86.848%					416.869
F11A [2]	480	417.203	86.917%	417.479	86.975%	427.368	89.035%	**413.887**	86.226%					413.887
F11B	480	416.678	86.808%	416.953	86.865%	426.842	88.925%	**413.887**	86.226%					413.887
F11C	480	416.658	86.804%	416.893	86.853%	426.809	88.919%	**411.437**	85.716%					411.437
F11D[1]	480	**409.524**	85.318%	409.795	85.374%	427.235	89.007%	413.621	86.171%					409.524
F11E	480	416.898	86.854%	417.174	86.911%	427.055	88.970%	**412.363**	85.909%					412.363
F11F	480	416.740	86.821%	417.015	86.878%	426.893	88.936%	**412.206**	85.876%					412.206
F12A	480	422.051	87.927%	422.347	87.989%	428.726	89.318%	**416.702**	86.813%					416.702
F12B	480	419.003	87.292%	419.297	87.354%	426.182	88.788%	**415.950**	86.656%					415.950
F12C	480	420.106	87.522%	420.402	87.584%	426.796	88.916%	**415.217**	86.504%					415.217
F12D	480	419.691	87.436%	419.988	87.498%	426.388	88.831%	**414.797**	86.416%					414.797
F14	480	420.360	87.575%	420.654	87.636%	426.917	88.941%	**416.702**	86.813%					416.702
F15	480	423.025	88.130%	423.321	88.192%	429.624	89.505%	**417.353**	86.949%					417.353
F16A	480	422.906	88.105%	423.202	88.167%	429.503	89.480%	**417.189**	86.914%					417.189
F16B	480	422.835	88.091%	423.131	88.152%	429.431	89.465%	**417.119**	86.900%					417.119
F21A	480	430.302	89.646%	430.641	89.717%	431.049	89.802%					**414.078**	86.266%	414.078
YE2	240	**205.705**	85.710%	206.186	85.911%	211.181	87.992%	211.517	88.132%					205.705
YF2	240	**210.377**	87.657%	210.517	87.715%	215.519	89.800%	211.865	88.277%					210.377
E11C for MV612 [1]		408.582	85.121%	409.532	85.319%	421.200	87.750%			**405.001**	84.375%			405.001
F11D for MV601 [1]		409.524	85.318%	409.795	85.374%	427.235	89.007%			**401.966**	83.743%			401.966
E11B for MVDH120 [2]		448.566	93.451%	448.566	93.451%	443.547	92.406%	**419.952**	87.490%					419.952
F11A for MVDH110 [2]		452.931	94.361%	452.931	94.361%	447.876	93.308%	**420.581**	87.621%					420.581

Note 1: MV601 and MV612 are running in study case ST4a5 and are not running in study case ST4a4. Therefore, the steady state voltages for MCC E11C and MCC F11D to be used for MV612 and MV601, respectively, include a comparison between the most limiting ST1 case and case ST4a5. For all other MOVs fed from MCC E11C and MCC F11D, the MCC voltage comparison is between the most limiting ST1 case and case ST4a4.

Note 2: MVDH120 (fed from MCC E11B) and MVDH110 (fed from MCC F11A) are manually operated valves. Therefore, the steady-state voltages for MCC E11B and MCC F11A to be used for MVDH120 and MVDH110, respectively, correspond to model event T=4 in the above cases.

Table 3. Scenarios LF1-LF4: Mode 1-4 Non-Accident Maximum Loading Minimum and Maximum Bus Voltages (Sheet 1 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
A 13.8KV SWGR	13.8	86.090	94.149	LF2d	105.210	99.356	LF2c
A MP2-1	13.8	86.090	94.107	LF2d	105.210	99.316	LF2c
A MP2-3	13.8	86.090	94.114	LF2d	105.210	99.322	LF2c
A MP36-1	13.8	86.090	94.106	LF2d	105.210	99.315	LF2c
A MP36-4	13.8	86.090	94.128	LF2d	105.210	99.336	LF2c
B 13.8KV SWGR	13.8	86.090	94.146	LF2d	105.210	99.441	LF2b
B MP2-2	13.8	86.090	94.092	LF2d	105.210	99.390	LF2b
B MP2-4	13.8	86.090	94.099	LF2d	105.210	99.397	LF2b
B MP36-2	13.8	86.090	94.097	LF2d	105.210	99.395	LF2b
B MP36-3	13.8	86.090	94.127	LF2d	105.210	99.423	LF2b
BF81 MCC	0.48	86.250	94.602	LF2d	105.410	99.469	LF2a
BF81 DBCSBOP	0.48	82.000	94.521	LF2d	110.000	99.384	LF2a
C1 4160 SWGR	4.16	91.010	94.760	LF2d	105.760	99.341	LF3b
C1 MP3-1	4.16	86.540	94.587	LF2d	105.760	99.176	LF3b
C1 MP37-1A	4.16	86.540	94.674	LF2d	105.760	99.259	LF3b
C1 MP42-1	4.16	86.540	94.760	LF2d	105.760	99.341	LF3b
C1 MP43-1	4.16	86.540	94.760	LF2d	105.760	99.341	LF3b
C1 MP58-1	4.16	86.540	94.760	LF2d	105.760	99.341	LF3b
C2 4160 SWGR	4.16	86.540	94.765	LF2d	105.760	99.345	LF3b
D1 4160 SWGR	4.16	91.010	95.335	LF2d	105.760	100.221	LF2a
D1 MP3-2	4.16	86.540	95.128	LF2d	105.760	100.024	LF2a
D1 MP37-2A	4.16	86.540	95.335	LF2d	105.760	100.221	LF2a
D1 MP42-2	4.16	86.540	95.335	LF2d	105.760	100.221	LF2a
D1 MP43-2	4.16	86.540	95.276	LF2d	105.760	100.165	LF2a
D1 MP58-2	4.16	86.540	95.335	LF2d	105.760	100.221	LF2a
D2 4160 SWGR	4.16	86.540	95.338	LF2d	105.760	100.224	LF2a
D3 4160 SWGR	4.16	86.540	95.330	LF2d	105.760	100.217	LF2a
E1 480V SWGR	0.48	86.250	94.786	LF2d	105.410	100.033	LF3b
E1 MP56-1	0.48	86.250	94.786	LF2d	105.410	100.033	LF3b
E11A MCC	0.48	87.100	94.644	LF2d	105.410	99.925	LF3b
E11A MC62-1	0.48	86.250	94.644	LF2d	105.410	99.925	LF3b
E11A MP89-1A	0.48	86.250	94.644	LF2d	105.410	99.925	LF3b
E11A MP89-1B	0.48	86.250	94.644	LF2d	105.410	99.925	LF3b
E11A MP89-3A	0.48	86.250	94.644	LF2d	105.410	99.925	LF3b
E11A MP89-3B	0.48	86.250	94.644	LF2d	105.410	99.925	LF3b
E11B MCC	0.48	87.100	94.617	LF2d	105.410	99.899	LF3b
E11B MC56-1	0.48	86.250	94.105	LF2d	105.410	99.415	LF3b
E11C MCC	0.48	87.100	94.636	LF2d	105.410	99.925	LF3b
E11C MC75-1	0.48	86.250	92.599	LF2d	105.410	99.925	LF3b
E11D MCC	0.48	86.770	94.637	LF2d	105.410	99.918	LF3b
E11D DBC1PN	0.48	82.000	94.637	LF2d	110.000	99.918	LF3b
E11D MP37-1B	0.48	86.250	94.306	LF2d	105.410	99.605	LF3b
E11D MRE5327	0.48	86.250	94.637	LF2d	105.410	99.918	LF3b
E11E MCC	0.48	87.100	94.636	LF2d	105.410	99.925	LF3b
E11E MV49060	0.48	85.000	94.636	LF2d	105.410	99.925	LF3b
E12A MCC	0.48	90.000	94.691	LF2d	105.410	99.955	LF3b

Table 3. Scenarios LF1-LF4: Mode 1-4 Non-Accident Maximum Loading Minimum and Maximum Bus Voltages (Sheet 2 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
E12A DBC1N	0.48	82.000	94.623	LF2d	110.000	99.888	LF3b
E12A DBC1P	0.48	82.000	94.631	LF2d	110.000	99.895	LF3b
E12A MC21-1	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
E12A MC30-1	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
E12A MC71-1	0.48	86.250	94.497	LF2d	105.410	99.955	LF3b
E12A MC73-1	0.48	86.250	94.008	LF2d	105.410	99.955	LF3b
E12A MS3311	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
E12A MS61-1	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
E12A MV5597	0.48	85.000	94.691	LF2d	105.410	99.955	LF3b
E12A YRF1	0.48	90.000	94.547	LF2d	110.000	99.803	LF3b
E12A YRF3	0.48	90.000	94.463	LF2d	110.000	99.715	LF3b
E12B MCC	0.48	87.100	94.537	LF2d	105.410	99.880	LF3b
E12B MC25-1	0.48	86.250	93.484	LF2d	105.410	99.880	LF3b
E12B MC25-2	0.48	86.250	93.750	LF2d	105.410	99.880	LF3b
E12B MC78-1	0.48	86.250	94.076	LF2d	105.410	99.880	LF3b
E12B MP147-1	0.48	86.250	94.244	LF2d	105.410	99.604	LF3b
E12B MP147-3	0.48	86.250	94.453	LF2d	105.410	99.801	LF3b
E12B YE1	0.48	82.100	94.537	LF2d	105.410	99.880	LF3b
E12C MCC	0.48	87.100	94.266	LF2d	105.410	99.799	LF3b
E12C MC99-1	0.48	86.250	93.254	LF2d	105.410	99.799	LF3b
E12C MC99-2	0.48	86.250	93.670	LF2d	105.410	99.799	LF3b
E12C MF15-1	0.48	86.250	94.037	LF2d	105.410	99.583	LF3b
E12D MCC	0.48	86.250	94.241	LF2d	105.410	99.776	LF3b
E12E MCC	0.48	87.100	94.691	LF2d	105.410	99.955	LF3b
E12E MC31-4	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
E12E MC31-5	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
E12E MP197-1	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
E12F MCC	0.48	86.250	94.426	LF2d	105.410	99.776	LF3b
E12F MC25-5	0.48	86.250	94.426	LF2d	105.410	99.776	LF3b
E12F MP195-1	0.48	86.250	94.426	LF2d	105.410	99.776	LF3b
E14 MCC	0.48	86.250	94.529	LF2d	105.410	99.790	LF3b
E14 MC1-1	0.48	86.250	93.420	LF2d	105.410	98.741	LF3b
E14 MC1-1LS	0.48	86.250			105.410		
E15 MCC	0.48	86.250	94.786	LF2d	105.410	100.033	LF3b
E16A MCC	0.48	89.800	94.655	LF2d	105.410	99.991	LF3b
E16A MP274-1	0.48	86.250	94.352	LF2d	105.410	99.671	LF3b
E16A XY1	0.48	85.000	94.606	LF2d	110.000	99.940	LF3b
E16A XY3	0.48	85.000	94.586	LF2d	110.000	99.918	LF3b
E16B MCC	0.48	90.300	94.638	LF2d	105.410	99.973	LF3b
E16B MP273-1	0.48	86.250	94.471	LF2d	105.410	99.796	LF3b
E2 480V SWGR	0.48		89.291	LF2d		94.432	LF2c
E21A MCC	0.48		88.707	LF2d		93.831	LF2c
E21B MCC	0.48		88.677	LF2d		93.799	LF2c
E21C MCC	0.48		88.183	LF2d		93.289	LF2c
E21D MCC	0.48		88.707	LF2d		93.831	LF2c
E22A MCC	0.48		88.404	LF2d		93.524	LF2c

Table 3. Scenarios LF1-LF4: Mode 1-4 Non-Accident Maximum Loading Minimum and Maximum Bus Voltages (Sheet 3 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
E22B MCC	0.48		88.391	LF2d		93.510	LF2c
E23A MCC	0.48		88.767	LF2d		93.910	LF2c
E23B MCC	0.48		88.275	LF2d		93.410	LF2c
E3 480V SWGR	0.48		90.986	LF2d		96.191	LF2c
E31A MCC	0.48		89.294	LF2d		94.508	LF2c
E31B MCC	0.48		89.206	LF2d		94.424	LF2c
E32A MCC	0.48		90.883	LF2d		96.087	LF2c
E32B MCC	0.48		90.387	LF2d		95.594	LF2c
E33A MCC	0.48		90.354	LF2d		95.578	LF2c
E33B MCC	0.48		90.354	LF2d		95.578	LF2c
E4 480V SWGR	0.48		91.290	LF2d		96.498	LF2c
E41A MCC	0.48		90.948	LF2d		96.146	LF2c
E41B MCC	0.48		90.658	LF2d		95.855	LF2c
E42 MCC	0.48		92.335	LF2d		96.839	LF3b
E43 MCC	0.48		91.290	LF2d		96.498	LF2c
E6 480V SWGR	0.48		94.062	LF2d		99.264	LF2c
E61 MCC	0.48		93.941	LF2d		99.136	LF2c
E62 MCC	0.48		94.062	LF2d		99.264	LF2c
E63 MCC	0.48		94.062	LF2d		99.264	LF2c
EF12C MCC	0.48	86.250	94.229	LF2d	105.410	99.765	LF3b
EF12C MF15-3	0.48	86.250	94.229	LF2d	105.410	99.765	LF3b
EF12D MCC	0.48	86.250	94.691	LF2d	105.410	99.955	LF3b
EF41 AE4	0.48		91.290	LF2d		96.498	LF2c
EF41 BF4	0.48		92.974	LF2d		98.237	LF2b
F1 480V SWGR	0.48	86.250	95.664	LF2d	105.410	100.931	LF3b
F1 MP56-2	0.48	86.250	95.664	LF2d	105.410	100.931	LF3b
F11A MCC	0.48	87.100	95.571	LF2d	105.410	100.859	LF3b
F11A MC21-2	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11A MC62-2	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11A MC75-2	0.48	86.250	94.397	LF2d	105.410	100.859	LF3b
F11A MRE5328	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11A MS3321	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11A MV4907	0.48	85.000	95.571	LF2d	105.410	100.859	LF3b
F11B MCC	0.48	87.100	95.571	LF2d	105.410	100.859	LF3b
F11C MCC	0.48	87.100	95.571	LF2d	105.410	100.859	LF3b
F11C MP37-2B	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11C MP37-2D	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11D MCC	0.48	87.100	95.571	LF2d	105.410	100.859	LF3b
F11D DBC2PN	0.48	82.000	95.571	LF2d	110.000	100.859	LF3b
F11D MC31-3	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11D MP89-2A	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11D MP89-2B	0.48	86.250	95.571	LF2d	105.410	100.859	LF3b
F11E MCC	0.48	86.250	95.502	LF2d	105.410	100.785	LF3b
F11E MC31-1	0.48	86.250	95.502	LF2d	105.410	100.785	LF3b
F11E MC31-2	0.48	86.250	95.502	LF2d	105.410	100.785	LF3b
F11F MCC	0.48	86.250	95.465	LF2d	105.410	100.747	LF3b

Table 3. Scenarios LF1-LF4: Mode 1-4 Non-Accident Maximum Loading Minimum and Maximum Bus Voltages (Sheet 4 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
F12A MCC	0.48	90.000	95.549	LF2d	105.410	100.841	LF3b
F12A DBC2N	0.48	82.000	95.452	LF2d	110.000	100.744	LF3b
F12A DBC2P	0.48	82.000	95.452	LF2d	110.000	100.744	LF3b
F12A MC133	0.48	86.250	94.410	LF2d	105.410	100.841	LF3b
F12A MC30-2	0.48	86.250	95.549	LF2d	105.410	100.841	LF3b
F12A MC73-2	0.48	86.250	93.289	LF2d	105.410	100.841	LF3b
F12A MP195-2	0.48	86.250	95.549	LF2d	105.410	100.841	LF3b
F12A MP198-1	0.48	86.250	95.549	LF2d	105.410	100.841	LF3b
F12A MS61-2	0.48	86.250	95.549	LF2d	105.410	100.841	LF3b
F12A MV5598	0.48	85.000	95.549	LF2d	105.410	100.841	LF3b
F12A YRF2	0.48	90.000	95.380	LF2d	110.000	100.663	LF3b
F12A YRF4	0.48	90.000	95.307	LF2d	110.000	100.586	LF3b
F12B MCC	0.48	87.100	95.417	LF2d	105.410	100.785	LF3b
F12B MC25-3	0.48	86.250	94.785	LF2d	105.410	100.785	LF3b
F12B MC25-4	0.48	86.250	94.490	LF2d	105.410	100.785	LF3b
F12B MC78-2	0.48	86.250	95.129	LF2d	105.410	100.785	LF3b
F12B MP147-2	0.48	86.250	95.113	LF2d	105.410	100.498	LF3b
F12B MP147-4	0.48	86.250	95.322	LF2d	105.410	100.696	LF3b
F12B YF1	0.48	81.600	95.380	LF2d	105.410	100.750	LF3b
F12C MCC	0.48	87.100	95.268	LF2d	105.410	100.828	LF3b
F12C MF15-2	0.48	87.100	95.061	LF2d	105.410	100.632	LF3b
F12D MCC	0.48	86.250	95.189	LF2d	105.410	100.828	LF3b
F12D MC99-3	0.48	86.250	94.497	LF2d	105.410	100.828	LF3b
F12D MC99-4	0.48	86.250	94.356	LF2d	105.410	100.828	LF3b
F13 MCC	0.48	86.250	94.874	LF2d	105.410	99.738	LF2a
F14 MCC	0.48	86.250	95.362	LF2d	105.410	100.646	LF3b
F14 MC1-2	0.48	86.250	94.192	LF2d	105.410	99.539	LF3b
F14 MC1-2LS	0.48	86.250			105.410		
F15 MCC	0.48	86.250	95.664	LF2d	105.410	100.931	LF3b
F16A MCC	0.48	89.700	95.637	LF2d	105.410	100.903	LF3b
F16A MC25-6	0.48	86.250	95.637	LF2d	105.410	100.903	LF3b
F16A MP274-3	0.48	86.250	95.393	LF2d	105.410	100.645	LF3b
F16A XY2	0.48	85.000	95.624	LF2d	110.000	100.890	LF3b
F16A XY4	0.48	85.000	95.606	LF2d	110.000	100.870	LF3b
F16B MCC	0.48	90.500	95.621	LF2d	105.410	100.886	LF3b
F16B MP273-4	0.48	86.250	95.085	LF2d	105.410	100.321	LF3b
F2 480V SWGR	0.48		90.094	LF2d		95.401	LF2b
F21A MCC	0.48		89.804	LF2d		95.102	LF2b
F21B MCC	0.48		89.703	LF2d		94.995	LF2b
F21C MCC	0.48		89.801	LF2d		95.099	LF2b
F22 MCC	0.48		88.730	LF2d		94.108	LF2b
F23A MCC	0.48		89.503	LF2d		94.824	LF2b
F23B MCC	0.48		88.623	LF2d		93.965	LF2b
F3 480V SWGR	0.48		90.920	LF2d		96.131	LF2b
F31A MCC	0.48		90.370	LF2d		95.557	LF2b
F31B MCC	0.48		89.286	LF2d		94.509	LF3b

Table 3. Scenarios LF1-LF4: Mode 1-4 Non-Accident Maximum Loading Minimum and Maximum Bus Voltages (Sheet 5 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
F32A MCC	0.48		90.693	LF2d		95.910	LF2b
F32B MCC	0.48		90.190	LF2d		95.435	LF2b
F33A MCC	0.48		90.378	LF2d		95.571	LF2b
F33B MCC	0.48		90.313	LF2d		95.507	LF2b
F4 480V SWGR	0.48		92.974	LF2d		98.237	LF2b
F41A MCC	0.48		92.604	LF2d		97.857	LF2b
F41B MCC	0.48		92.585	LF2d		97.840	LF2b
F4A LOAD CTR	0.48		93.759	LF2d		99.032	LF2b
F6 480V SWGR	0.48		94.089	LF2d		99.381	LF2b
F61 MCC	0.48		94.089	LF2d		99.381	LF2b
F62 MCC	0.48		94.017	LF2d		99.305	LF2b
F63 MCC	0.48		94.089	LF2d		99.381	LF2b
F7 480V SWGR	0.48		95.001	LF2d		99.872	LF2a
F71 MCC	0.48		94.966	LF2d		99.836	LF2a
M22A MCC	0.48		90.920	LF2d		96.131	LF2b
YE2 MCC	0.24	87.080	97.043	LF2d	105.410	102.461	LF3b
YE2 MV5443C	0.24	85.000	97.043	LF2d	105.410	102.461	LF3b
YF2 MCC	0.24	86.780	98.022	LF2d	105.410	103.445	LF3b
YF2 MV5444C	0.24	85.000	98.022	LF2d	105.410	103.445	LF3b

Table 4. Scenario LF5: Mode 5 and 6 Non-Accident Light Loading Minimum and Maximum Bus Voltages (Sheet 1 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
A 13.8KV SWGR	13.8	86.090	102.571	LF5c1	105.210	**105.358**	LF5c
A MP2-1	13.8	86.090	102.571	LF5c1	105.210	**105.358**	LF5c
A MP2-3	13.8	86.090	102.571	LF5c1	105.210	**105.358**	LF5c
A MP36-1	13.8	86.090	102.571	LF5c1	105.210	**105.358**	LF5c
A MP36-4	13.8	86.090	102.571	LF5c1	105.210	**105.358**	LF5c
B 13.8KV SWGR	13.8	86.090	102.632	LF5c1	105.210	**105.417**	LF5c
B MP2-2	13.8	86.090	102.632	LF5c1	105.210	**105.417**	LF5c
B MP2-4	13.8	86.090	102.632	LF5c1	105.210	**105.417**	LF5c
B MP36-2	13.8	86.090	102.632	LF5c1	105.210	**105.417**	LF5c
B MP36-3	13.8	86.090	102.632	LF5c1	105.210	**105.417**	LF5c
BF81 MCC	0.48	86.250	104.014	LF5c1	105.410	**106.857**	LF5c
BF81 DBCSBOP	0.48	82.000	103.925	LF5c1	110.000	106.766	LF5c
C1 4160 SWGR	4.16	91.010	104.421	LF5c1	105.760	**107.283**	LF5c
C1 MP3-1	4.16	86.540	104.263	LF5c1	105.760	**107.129**	LF5c
C1 MP37-1A	4.16	86.540	104.421	LF5c1	105.760	**107.283**	LF5c
C1 MP42-1	4.16	86.540	104.368	LF5c1	105.760	**107.231**	LF5c
C1 MP43-1	4.16	86.540	104.368	LF5c1	105.760	**107.232**	LF5c
C1 MP58-1	4.16	86.540	104.421	LF5c1	105.760	**107.283**	LF5c
C2 4160 SWGR	4.16	86.540	104.424	LF5c1	105.760	**107.286**	LF5c
D1 4160 SWGR	4.16	91.010	104.673	LF5c1	105.760	**107.531**	LF5c
D1 MP3-2	4.16	86.540	104.485	LF5c1	105.760	**107.348**	LF5c
D1 MP37-2A	4.16	86.540	104.673	LF5c1	105.760	**107.531**	LF5c
D1 MP42-2	4.16	86.540	104.673	LF5c1	105.760	**107.531**	LF5c
D1 MP43-2	4.16	86.540	104.673	LF5c1	105.760	**107.531**	LF5c
D1 MP58-2	4.16	86.540	104.673	LF5c1	105.760	**107.531**	LF5c
D2 4160 SWGR	4.16	86.540	104.675	LF5c1	105.760	**107.533**	LF5c
D3 4160 SWGR	4.16	86.540	104.668	LF5c1	105.760	**107.526**	LF5c
E1 480V SWGR	0.48	86.250	103.607	LF5c1	105.410	**109.165**	LF5a
E1 MP56-1	0.48	86.250	103.607	LF5c1	105.410	**109.165**	LF5a
E11A MCC	0.48	87.100	103.354	LF5c1	105.410	**108.898**	LF5a
E11A MC62-1	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a
E11A MP89-1A	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a
E11A MP89-1B	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a
E11A MP89-3A	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a
E11A MP89-3B	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a
E11B MCC	0.48	87.100	103.354	LF5c1	105.410	**108.898**	LF5a
E11B MC56-1	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a
E11C MCC	0.48	87.100	103.279	LF5c1	105.410	**108.820**	LF5a
E11C MC75-1	0.48	86.250	103.279	LF5c1	105.410	**108.820**	LF5a
E11D MCC	0.48	86.770	103.354	LF5c1	105.410	**108.898**	LF5a
E11D DBC1PN	0.48	82.000	103.354	LF5c1	110.000	108.898	LF5a
E11D MP37-1B	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a
E11D MRE5327	0.48	86.250	103.354	LF5c1	105.410	**108.898**	LF5a

**Table 4. Scenario LF5: Mode 5 and 6 Non-Accident Light Loading
Minimum and Maximum Bus Voltages (Sheet 2 of 5)**

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
E11E MCC	0.48	87.100	103.279	LF5c1	105.410	**108.820**	LF5a
E11E MV49060	0.48	85.000	103.279	LF5c1	105.410	**108.820**	LF5a
E12A MCC	0.48	90.000	103.577	LF5c1	105.410	**109.134**	LF5a
E12A DBC1N	0.48	82.000	103.565	LF5c1	110.000	109.122	LF5a
E12A DBC1P	0.48	82.000	103.566	LF5c1	110.000	109.124	LF5a
E12A MC21-1	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12A MC30-1	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12A MC71-1	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12A MC73-1	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12A MS3311	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12A MS61-1	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12A MV5597	0.48	85.000	103.577	LF5c1	105.410	**109.134**	LF5a
E12A YRF1	0.48	90.000	103.420	LF5c1	110.000	108.969	LF5a
E12A YRF3	0.48	90.000	103.328	LF5c1	110.000	108.872	LF5a
E12B MCC	0.48	87.100	103.522	LF5c1	105.410	**109.077**	LF5a
E12B MC25-1	0.48	86.250	103.522	LF5c1	105.410	**109.077**	LF5a
E12B MC25-2	0.48	86.250	103.522	LF5c1	105.410	**109.077**	LF5a
E12B MC78-1	0.48	86.250	103.522	LF5c1	105.410	**109.077**	LF5a
E12B MP147-1	0.48	86.250	103.255	LF5c1	105.410	**108.823**	LF5a
E12B MP147-3	0.48	86.250	103.446	LF5c1	105.410	**109.004**	LF5a
E12B YE1	0.48	82.100	103.522	LF5c1	105.410	**109.077**	LF5a
E12C MCC	0.48	87.100	103.427	LF5c1	105.410	**108.992**	LF5a
E12C MC99-1	0.48	86.250	103.427	LF5c1	105.410	**108.992**	LF5a
E12C MC99-2	0.48	86.250	103.427	LF5c1	105.410	**108.992**	LF5a
E12C MF15-1	0.48	86.250	103.219	LF5c1	105.410	**108.795**	LF5a
E12D MCC	0.48	86.250	103.405	LF5c1	105.410	**108.971**	LF5a
E12E MCC	0.48	87.100	103.577	LF5c1	105.410	**109.134**	LF5a
E12E MC31-4	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12E MC31-5	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12E MP197-1	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
E12F MCC	0.48	86.250	103.522	LF5c1	105.410	**109.077**	LF5a
E12F MC25-5	0.48	86.250	103.522	LF5c1	105.410	**109.077**	LF5a
E12F MP195-1	0.48	86.250	103.522	LF5c1	105.410	**109.077**	LF5a
E14 MCC	0.48	86.250	103.607	LF5c1	105.410	**109.165**	LF5a
E14 MC1-1	0.48	86.250	103.607	LF5c1	105.410	**109.165**	LF5a
E14 MC1-1LS	0.48	86.250			105.410		
E15 MCC	0.48	86.250	103.607	LF5c1	105.410	**109.165**	LF5a
E16A MCC	0.48	89.800	103.563	LF5c1	105.410	**109.119**	LF5a
E16A MP274-1	0.48	86.250	103.232	LF5c1	105.410	**108.770**	LF5a
E16A XY1	0.48	85.000	103.510	LF5c1	110.000	109.063	LF5a
E16A XY3	0.48	85.000	103.488	LF5c1	110.000	109.040	LF5a
E16B MCC	0.48	90.300	103.545	LF5c1	105.410	**109.100**	LF5a
E16B MP273-1	0.48	86.250	103.362	LF5c1	105.410	**108.907**	LF5a

Table 4. Scenario LF5: Mode 5 and 6 Non-Accident Light Loading Minimum and Maximum Bus Voltages (Sheet 3 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
E2 480V SWGR	0.48		98.505	LF5c1		101.254	LF5c
E21A MCC	0.48		97.848	LF5c1		100.583	LF5c
E21B MCC	0.48		97.815	LF5c1		100.549	LF5c
E21C MCC	0.48		97.347	LF5c1		100.068	LF5c
E21D MCC	0.48		97.825	LF5c1		100.559	LF5c
E22A MCC	0.48		97.100	LF5c1		99.818	LF5c
E22B MCC	0.48		97.092	LF5c1		99.809	LF5c
E23A MCC	0.48		98.121	LF5c1		100.873	LF5c
E23B MCC	0.48		97.782	LF5c1		100.529	LF5c
E3 480V SWGR	0.48		101.205	LF5c1		103.959	LF5c
E31A MCC	0.48		100.992	LF5c1		103.740	LF5c
E31B MCC	0.48		100.992	LF5c1		103.740	LF5c
E32A MCC	0.48		101.135	LF5c1		103.887	LF5c
E32B MCC	0.48		101.135	LF5c1		103.887	LF5c
E33A MCC	0.48		100.658	LF5c1		103.403	LF5c
E33B MCC	0.48		100.619	LF5c1		103.362	LF5c
E4 480V SWGR	0.48		99.825	LF5c1		102.607	LF5c
E41A MCC	0.48		99.536	LF5c1		102.314	LF5c
E41B MCC	0.48		99.289	LF5c1		102.064	LF5c
E42 MCC	0.48		101.831	LF5c1		104.643	LF5c
E43 MCC	0.48		99.825	LF5c1		102.607	LF5c
E6 480V SWGR	0.48		102.571	LF5c1		105.358	LF5c
E61 MCC	0.48		102.571	LF5c1		105.358	LF5c
E62 MCC	0.48		102.571	LF5c1		105.358	LF5c
E63 MCC	0.48		102.571	LF5c1		105.358	LF5c
EF12C MCC	0.48	86.250	103.393	LF5c1	105.410	**108.961**	LF5a
EF12C MF15-3	0.48	86.250	103.393	LF5c1	105.410	**108.961**	LF5a
EF12D MCC	0.48	86.250	103.577	LF5c1	105.410	**109.134**	LF5a
EF41 AE4	0.48		99.825	LF5c1		102.607	LF5c
EF41 BF4	0.48		100.836	LF5c1		103.613	LF5c
F1 480V SWGR	0.48	86.250	103.681	LF5c1	105.410	**109.223**	LF5a
F1 MP56-2	0.48	86.250	103.681	LF5c1	105.410	**109.223**	LF5a
F11A MCC	0.48	87.100	103.383	LF5c1	105.410	**108.908**	LF5a
F11A MC21-2	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11A MC62-2	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11A MC75-2	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11A MRE5328	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11A MS3321	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11A MV4907	0.48	85.000	103.383	LF5c1	105.410	**108.908**	LF5a
F11B MCC	0.48	87.100	103.383	LF5c1	105.410	**108.908**	LF5a
F11C MCC	0.48	87.100	103.383	LF5c1	105.410	**108.908**	LF5a
F11C MP37-2B	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11C MP37-2D	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a

**Table 4. Scenario LF5: Mode 5 and 6 Non-Accident Light Loading
Minimum and Maximum Bus Voltages (Sheet 4 of 5)**

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
F11D MCC	0.48	87.100	103.383	LF5c1	105.410	**108.908**	LF5a
F11D DBC2PN	0.48	82.000	103.383	LF5c1	110.000	108.908	LF5a
F11D MC31-3	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11D MP89-2A	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11D MP89-2B	0.48	86.250	103.383	LF5c1	105.410	**108.908**	LF5a
F11E MCC	0.48	86.250	103.307	LF5c1	105.410	**108.829**	LF5a
F11E MC31-1	0.48	86.250	103.307	LF5c1	105.410	**108.829**	LF5a
F11E MC31-2	0.48	86.250	103.307	LF5c1	105.410	**108.829**	LF5a
F11F MCC	0.48	86.250	103.268	LF5c1	105.410	**108.787**	LF5a
F12A MCC	0.48	90.000	103.651	LF5c1	105.410	**109.192**	LF5a
F12A DBC2N	0.48	82.000	103.634	LF5c1	110.000	109.174	LF5a
F12A DBC2P	0.48	82.000	103.634	LF5c1	110.000	109.174	LF5a
F12A MC133	0.48	86.250	103.651	LF5c1	105.410	**109.192**	LF5a
F12A MC30-2	0.48	86.250	103.651	LF5c1	105.410	**109.192**	LF5a
F12A MC73-2	0.48	86.250	103.651	LF5c1	105.410	**109.192**	LF5a
F12A MP195-2	0.48	86.250	103.651	LF5c1	105.410	**109.192**	LF5a
F12A MP198-1	0.48	86.250	103.651	LF5c1	105.410	**109.192**	LF5a
F12A MS61-2	0.48	86.250	103.651	LF5c1	105.410	**109.192**	LF5a
F12A MV5598	0.48	85.000	103.651	LF5c1	105.410	**109.192**	LF5a
F12A YRF2	0.48	90.000	103.468	LF5c1	110.000	108.999	LF5a
F12A YRF4	0.48	90.000	103.389	LF5c1	110.000	108.916	LF5a
F12B MCC	0.48	87.100	103.603	LF5c1	105.410	**109.142**	LF5a
F12B MC25-3	0.48	86.250	103.603	LF5c1	105.410	**109.142**	LF5a
F12B MC25-4	0.48	86.250	103.603	LF5c1	105.410	**109.142**	LF5a
F12B MC78-2	0.48	86.250	103.603	LF5c1	105.410	**109.142**	LF5a
F12B MP147-2	0.48	86.250	103.324	LF5c1	105.410	**108.877**	LF5a
F12B MP147-4	0.48	86.250	103.516	LF5c1	105.410	**109.060**	LF5a
F12B YF1	0.48	81.600	103.569	LF5c1	105.410	**109.110**	LF5a
F12C MCC	0.48	87.100	103.638	LF5c1	105.410	**109.180**	LF5a
F12C MF15-2	0.48	87.100	103.448	LF5c1	105.410	**108.999**	LF5a
F12D MCC	0.48	86.250	103.638	LF5c1	105.410	**109.180**	LF5a
F12D MC99-3	0.48	86.250	103.638	LF5c1	105.410	**109.180**	LF5a
F12D MC99-4	0.48	86.250	103.638	LF5c1	105.410	**109.180**	LF5a
F13 MCC	0.48	86.250	104.170	LF5c1	105.410	**107.016**	LF5c
F14 MCC	0.48	86.250	103.681	LF5c1	105.410	**109.223**	LF5a
F14 MC1-2	0.48	86.250	103.681	LF5c1	105.410	**109.223**	LF5a
F14 MC1-2LS	0.48	86.250			105.410		
F15 MCC	0.48	86.250	103.681	LF5c1	105.410	**109.223**	LF5a
F16A MCC	0.48	89.700	103.652	LF5c1	105.410	**109.192**	LF5a
F16A MC25-6	0.48	86.250	103.652	LF5c1	105.410	**109.192**	LF5a
F16A MP274-3	0.48	86.250	103.388	LF5c1	105.410	**108.913**	LF5a
F16A XY2	0.48	85.000	103.639	LF5c1	110.000	109.178	LF5a
F16A XY4	0.48	85.000	103.619	LF5c1	110.000	109.157	LF5a

Table 4. Scenario LF5: Mode 5 and 6 Non-Accident Light Loading Minimum and Maximum Bus Voltages (Sheet 5 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
F16B MCC	0.48	90.500	103.635	LF5c1	105.410	**109.174**	LF5a
F16B MP273-4	0.48	86.250	103.055	LF5c1	105.410	**108.562**	LF5a
F2 480V SWGR	0.48		98.787	LF5c1		101.557	LF5c
F21A MCC	0.48		98.121	LF5c1		100.878	LF5c
F21B MCC	0.48		98.011	LF5c1		100.765	LF5c
F21C MCC	0.48		98.109	LF5c1		100.866	LF5c
F22 MCC	0.48		97.221	LF5c1		99.996	LF5c
F23A MCC	0.48		98.314	LF5c1		101.088	LF5c
F23B MCC	0.48		97.764	LF5c1		100.544	LF5c
F3 480V SWGR	0.48		99.579	LF5c1		102.294	LF5c
F31A MCC	0.48		99.030	LF5c1		101.730	LF5c
F31B MCC	0.48		98.170	LF5c1		100.846	LF5c
F32A MCC	0.48		99.470	LF5c1		102.183	LF5c
F32B MCC	0.48		99.383	LF5c1		102.094	LF5c
F33A MCC	0.48		99.062	LF5c1		101.765	LF5c
F33B MCC	0.48		99.062	LF5c1		101.765	LF5c
F4 480V SWGR	0.48		100.836	LF5c1		103.613	LF5c
F41A MCC	0.48		100.258	LF5c1		103.033	LF5c
F41B MCC	0.48		100.203	LF5c1		102.976	LF5c
F4A LOAD CTR	0.48		102.620	LF5c1		105.406	LF5c
F6 480V SWGR	0.48		102.632	LF5c1		105.417	LF5c
F61 MCC	0.48		102.632	LF5c1		105.417	LF5c
F62 MCC	0.48		102.632	LF5c1		105.417	LF5c
F63 MCC	0.48		102.632	LF5c1		105.417	LF5c
F7 480V SWGR	0.48		104.310	LF5c1		107.159	LF5c
F71 MCC	0.48		104.272	LF5c1		107.120	LF5c
M22A MCC	0.48		99.579	LF5c1		102.294	LF5c
YE2 MCC	0.24	87.080	106.004	LF5c1	105.410	**111.690**	LF5a
YE2 MV5443C	0.24	85.000	106.004	LF5c1	105.410	**111.690**	LF5a
YF2 MCC	0.24	86.780	106.034	LF5c1	105.410	**111.701**	LF5a
YF2 MV5444C	0.24	85.000	106.034	LF5c1	105.410	**111.701**	LF5a

**Table 5. Scenario ST1: Mode 1 Design Basis Accident
Transient Minimum Bus Voltages (Sheet 1 of 4)**

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=1		T=2		T=3		T=4	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
A 13.8KV SWGR	13.8	86.090	76.530	93.802	ST1k	89.100	ST1k2	92.707	ST1k	93.014	ST1k	93.184	ST1k2	93.215	ST1k2
A MP2-1	13.8	86.090	76.530	93.760	ST1k	89.056	ST1k2	92.664	ST1k	92.971	ST1k	93.141	ST1k2	93.173	ST1k2
A MP2-3	13.8	86.090	76.530	93.767	ST1k	89.063	ST1k2	92.671	ST1k	92.978	ST1k	93.148	ST1k2	93.180	ST1k2
A MP36-1	13.8	86.090	76.530	93.759	ST1k	89.055	ST1k2	92.663	ST1k	92.970	ST1k	93.140	ST1k2	93.172	ST1k2
A MP36-4	13.8	86.090	76.530	93.782	ST1k	89.079	ST1k2	92.686	ST1k	92.993	ST1k	93.163	ST1k2	93.195	ST1k2
B 13.8KV SWGR	13.8	86.090	76.530	93.799	ST1k	89.098	ST1k2	92.704	ST1k	93.011	ST1k	93.181	ST1k2	93.213	ST1k2
B MP2-2	13.8	86.090	76.530	93.745	ST1k	89.041	ST1k2	92.649	ST1k	92.956	ST1k	93.127	ST1k2	93.158	ST1k2
B MP2-4	13.8	86.090	76.530	93.752	ST1k	89.048	ST1k2	92.657	ST1k	92.963	ST1k	93.134	ST1k2	93.165	ST1k2
B MP36-2	13.8	86.090	76.530	93.750	ST1k	89.046	ST1k2	92.654	ST1k	92.961	ST1k	93.132	ST1k2	93.163	ST1k2
B MP36-3	13.8	86.090	76.530	93.780	ST1k	89.078	ST1k2	92.685	ST1k	92.992	ST1k	93.162	ST1k2	93.193	ST1k2
BF81 MCC	0.48	86.250	76.670	94.305	ST1k	82.957	ST1g	92.182	ST1g	92.905	ST1k	93.229	ST1k2	93.285	ST1k2
BF81 DBCSBOP	0.48	82.000		94.224	ST1k	82.886	ST1g	92.103	ST1g	92.825	ST1k	93.150	ST1k2	93.205	ST1k2
C1 4160 SWGR	4.16	91.010	67.310	94.466	ST1k	83.534	ST1g	92.379	ST1k	92.939	ST1k	93.262	ST1k2	93.324	ST1k2
C1 MP3-1	4.16	86.540	67.310	94.292	ST1k	83.337	ST1g	92.201	ST1k	92.762	ST1k	93.085	ST1k2	93.148	ST1k2
C1 MP37-1A	4.16	86.540	76.930	94.379	ST1k	83.436	ST1g	92.291	ST1k	92.851	ST1k	93.175	ST1k2	93.237	ST1k2
C1 MP42-1	4.16	86.540	67.310	94.466	ST1k	83.297	ST1g	92.310	ST1k	92.870	ST1k	93.194	ST1k2	93.256	ST1k2
C1 MP43-1	4.16	86.540	67.310	94.466	ST1k	83.348	ST1g	92.320	ST1k	92.880	ST1k	93.203	ST1k2	93.265	ST1k2
C1 MP58-1	4.16	86.540	67.310	94.466	ST1k	83.117	ST1g	92.231	ST1k	92.792	ST1k	93.115	ST1k2	93.177	ST1k2
C2 4160 SWGR	4.16	86.540	76.930	94.470	ST1k	83.566	ST1g	92.391	ST1k	92.949	ST1k	93.271	ST1k2	93.333	ST1k2
D1 4160 SWGR	4.16	91.010	67.310	95.037	ST1k	83.659	ST1g	92.914	ST1g	93.628	ST1k	93.954	ST1k2	94.010	ST1k2
D1 MP3-2	4.16	86.540	67.310	94.829	ST1k	83.423	ST1g	92.702	ST1g	93.417	ST1k	93.745	ST1k2	93.801	ST1k2
D1 MP37-2A	4.16	86.540	76.930	95.104	ST1k1	86.937	ST1k1	93.144	ST1k1	93.699	ST1k1	94.121	ST1k1	94.250	ST1k1
D1 MP42-2	4.16	86.540	67.310	95.037	ST1k	83.503	ST1g	92.861	ST1g	93.575	ST1k	93.902	ST1k2	93.958	ST1k2
D1 MP43-2	4.16	86.540	67.310	94.978	ST1k	83.592	ST1g	92.854	ST1g	93.568	ST1k	93.895	ST1k2	93.951	ST1k2
D1 MP58-2	4.16	86.540	67.310	95.037	ST1k	83.415	ST1g	92.826	ST1g	93.540	ST1k	93.867	ST1k2	93.923	ST1k2
D2 4160 SWGR	4.16	86.540	76.930	95.040	ST1k	83.653	ST1g	92.909	ST1g	93.635	ST1k	93.960	ST1k2	94.016	ST1k2
D3 4160 SWGR	4.16	86.540	76.930	95.032	ST1k	83.646	ST1g	92.902	ST1g	93.627	ST1k	93.953	ST1k2	94.009	ST1k2
E1 480V SWGR	0.48	86.250	67.090	95.219	ST1k	76.304	ST1k2	87.278	ST1k	90.385	ST1k	92.262	ST1k2	92.648	ST1k2
E1 MP56-1	0.48	86.250	67.090	95.219	ST1k2	71.063	ST1k2	87.062	ST1k2	90.268	ST1k2	90.886	ST1k2	91.277	ST1k2
E11A MCC	0.48	87.100	67.090	95.027	ST1k	75.631	ST1k2	85.506	ST1k	88.571	ST1k	91.840	ST1k2	92.448	ST1k2
E11A MC62-1	0.48	86.250	67.090	95.027	ST1k	75.631	ST1k2	85.506	ST1k	88.571	ST1k	91.840	ST1k2	92.448	ST1k2
E11A MP89-1A	0.48	86.250	67.090	95.027	ST1k	75.631	ST1k2	85.506	ST1k	88.571	ST1k	91.840	ST1k2	92.448	ST1k2
E11A MP89-1B	0.48	86.250	67.090	95.027	ST1k	75.631	ST1k2	85.506	ST1k	88.571	ST1k	91.840	ST1k2	92.448	ST1k2
E11A MP89-3A	0.48	86.250	67.090	95.027	ST1k	75.631	ST1k2	85.506	ST1k	88.571	ST1k	91.840	ST1k2	92.448	ST1k2
E11A MP89-3B	0.48	86.250	67.090	95.027	ST1k	75.631	ST1k2	85.506	ST1k	88.571	ST1k	91.840	ST1k2	92.448	ST1k2
E11B MCC	0.48	87.100	67.090	94.986	ST1k	75.519	ST1k2	85.414	ST1k	88.480	ST1k	91.766	ST1k2	92.406	ST1k2
E11B MC56-1	0.48	86.250	67.090	94.140	ST1k	74.449	ST1k2	84.471	ST1k	87.571	ST1k	90.891	ST1k2	91.536	ST1k2
E11C MCC	0.48	87.100	67.090	95.019	ST1k	75.593	ST1k2	85.121	ST1k	88.175	ST1k	91.817	ST1k2	92.440	ST1k2
E11C MC75-1	0.48	86.250	67.090	92.991	ST1k	73.000	ST1k2	82.841	ST1k	85.979	ST1k	89.713	ST1k2	90.351	ST1k2
E11D MCC	0.48	86.770	67.090	95.020	ST1k	75.606	ST1k2	85.498	ST1k	88.564	ST1k	91.824	ST1k2	92.441	ST1k2
E11D DBC1PN	0.48	82.000		95.020	ST1k	75.606	ST1k2	85.498	ST1k	88.564	ST1k	91.824	ST1k2	92.441	ST1k2
E11D MP37-1B	0.48	86.250	67.090	94.690	ST1k	75.191	ST1k2	85.131	ST1k	88.210	ST1k	91.483	ST1k2	92.102	ST1k2
E11D MRE5327	0.48	86.250	67.090	95.020	ST1k	75.606	ST1k2	85.498	ST1k	88.564	ST1k	91.824	ST1k2	92.441	ST1k2
E11E MCC	0.48	87.100	67.090	95.019	ST1k	75.575	ST1k2	84.766	ST1k	87.823	ST1k	91.813	ST1k2	92.436	ST1k2
E11E MV49060	0.48	85.000	67.090	95.019	ST1k	**66.884**	ST1k2	75.018	ST1k	85.739	ST1k	89.828	ST1k2	90.465	ST1k2
E12A MCC	0.48	90.000	67.090	95.124	ST1k	76.158	ST1k2	87.125	ST1k	90.275	ST1k	92.155	ST1k2	92.544	ST1k2
E12A DBC1N	0.48	82.000		95.057	ST1k	76.088	ST1k2	87.057	ST1k	90.208	ST1k	92.087	ST1k2	92.476	ST1k2
E12A DBC1P	0.48	82.000		95.064	ST1k	76.095	ST1k2	87.064	ST1k	90.215	ST1k	92.095	ST1k2	92.483	ST1k2
E12A MC21-1	0.48	86.250	67.090	95.124	ST1k	76.158	ST1k2	87.125	ST1k	90.275	ST1k	92.155	ST1k2	92.544	ST1k2
E12A MC30-1	0.48	86.250	67.090	95.124	ST1k	75.477	ST1k2	86.346	ST1k	90.275	ST1k	91.933	ST1k2	92.322	ST1k2
E12A MC71-1	0.48	86.250	67.090	94.931	ST1k	75.916	ST1k2	86.914	ST1k	90.072	ST1k	91.956	ST1k2	92.345	ST1k2
E12A MC73-1	0.48	86.250	67.090	94.445	ST1k	75.305	ST1k2	86.382	ST1k	89.559	ST1k	91.453	ST1k2	91.845	ST1k2
E12A MS3311	0.48	86.250	67.090	95.124	ST1k	76.158	ST1k2	87.125	ST1k	90.275	ST1k	92.155	ST1k2	92.544	ST1k2
E12A MS61-1	0.48	86.250	67.090	95.124	ST1k	76.158	ST1k2	87.125	ST1k	90.275	ST1k	92.155	ST1k2	92.544	ST1k2
E12A MV5597	0.48	85.000	67.090	95.124	ST1k	67.576	ST1k2	77.307	ST1k	88.269	ST1k	90.223	ST1k2	90.620	ST1k2
E12A YRF1	0.48	90.000		94.980	ST1k	76.042	ST1k2	86.992	ST1k	90.138	ST1k	92.015	ST1k2	92.403	ST1k2
E12A YRF3	0.48	90.000		94.895	ST1k	75.975	ST1k2	86.915	ST1k	90.058	ST1k	91.934	ST1k2	92.321	ST1k2
E12B MCC	0.48	87.100	67.090	95.112	ST1k	75.478	ST1k2	86.409	ST1k	89.967	ST1k	91.976	ST1k2	92.362	ST1k2
E12B MC25-1	0.48	86.250	67.090	95.112	ST1k	71.861	ST1k2	82.268	ST1k	88.860	ST1k	90.893	ST1k2	91.284	ST1k2
E12B MC25-2	0.48	86.250	67.090	95.112	ST1k	72.760	ST1k2	83.297	ST1k	89.140	ST1k	91.167	ST1k2	91.556	ST1k2
E12B MC78-1	0.48	86.250	67.090	94.654	ST1k	74.898	ST1k2	85.904	ST1k	89.483	ST1k	91.503	ST1k2	91.890	ST1k2
E12B MP147-1	0.48	86.250	67.090	94.821	ST1k	75.111	ST1k2	86.088	ST1k	89.660	ST1k	91.675	ST1k2	92.063	ST1k2
E12B MP147-3	0.48	86.250	67.090	95.029	ST1k	75.373	ST1k2	86.317	ST1k	89.879	ST1k	91.890	ST1k2	92.276	ST1k2
E12B YE1	0.48	82.100		95.075	ST1k	75.432	ST1k2	86.368	ST1k	89.929	ST1k	91.938	ST1k2	92.324	ST1k2
E12C MCC	0.48	87.100	67.090	94.701	ST1k	75.546	ST1k2	86.570	ST1k	89.734	ST1k	91.679	ST1k2	92.108	ST1k2
E12C MC99-1	0.48	86.250	67.090	93.694	ST1k	74.273	ST1k2	85.465	ST1k	88.670	ST1k	90.638	ST1k2	91.072	ST1k2

Table 5. Scenario ST1: Mode 1 Design Basis Accident
Transient Minimum Bus Voltages (Sheet 2 of 4)

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=1		T=2		T=3		T=4	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
E12C MC99-2	0.48	86.250	67.090	94.108	ST1k	74.798	ST1k2	85.920	ST1k	89.108	ST1k	91.066	ST1k2	91.498	ST1k2
E12C MF15-1	0.48	86.250	67.090	94.473	ST1k	75.260	ST1k2	86.321	ST1k	89.494	ST1k	91.444	ST1k2	91.874	ST1k2
E12D MCC	0.48	86.250	67.090	94.677	ST1k	75.515	ST1k2	86.544	ST1k	89.709	ST1k	91.654	ST1k2	92.083	ST1k2
E12E MCC	0.48	87.100	67.090	95.124	ST1k	76.010	ST1k2	86.807	ST1k	90.097	ST1k	92.131	ST1k2	92.520	ST1k2
E12E MC31-4	0.48	86.250	67.090	95.124	ST1k	76.010	ST1k2	86.807	ST1k	90.097	ST1k	92.131	ST1k2	92.520	ST1k2
E12E MC31-5	0.48	86.250	67.090	95.124	ST1k	76.010	ST1k2	86.807	ST1k	90.097	ST1k	92.131	ST1k2	92.520	ST1k2
E12E MP197-1	0.48	86.250	67.090	95.124	ST1k	73.385	ST1k2	83.809	ST1k	89.700	ST1k	91.744	ST1k2	92.134	ST1k2
E12F MCC	0.48	86.250	67.090	95.093	ST1k	75.090	ST1k2	86.266	ST1k	89.830	ST1k	91.843	ST1k2	92.229	ST1k2
E12F MC25-5	0.48	86.250	67.090	95.093	ST1k	75.090	ST1k2	86.266	ST1k	89.830	ST1k	91.843	ST1k2	92.229	ST1k2
E12F MP195-1	0.48	86.250	67.090	94.539	ST1k	74.385	ST1k2	85.654	ST1k	89.243	ST1k	91.268	ST1k2	91.657	ST1k2
E14 MCC	0.48	86.250	67.090	95.219	ST1k	75.897	ST1k2	86.811	ST1k	90.275	ST1k	92.154	ST1k2	92.540	ST1k2
E14 MC1-1	0.48	86.250	67.090	95.219	ST1k	75.897	ST1k2	86.811	ST1k	90.275	ST1k	92.154	ST1k2	92.540	ST1k2
E14 MC1-1LS	0.48	86.250	67.090	95.219	ST1k	74.022	ST1k2	84.667	ST1k	89.762	ST1k	91.652	ST1k2	92.040	ST1k2
E15 MCC	0.48	86.250	67.090	95.219	ST1k	76.304	ST1k2	87.278	ST1k	90.385	ST1k	92.262	ST1k2	92.648	ST1k2
E16A MCC	0.48	89.800	67.090	95.088	ST1k	76.191	ST1k2	87.154	ST1k	90.258	ST1k	92.134	ST1k2	92.519	ST1k2
E16A MP274-1	0.48	86.250	67.090	94.784	ST1k	75.947	ST1k2	86.875	ST1k	89.970	ST1k	91.839	ST1k2	92.223	ST1k2
E16A XY1	0.48	85.000		95.039	ST1k	76.152	ST1k2	87.109	ST1k	90.212	ST1k	92.086	ST1k2	92.471	ST1k2
E16A XY3	0.48	85.000		95.019	ST1k	76.135	ST1k2	87.091	ST1k	90.193	ST1k	92.067	ST1k2	92.452	ST1k2
E16B MCC	0.48	90.300	67.090	95.071	ST1k	76.177	ST1k2	87.138	ST1k	90.242	ST1k	92.117	ST1k2	92.502	ST1k2
E16B MP273-1	0.48	86.250	67.090	94.903	ST1k	76.042	ST1k2	86.984	ST1k	90.082	ST1k	91.954	ST1k2	92.338	ST1k2
E2 480V SWGR	0.48			90.266	ST1k	85.592	ST1k2	89.178	ST1k	89.483	ST1k	89.651	ST1k2	89.683	ST1k2
E21A MCC	0.48			89.678	ST1k	85.019	ST1k2	88.594	ST1k	88.897	ST1k	89.066	ST1k2	89.097	ST1k2
E21B MCC	0.48			89.647	ST1k	84.990	ST1k2	88.564	ST1k	88.867	ST1k	89.035	ST1k2	89.067	ST1k2
E21C MCC	0.48			89.151	ST1k	84.507	ST1k2	88.070	ST1k	88.373	ST1k	88.540	ST1k2	88.572	ST1k2
E21D MCC	0.48			89.678	ST1k	85.019	ST1k2	88.594	ST1k	88.897	ST1k	89.066	ST1k2	89.097	ST1k2
E22A MCC	0.48			89.374	ST1k	84.718	ST1k2	88.291	ST1k	88.594	ST1k	88.763	ST1k2	88.794	ST1k2
E22B MCC	0.48			89.361	ST1k	84.705	ST1k2	88.278	ST1k	88.581	ST1k	88.750	ST1k2	88.781	ST1k2
E23A MCC	0.48			89.833	ST1k	85.160	ST1k2	88.746	ST1k	89.050	ST1k	89.219	ST1k2	89.251	ST1k2
E23B MCC	0.48			89.339	ST1k	84.673	ST1k2	88.253	ST1k	88.558	ST1k	88.726	ST1k2	88.758	ST1k2
E3 480V SWGR	0.48			90.639	ST1k	85.705	ST1k	89.025	ST1k	89.792	ST1k	90.015	ST1k	90.051	ST1k2
E31A MCC	0.48			88.946	ST1k	83.998	ST1k	87.328	ST1k	88.098	ST1k	88.321	ST1k	88.357	ST1k2
E31B MCC	0.48			88.857	ST1k	83.904	ST1k	87.238	ST1k	88.008	ST1k	88.232	ST1k	88.268	ST1k2
E32A MCC	0.48			90.536	ST1k	85.551	ST1k	88.868	ST1k	89.683	ST1k	89.906	ST1k	89.949	ST1k2
E32B MCC	0.48			90.040	ST1k	85.049	ST1k	88.370	ST1k	89.186	ST1k	89.409	ST1k	89.452	ST1k2
E33A MCC	0.48			90.005	ST1k	85.051	ST1k	88.385	ST1k	89.156	ST1k	89.380	ST1k	89.416	ST1k2
E33B MCC	0.48			90.005	ST1k	85.051	ST1k	88.385	ST1k	89.156	ST1k	89.380	ST1k	89.416	ST1k2
E4 480V SWGR	0.48			91.732	ST1k	87.002	ST1k2	90.631	ST1k	90.939	ST1k	91.110	ST1k2	91.142	ST1k2
E41A MCC	0.48			91.389	ST1k	86.668	ST1k2	90.290	ST1k	90.598	ST1k	90.768	ST1k2	90.800	ST1k2
E41B MCC	0.48			91.099	ST1k	86.377	ST1k2	90.000	ST1k	90.308	ST1k	90.478	ST1k2	90.510	ST1k2
E42 MCC	0.48			92.045	ST1k	81.314	ST1g	90.000	ST1k	90.549	ST1k	90.866	ST1k2	90.927	ST1k2
E43 MCC	0.48			91.732	ST1k	87.002	ST1k2	90.631	ST1k	90.939	ST1k	91.110	ST1k2	91.142	ST1k2
E6 480V SWGR	0.48			93.802	ST1k	89.100	ST1k2	92.707	ST1k	93.014	ST1k	93.184	ST1k2	93.215	ST1k2
E61 MCC	0.48			93.802	ST1k	89.100	ST1k2	92.707	ST1k	93.014	ST1k	93.184	ST1k2	93.215	ST1k2
E62 MCC	0.48			93.802	ST1k	89.100	ST1k2	92.707	ST1k	93.014	ST1k	93.184	ST1k2	93.215	ST1k2
E63 MCC	0.48			93.802	ST1k	89.100	ST1k2	92.707	ST1k	93.014	ST1k	93.184	ST1k2	93.215	ST1k2
EF12C MCC	0.48	86.250	67.090	94.664	ST1k	75.499	ST1k2	86.530	ST1k	89.696	ST1k	91.641	ST1k2	92.071	ST1k2
EF12C MF15-3	0.48	86.250	67.090	94.664	ST1k	75.499	ST1k2	86.530	ST1k	89.696	ST1k	91.641	ST1k2	92.071	ST1k2
EF12D MCC	0.48	86.250	67.090	95.124	ST1k	76.158	ST1k2	87.125	ST1k	90.275	ST1k	92.155	ST1k2	92.544	ST1k2
EF41 AE4	0.48			91.732	ST1k	87.002	ST1k2	90.631	ST1k	90.939	ST1k	91.110	ST1k2	91.142	ST1k2
EF41 BF4	0.48			92.629	ST1k	87.954	ST1k2	91.540	ST1k	91.845	ST1k	92.014	ST1k2	92.046	ST1k2
F1 480V SWGR	0.48	86.250	67.090	96.052	ST1k	77.838	ST1k2	87.978	ST1g	91.235	ST1k	93.184	ST1k2	93.505	ST1k2
F1 MP56-2	0.48	86.250	67.090	96.052	ST1k2	73.005	ST1k2	88.165	ST1k2	91.374	ST1k2	91.899	ST1k2	92.224	ST1k2
F11A MCC	0.48	87.100	67.090	95.913	ST1k	77.391	ST1k2	86.767	ST1g	89.994	ST1k	92.868	ST1k2	93.308	ST1k2
F11A MC21-2	0.48	86.250	67.090	95.913	ST1k	77.391	ST1k2	86.767	ST1g	89.994	ST1k	92.868	ST1k2	93.308	ST1k2
F11A MC62-2	0.48	86.250	67.090	95.913	ST1k	77.391	ST1k2	86.767	ST1g	89.994	ST1k	92.868	ST1k2	93.308	ST1k2
F11A MC75-2	0.48	86.250	67.090	94.743	ST1k	75.928	ST1k2	85.469	ST1g	88.744	ST1k	91.658	ST1k2	92.104	ST1k2
F11A MRE5328	0.48	86.250	67.090	95.913	ST1k	77.391	ST1k2	86.767	ST1g	89.994	ST1k	92.868	ST1k2	93.308	ST1k2
F11A MS3321	0.48	86.250	67.090	95.913	ST1k	77.391	ST1k2	86.767	ST1g	89.994	ST1k	92.868	ST1k2	93.308	ST1k2
F11A MV4907	0.48	85.000	67.090	95.913	ST1k	68.603	ST1k2	76.914	ST1g	87.999	ST1k	90.935	ST1k2	91.384	ST1k2
F11B MCC	0.48	87.100	67.090	95.913	ST1k	77.296	ST1k2	86.657	ST1g	89.880	ST1k	92.819	ST1k2	93.308	ST1k2
F11C MCC	0.48	87.100	67.090	95.913	ST1k	77.290	ST1k2	86.653	ST1g	89.876	ST1k	92.810	ST1k2	93.308	ST1k2
F11C MP37-2B	0.48	86.250	67.090	95.648	ST1k1	80.281	ST1k1	86.504	ST1k1	89.591	ST1k1	93.011	ST1k1	94.095	ST1k1
F11C MP37-2D	0.48	86.250	67.090	95.913	ST1k	77.290	ST1k2	86.653	ST1g	89.876	ST1k	92.810	ST1k2	93.308	ST1k2
F11D MCC	0.48	87.100	67.090	95.913	ST1k	76.227	ST1g	85.170	ST1g	88.337	ST1k	92.859	ST1k2	93.308	ST1k2
F11D DBC2PN	0.48	82.000		95.913	ST1k	76.227	ST1g	85.170	ST1g	88.337	ST1k	92.859	ST1k2	93.308	ST1k2
F11D MC31-3	0.48	86.250	67.090	95.913	ST1k	76.227	ST1g	85.170	ST1g	88.337	ST1k	92.859	ST1k2	93.308	ST1k2

**Table 5. Scenario ST1: Mode 1 Design Basis Accident
Transient Minimum Bus Voltages (Sheet 3 of 4)**

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=1		T=2		T=3		T=4	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
F11D MP89-2A	0.48	86.250	67.090	95.913	ST1k	76.227	ST1g	85.170	ST1g	88.337	ST1k	92.859	ST1k2	93.308	ST1k2
F11D MP89-2B	0.48	86.250	67.090	95.913	ST1k	76.227	ST1g	85.170	ST1g	88.337	ST1k	92.859	ST1k2	93.308	ST1k2
F11E MCC	0.48	86.250	67.090	95.843	ST1k	77.334	ST1k2	86.703	ST1g	89.928	ST1k	92.800	ST1k2	93.239	ST1k2
F11E MC31-1	0.48	86.250	67.090	95.843	ST1k	77.334	ST1k2	86.703	ST1g	89.928	ST1k	92.800	ST1k2	93.239	ST1k2
F11E MC31-2	0.48	86.250	67.090	95.843	ST1k	77.334	ST1k2	86.703	ST1g	89.928	ST1k	92.800	ST1k2	93.239	ST1k2
F11F MCC	0.48	86.250	67.090	95.807	ST1k	77.305	ST1k2	86.670	ST1g	89.894	ST1k	92.765	ST1k2	93.204	ST1k2
F12A MCC	0.48	90.000	67.090	95.936	ST1k	77.655	ST1k2	87.775	ST1g	91.090	ST1k	93.053	ST1k2	93.378	ST1k2
F12A DBC2N	0.48	82.000		95.839	ST1k	77.556	ST1k2	87.677	ST1g	90.993	ST1k	92.956	ST1k2	93.281	ST1k2
F12A DBC2P	0.48	82.000		95.839	ST1k	77.556	ST1k2	87.677	ST1g	90.993	ST1k	92.956	ST1k2	93.281	ST1k2
F12A MC133	0.48	86.250	67.090	94.802	ST1k	76.244	ST1k2	86.532	ST1g	89.894	ST1k	91.883	ST1k2	92.212	ST1k2
F12A MC30-2	0.48	86.250	67.090	95.936	ST1k	76.502	ST1k2	86.471	ST1g	91.090	ST1k	92.672	ST1k2	92.999	ST1k2
F12A MC73-2	0.48	86.250	67.090	93.686	ST1k	74.831	ST1k2	85.301	ST1g	88.712	ST1k	90.729	ST1k2	91.063	ST1k2
F12A MP195-2	0.48	86.250	67.090	95.418	ST1k	77.013	ST1k2	87.208	ST1g	90.544	ST1k	92.519	ST1k2	92.846	ST1k2
F12A MP198-1	0.48	86.250	67.090	95.936	ST1k	73.220	ST1k2	82.762	ST1g	90.427	ST1k	92.405	ST1k2	92.732	ST1k2
F12A MS61-2	0.48	86.250	67.090	95.936	ST1k	77.655	ST1k2	87.775	ST1g	91.090	ST1k	93.053	ST1k2	93.378	ST1k2
F12A MV5598	0.48	85.000	67.090	95.936	ST1k	71.005	ST1k2	80.258	ST1g	89.645	ST1k	91.647	ST1k2	91.977	ST1k2
F12A YRF2	0.48	90.000		95.766	ST1k	77.518	ST1k2	87.620	ST1g	90.928	ST1k	92.888	ST1k2	93.213	ST1k2
F12A YRF4	0.48	90.000		95.693	ST1k	77.459	ST1k2	87.553	ST1g	90.859	ST1k	92.818	ST1k2	93.142	ST1k2
F12B MCC	0.48	87.100	67.090	95.967	ST1k	76.995	ST1k2	87.141	ST1g	90.832	ST1k	92.919	ST1k2	93.241	ST1k2
F12B MC25-3	0.48	86.250	67.090	95.967	ST1k	74.744	ST1k2	84.593	ST1g	90.169	ST1k	92.271	ST1k2	92.595	ST1k2
F12B MC25-4	0.48	86.250	67.090	95.967	ST1k	74.166	ST1k2	83.939	ST1g	89.858	ST1k	91.967	ST1k2	92.292	ST1k2
F12B MC78-2	0.48	86.250	67.090	95.681	ST1k	76.637	ST1k2	86.826	ST1g	90.530	ST1k	92.624	ST1k2	92.946	ST1k2
F12B MP147-2	0.48	86.250	67.090	95.666	ST1k	76.618	ST1k2	86.808	ST1g	90.513	ST1k	92.607	ST1k2	92.930	ST1k2
F12B MP147-4	0.48	86.250	67.090	95.874	ST1k	76.878	ST1k2	87.038	ST1g	90.733	ST1k	92.823	ST1k2	93.144	ST1k2
F12B YF1	0.48	81.600		95.931	ST1k	76.950	ST1k2	87.101	ST1g	90.794	ST1k	92.882	ST1k2	93.203	ST1k2
F12C MCC	0.48	87.100	67.090	95.657	ST1k	77.220	ST1k2	87.369	ST1g	90.692	ST1k	92.722	ST1k2	93.091	ST1k2
F12C MF15-2	0.48	87.100	67.090	95.450	ST1k	76.964	ST1k2	87.143	ST1g	90.474	ST1k	92.509	ST1k2	92.879	ST1k2
F12D MCC	0.48	86.250	67.090	95.578	ST1k	77.122	ST1k2	87.283	ST1g	90.609	ST1k	92.641	ST1k2	93.010	ST1k2
F12D MC99-3	0.48	86.250	67.090	94.888	ST1k	76.263	ST1k2	86.526	ST1g	89.881	ST1k	91.929	ST1k2	92.301	ST1k2
F12D MC99-4	0.48	86.250	67.090	94.748	ST1k	76.087	ST1k2	86.372	ST1g	89.733	ST1k	91.784	ST1k2	92.157	ST1k2
F13 MCC	0.48	86.250	67.090	94.577	ST1k	83.241	ST1g	92.456	ST1g	93.178	ST1k	93.502	ST1k2	93.558	ST1k2
F14 MCC	0.48	86.250	67.090	96.052	ST1k	77.348	ST1k2	87.424	ST1g	91.106	ST1k	93.058	ST1k2	93.379	ST1k2
F14 MC1-2	0.48	86.250	67.090	96.052	ST1k	77.348	ST1k2	87.424	ST1g	91.106	ST1k	93.058	ST1k2	93.379	ST1k2
F14 MC1-2LS	0.48	86.250	67.090	96.052	ST1k	75.210	ST1k2	85.007	ST1g	90.536	ST1k	92.500	ST1k2	92.824	ST1k2
F15 MCC	0.48	86.250	67.090	96.052	ST1k	77.838	ST1k2	87.978	ST1g	91.235	ST1k	93.184	ST1k2	93.505	ST1k2
F16A MCC	0.48	89.700	67.090	96.025	ST1k	77.816	ST1k2	87.953	ST1g	91.209	ST1k	93.158	ST1k2	93.479	ST1k2
F16A MC25-6	0.48	86.250	67.090	96.025	ST1k	77.816	ST1k2	87.953	ST1g	91.209	ST1k	93.158	ST1k2	93.479	ST1k2
F16A MP274-3	0.48	86.250	67.090	95.780	ST1k	77.618	ST1k2	87.729	ST1g	90.977	ST1k	92.920	ST1k2	93.240	ST1k2
F16A XY2	0.48	85.000		96.012	ST1k	77.806	ST1k2	87.942	ST1g	91.197	ST1k	93.146	ST1k2	93.467	ST1k2
F16A XY4	0.48	85.000		95.994	ST1k	77.791	ST1k2	87.925	ST1g	91.180	ST1k	93.128	ST1k2	93.449	ST1k2
F16B MCC	0.48	90.500	67.090	96.009	ST1k	77.803	ST1k2	87.938	ST1g	91.194	ST1k	93.142	ST1k2	93.463	ST1k2
F16B MP273-4	0.48	86.250	67.090	95.471	ST1k	77.368	ST1k2	87.446	ST1g	90.684	ST1k	92.621	ST1k2	92.940	ST1k2
F2 480V SWGR	0.48			91.040	ST1k	86.294	ST1k2	89.936	ST1k	90.245	ST1k	90.417	ST1k2	90.449	ST1k2
F21A MCC	0.48			90.749	ST1k	86.011	ST1k2	89.646	ST1k	89.955	ST1k	90.127	ST1k2	90.158	ST1k2
F21B MCC	0.48			90.647	ST1k	85.914	ST1k2	89.546	ST1k	89.854	ST1k	90.025	ST1k2	90.057	ST1k2
F21C MCC	0.48			90.746	ST1k	86.008	ST1k2	89.644	ST1k	89.953	ST1k	90.124	ST1k2	90.156	ST1k2
F22 MCC	0.48			90.253	ST1k	85.470	ST1k2	89.140	ST1k	89.452	ST1k	89.625	ST1k2	89.657	ST1k2
F23A MCC	0.48			90.452	ST1k	85.692	ST1k2	89.344	ST1k	89.655	ST1k	89.827	ST1k2	89.859	ST1k2
F23B MCC	0.48			89.576	ST1k	84.794	ST1k2	88.464	ST1k	88.776	ST1k	88.948	ST1k2	88.981	ST1k2
F3 480V SWGR	0.48			90.578	ST1k	85.730	ST1k	88.994	ST1k	89.746	ST1k	89.965	ST1k	90.001	ST1k2
F31A MCC	0.48			90.030	ST1k	85.205	ST1k	88.454	ST1k	89.202	ST1k	89.420	ST1k	89.455	ST1k2
F31B MCC	0.48			88.949	ST1k	84.170	ST1k	87.388	ST1k	88.129	ST1k	88.345	ST1k	88.380	ST1k2
F32A MCC	0.48			90.351	ST1k	85.352	ST1k	88.614	ST1k	89.499	ST1k	89.718	ST1k	89.772	ST1k2
F32B MCC	0.48			89.846	ST1k	84.817	ST1k	88.100	ST1k	88.989	ST1k	89.210	ST1k	89.264	ST1k2
F33A MCC	0.48			90.038	ST1k	85.207	ST1k	88.459	ST1k	89.208	ST1k	89.427	ST1k	89.462	ST1k2
F33B MCC	0.48			89.972	ST1k	85.139	ST1k	88.393	ST1k	89.142	ST1k	89.361	ST1k	89.396	ST1k2
F4 480V SWGR	0.48			92.629	ST1k	87.954	ST1k2	91.540	ST1k	91.845	ST1k	92.014	ST1k2	92.046	ST1k2
F41A MCC	0.48			92.259	ST1k	87.593	ST1k2	91.173	ST1k	91.477	ST1k	91.646	ST1k2	91.677	ST1k2
F41B MCC	0.48			92.241	ST1k	87.573	ST1k2	91.154	ST1k	91.458	ST1k	91.627	ST1k2	91.659	ST1k2
F4A LOAD CTR	0.48			93.413	ST1k	88.731	ST1k2	92.322	ST1k	92.628	ST1k	92.797	ST1k2	92.829	ST1k2
F6 480V SWGR	0.48			93.799	ST1k	89.098	ST1k2	92.704	ST1k	93.011	ST1k	93.181	ST1k2	93.213	ST1k2
F61 MCC	0.48			93.799	ST1k	89.098	ST1k2	92.704	ST1k	93.011	ST1k	93.181	ST1k2	93.213	ST1k2
F62 MCC	0.48			93.799	ST1k	89.098	ST1k2	92.704	ST1k	93.011	ST1k	93.181	ST1k2	93.213	ST1k2
F63 MCC	0.48			93.799	ST1k	89.098	ST1k2	92.704	ST1k	93.011	ST1k	93.181	ST1k2	93.213	ST1k2
F7 480V SWGR	0.48			94.704	ST1k	83.352	ST1g	92.580	ST1g	93.303	ST1k	93.628	ST1k2	93.684	ST1k2
F71 MCC	0.48			94.669	ST1k	83.321	ST1g	92.545	ST1g	93.269	ST1k	93.593	ST1k2	93.649	ST1k2

Table 5. Scenario ST1: Mode 1 Design Basis Accident Transient Minimum Bus Voltages (Sheet 4 of 4)

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=1		T=2		T=3		T=4	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
M22A MCC	0.48			90.578	ST1k	85.730	ST1k	88.994	ST1k	89.746	ST1k	89.965	ST1k	90.001	ST1k2
YE2 MCC	0.24	87.080	65.000	97.251	ST1k	75.734	ST1k2	85.710	ST1k	88.889	ST1k	93.105	ST1k2	94.581	ST1k2
YE2 MV5443C	0.24	85.000	67.090	97.251	ST1k	74.834	ST1k2	84.691	ST1k	88.701	ST1k	92.925	ST1k2	94.405	ST1k2
YF2 MCC	0.24	86.780	65.000	98.242	ST1k	78.016	ST1k2	87.505	ST1g	90.840	ST1k	94.456	ST1k2	95.552	ST1k2
YF2 MV5444C	0.24	85.000	67.090	98.242	ST1k	77.167	ST1k2	86.552	ST1g	90.672	ST1k	94.294	ST1k2	95.392	ST1k2

**Table 6. Scenarios ST2 and ST3 Large Motor Starting
Transient Minimum Bus VOltages (Sheet 1 of 3)**

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=0		T=1		T=2		T=3		T=4		T=5		T=6		T=7		T=8	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
A 13.8KV SWGR	13.8	86.090	76.530	93.275	ST2h	94.359	ST2h	82.546	ST2h	93.500	ST2h	90.880	ST2h	94.364	ST2h	82.606	ST2h	93.511	ST2h	90.873	ST2h
A MP2-1	13.8	86.090	76.530	93.233	ST2h	94.317	ST2h	82.498	ST2h	93.458	ST2h	90.837	ST2h	94.322	ST2h	82.558	ST2h	93.469	ST2h	90.830	ST2h
A MP2-3	13.8	86.090	76.530	93.239	ST2h	94.324	ST2h	82.506	ST2h	93.465	ST2h	90.844	ST2h	94.329	ST2h	82.566	ST2h	93.476	ST2h	90.836	ST2h
A MP36-1	13.8	86.090	76.530	93.232	ST2h	94.359	ST2h	82.320	ST2h	93.458	ST2h	90.836	ST2h	94.322	ST2h	82.558	ST2h	93.469	ST2h	90.829	ST2h
A MP36-4	13.8	86.090	76.530	93.254	ST2h	94.339	ST2h	82.523	ST2h	93.480	ST2h	90.859	ST2h	94.344	ST2h	82.583	ST2h	93.491	ST2h	90.852	ST2h
B 13.8KV SWGR	13.8	86.090	76.530	93.272	ST2h	94.350	ST2h	82.604	ST2h	93.498	ST2h	90.860	ST2h	94.368	ST2h	82.530	ST2h	93.507	ST2h	90.884	ST2h
B MP2-2	13.8	86.090	76.530	93.217	ST2h	94.296	ST2h	82.543	ST2h	93.444	ST2h	90.805	ST2h	94.315	ST2h	82.468	ST2h	93.452	ST2h	90.828	ST2h
B MP2-4	13.8	86.090	76.530	93.224	ST2h	94.303	ST2h	82.551	ST2h	93.451	ST2h	90.812	ST2h	94.321	ST2h	82.476	ST2h	93.459	ST2h	90.835	ST2h
B MP36-2	13.8	86.090	76.530	93.222	ST2h	94.301	ST2h	82.548	ST2h	93.449	ST2h	90.809	ST2h	94.319	ST2h	82.474	ST2h	93.457	ST2h	90.833	ST2h
B MP36-3	13.8	86.090	76.530	93.252	ST2h	94.331	ST2h	82.582	ST2h	93.479	ST2h	90.841	ST2h	94.368	ST2h	82.428	ST2h	93.487	ST2h	90.864	ST2h
BF81 MCC	0.48	86.250	76.670	93.274	ST2h	93.709	ST2g	82.193	ST2h	93.850	ST2h	86.301	ST2h	93.659	ST2f	82.116	ST2h	93.517	ST2h	86.579	ST2f
BF81 DBCSBOP	0.48	82.000		93.194	ST2h	93.629	ST2g	82.123	ST2h	93.770	ST2h	86.227	ST2h	93.579	ST2f	82.045	ST2h	93.437	ST2h	86.505	ST2f
C1 4160 SWGR	4.16	91.010	67.310	93.483	ST2h	94.446	ST2g	82.241	ST2h	93.719	ST2h	87.237	ST2f	94.348	ST2f	82.305	ST2h	94.088	ST2h	86.479	ST2h
C1 MP3-1	4.16	86.540	67.310	93.308	ST2h	94.272	ST2g	82.041	ST2h	93.543	ST2h	87.049	ST2f	94.173	ST2f	82.105	ST2h	93.913	ST2h	86.289	ST2h
C1 MP37-1A	4.16	86.540	76.930	93.483	ST2h	94.446	ST2g	82.241	ST2h	93.719	ST2h	87.237	ST2f	94.348	ST2f	82.305	ST2h	94.088	ST2h	86.479	ST2h
C1 MP42-1	4.16	86.540	67.310	93.415	ST2h	94.379	ST2g	82.164	ST2h	93.651	ST2h	87.164	ST2f	94.280	ST2f	82.227	ST2h	94.020	ST2h	86.405	ST2h
C1 MP43-1	4.16	86.540	67.310	93.425	ST2h	94.389	ST2g	82.175	ST2h	93.661	ST2h	87.175	ST2f	94.290	ST2f	82.238	ST2h	94.030	ST2h	86.416	ST2h
C1 MP58-1	4.16	86.540	67.310	93.337	ST2h	94.302	ST2g	82.075	ST2h	93.573	ST2h	87.081	ST2f	94.203	ST2f	82.139	ST2h	93.942	ST2h	86.321	ST2h
C2 4160 SWGR	4.16	86.540	76.930	93.492	ST2h	94.434	ST2g	82.250	ST2h	93.727	ST2h	87.246	ST2f	94.356	ST2f	82.314	ST2h	94.096	ST2h	86.487	ST2h
D1 4160 SWGR	4.16	91.010	67.310	93.999	ST2h	94.436	ST2g	82.880	ST2h	94.578	ST2h	87.001	ST2h	94.397	ST2f	82.802	ST2h	94.243	ST2h	87.292	ST2f
D1 MP3-2	4.16	86.540	67.310	93.789	ST2h	94.228	ST2g	82.642	ST2h	94.369	ST2h	86.774	ST2h	94.188	ST2f	82.564	ST2h	94.034	ST2h	87.067	ST2f
D1 MP37-2A	4.16	86.540	76.930	93.999	ST2h	94.436	ST2g	82.880	ST2h	94.578	ST2h	87.001	ST2h	94.397	ST2f	82.802	ST2h	94.243	ST2h	87.292	ST2f
D1 MP42-2	4.16	86.540	67.310	93.946	ST2h	94.384	ST2g	82.820	ST2h	94.525	ST2h	86.944	ST2h	94.345	ST2f	82.742	ST2h	94.191	ST2h	87.236	ST2f
D1 MP43-2	4.16	86.540	67.310	93.940	ST2h	94.377	ST2g	82.813	ST2h	94.519	ST2h	86.937	ST2h	94.338	ST2f	82.735	ST2h	94.184	ST2h	87.229	ST2f
D1 MP58-2	4.16	86.540	67.310	93.911	ST2h	94.349	ST2g	82.781	ST2h	94.491	ST2h	86.906	ST2h	94.310	ST2f	82.703	ST2h	94.156	ST2h	87.198	ST2f
D2 4160 SWGR	4.16	86.540	76.930	94.005	ST2h	94.442	ST2g	82.887	ST2h	94.584	ST2h	87.007	ST2h	94.391	ST2f	82.809	ST2h	94.249	ST2h	87.286	ST2f
D3 4160 SWGR	4.16	86.540	76.930	93.998	ST2h	94.435	ST2g	82.880	ST2h	94.576	ST2h	87.000	ST2h	94.384	ST2f	82.802	ST2h	94.242	ST2h	87.279	ST2f
E1 480V SWGR	0.48	86.250	67.090	92.572	ST2h	93.581	ST2g	80.737	ST2h	92.819	ST2h	86.011	ST2f	93.478	ST2f	80.804	ST2h	93.205	ST2h	85.212	ST2h
E1 MP56-1	0.48	86.250	67.090	91.282	ST2h	92.305	ST2g	79.250	ST2h	91.532	ST2h	84.619	ST2f	92.200	ST2f	79.318	ST2h	91.924	ST2h	83.807	ST2h
E11A MCC	0.48	87.100	67.090	92.308	ST2h	93.320	ST2g	80.433	ST2h	92.556	ST2h	85.727	ST2f	93.216	ST2f	80.500	ST2h	92.943	ST2h	84.925	ST2h
E11A MC62-1	0.48	86.250	67.090	92.308	ST2h	93.320	ST2g	80.433	ST2h	92.556	ST2h	85.727	ST2f	93.216	ST2f	80.500	ST2h	92.943	ST2h	84.925	ST2h
E11A MP89-1A	0.48	86.250	67.090	91.675	ST2h	92.693	ST2g	79.704	ST2h	91.924	ST2h	85.043	ST2f	92.589	ST2f	79.772	ST2h	92.314	ST2h	84.235	ST2h
E11A MP89-1B	0.48	86.250	67.090	92.308	ST2h	93.320	ST2g	80.433	ST2h	92.556	ST2h	85.727	ST2f	93.216	ST2f	80.500	ST2h	92.943	ST2h	84.925	ST2h
E11A MP89-3A	0.48	86.250	67.090	91.171	ST2h	92.195	ST2g	79.121	ST2h	91.421	ST2h	84.499	ST2f	92.090	ST2f	79.189	ST2h	91.813	ST2h	83.685	ST2h
E11A MP89-3B	0.48	86.250	67.090	92.308	ST2h	93.320	ST2g	80.433	ST2h	92.556	ST2h	85.727	ST2f	93.216	ST2f	80.500	ST2h	92.943	ST2h	84.925	ST2h
E11B MCC	0.48	87.100	67.090	92.266	ST2h	93.277	ST2g	80.384	ST2h	92.513	ST2h	85.680	ST2f	93.174	ST2f	80.451	ST2h	92.901	ST2h	84.878	ST2h
E11B MC56-1	0.48	86.250	67.090	91.394	ST2h	92.416	ST2g	79.380	ST2h	91.644	ST2h	84.741	ST2f	92.311	ST2f	79.448	ST2h	92.035	ST2h	83.930	ST2h
E11C MCC	0.48	87.100	67.090	92.300	ST2h	93.311	ST2g	80.423	ST2h	92.547	ST2h	85.717	ST2f	93.208	ST2f	80.490	ST2h	92.935	ST2h	84.916	ST2h
E11C MC75-1	0.48	86.250	67.090	90.208	ST2h	91.244	ST2g	77.999	ST2h	90.461	ST2h	83.454	ST2f	91.138	ST2f	78.069	ST2h	90.858	ST2h	82.630	ST2h
E11D MCC	0.48	86.770	67.090	92.280	ST2h	93.292	ST2g	80.401	ST2h	92.528	ST2h	85.697	ST2f	93.189	ST2f	80.468	ST2h	92.915	ST2h	84.895	ST2h
E11D DBC1PN	0.48	82.000		92.280	ST2h	93.292	ST2g	80.401	ST2h	92.528	ST2h	85.697	ST2f	93.189	ST2f	80.468	ST2h	92.915	ST2h	84.895	ST2h
E11D MP37-1B	0.48	86.250	67.090	92.280	ST2h	93.292	ST2g	80.401	ST2h	92.528	ST2h	85.697	ST2f	93.189	ST2f	80.468	ST2h	92.915	ST2h	84.895	ST2h
E11D MRE5327	0.48	86.250	67.090	91.977	ST2h	92.992	ST2g	80.052	ST2h	92.225	ST2h	85.370	ST2f	92.888	ST2f	80.120	ST2h	92.614	ST2h	84.565	ST2h
E11E MCC	0.48	87.100	67.090	92.296	ST2h	93.307	ST2g	80.418	ST2h	92.543	ST2h	85.713	ST2f	93.204	ST2f	80.486	ST2h	92.931	ST2h	84.911	ST2h
E11E MV49060	0.48	85.000	67.090	90.322	ST2h	91.356	ST2g	78.133	ST2h	90.575	ST2h	83.578	ST2f	91.250	ST2f	78.202	ST2h	90.971	ST2h	82.755	ST2h
E12A MCC	0.48	90.000	67.090	92.441	ST2h	93.450	ST2g	80.596	ST2h	92.688	ST2h	85.875	ST2f	93.347	ST2f	80.663	ST2h	93.074	ST2h	85.076	ST2h
E12A DBC1N	0.48	82.000		92.373	ST2h	93.382	ST2g	80.527	ST2h	92.620	ST2h	85.807	ST2f	93.279	ST2f	80.594	ST2h	93.007	ST2h	85.008	ST2h
E12A DBC1P	0.48	82.000		92.381	ST2h	93.390	ST2g	80.535	ST2h	92.627	ST2h	85.815	ST2f	93.287	ST2f	80.602	ST2h	93.014	ST2h	85.015	ST2h
E12A MC21-1	0.48	86.250	67.090	90.835	ST2h	91.862	ST2g	78.742	ST2h	91.086	ST2h	84.141	ST2f	91.757	ST2f	78.810	ST2h	91.479	ST2h	83.324	ST2h
E12A MC30-1	0.48	86.250	67.090	92.219	ST2h	93.231	ST2g	80.342	ST2h	92.467	ST2h	85.637	ST2f	93.127	ST2f	80.409	ST2h	92.854	ST2h	84.835	ST2h
E12A MC71-1	0.48	86.250	67.090	92.242	ST2h	93.254	ST2g	80.368	ST2h	92.490	ST2h	85.662	ST2f	93.150	ST2f	80.436	ST2h	92.877	ST2h	84.860	ST2h
E12A MC73-1	0.48	86.250	67.090	91.742	ST2h	92.758	ST2g	79.792	ST2h	91.990	ST2h	85.121	ST2f	92.654	ST2f	79.859	ST2h	92.380	ST2h	84.315	ST2h
E12A MS3311	0.48	86.250	67.090	91.209	ST2h	92.232	ST2g	79.176	ST2h	91.459	ST2h	84.546	ST2f	92.127	ST2f	79.244	ST2h	91.851	ST2h	83.733	ST2h
E12A MS61-1	0.48	86.250	67.090	90.011	ST2h	91.048	ST2g	77.777	ST2h	90.264	ST2h	83.245	ST2f	90.942	ST2f	77.847	ST2h	90.662	ST2h	82.418	ST2h
E12A MV5597	0.48	85.000	67.090	90.515	ST2h	91.546	ST2g	78.369	ST2h	90.767	ST2h	83.794	ST2f	91.441	ST2f	78.438	ST2h	91.162	ST2h	82.973	ST2h
E12A YRF1	0.48	90.000		92.301	ST2h	93.308	ST2g	80.474	ST2h	92.547	ST2h	85.745	ST2f	93.205	ST2f	80.541	ST2h	92.933	ST2h	84.947	ST2h
E12A YRF3	0.48	90.000		92.219	ST2h	93.225	ST2g	80.403	ST2h	92.465	ST2h	85.669	ST2f	93.122	ST2f	80.469	ST2h	92.850	ST2h	84.871	ST2h
E12B MCC	0.48	87.100	67.090	92.398	ST2h	93.408	ST2g	80.544	ST2h	92.645	ST2h	85.828	ST2f	93.305	ST2f	80.611	ST2h	93.032	ST2h	85.028	ST2h
E12B MC25-1	0.48	86.250	67.090	91.321	ST2h	92.342	ST2g	79.303	ST2h	91.570	ST2h	84.665	ST2f	92.238	ST2f	79.371	ST2h	91.962	ST2h	83.854	ST2h
E12B MC25-2	0.48	86.250	67.090	91.593	ST2h	92.611	ST2g	79.617	ST2h	91.842	ST2h	84.959	ST2f	92.507	ST2f	79.685	ST2h	92.232	ST2h	84.151	ST2h
E12B MC78-1	0.48	86.250	67.090	91.927	ST2h	92.942	ST2g	80.002	ST2h	92.175	ST2h	85.320	ST2f	92.838	ST2f	80.069	ST2h	92.564	ST2h	84.514	ST2h
E12B MP147-1	0.48	86.250	67.090	92.099	ST2h	93.112	ST2g	80.200	ST2h	92.347	ST2h	85.505	ST2f	93.008	ST2f	80.268	ST2h	92.735	ST2h	84.702	ST2h
E12B MP147-3	0.48	86.250	67.090	92.313	ST2h	93.323	ST2g	80.446	ST2h	92.560	ST2h	85.736	ST2f	93.220	ST2f	80.513	ST2h	92.947	ST2h	84.934	ST2h
E12B YE1	0.48	82.100		92.361	ST2h	93.371	ST2g	80.501	ST2h	92.608	ST2h	85.787	ST2f	93.267	ST2f	80.568	ST2h	92.994	ST2h	84.987	ST2h
E12C MCC	0.48	87.100	67.090	92.005	ST2h	93.019	ST2g	80.094	ST2h	92.253	ST2h	85.405	ST2f	92.915	ST2f	80.162	ST2h	92.641	ST2h	84.601	ST2h
E12C MC99-1	0.48	86.250	67.090	90.968	ST2h	91.993	ST2g	78.897	ST2h	91.218	ST2h	84.285	ST2f	91.888	ST2f	78.965	ST2h	91.611	ST2h	83.470	ST2h
E12C MC99-2	0.48	86.250	67.090	91.394	ST2h	92.415	ST2g	79.391	ST2h	91.644	ST2h	84.746	ST2f	92.311	ST2f	79.459	ST2h	92.035	ST2h	83.936	ST2h
E12C MF15-1	0.48	86.250	67.090	91.771	ST2h	92.787	ST2g	79.825	ST2h	92.019	ST2h	85.153	ST2f	92.683	ST2f	79.892	ST2h	92.409	ST2h	84.346	ST2h
E12D MCC	0.48	86.250	67.090	91.980	ST2h	92.994	ST2g	80.065	ST2h	92.228	ST2h	85.378	ST2f	92.890	ST2f	80.133	ST2h	92.616	ST2h	84.574	ST2h
E12E MCC	0.48	87.100	67.090	92.065	ST2h	93.079	ST2g	80.163	ST2h	92.313	ST2h	85.470	ST2f	92.975	ST2f	80.230	ST2h	92.701	ST2h	84.666	ST2h
E12E MC31-4	0.48	86.250	67.090	90.390	ST2h	91.423	ST2g	78.225	ST2h	90.643	ST2h	83.659	ST2f	91.317	ST2f	78.294	ST2h	91.038	ST2h	82.837	ST2h
E12E MC31-5	0.48	86.250	67.090	90.859	ST2h	91.886	ST2g	78.770	ST2h	91.110	ST2h	84.167	ST2f	91.781	ST2f	78.839	ST2h	91.503	ST2h	83.351	ST2h
E12E MP197-1	0.48	86.250	67.090	91.677	ST2h	92.695	ST2g	79.716	ST2h	91.926	ST2h	85.052	ST2f	92.591	ST2f	79.784	ST2h	92.316	ST2h	84.244	ST2h
E12F MCC	0.48	86.250	67.090	92.379	ST2h	93.389	ST2g	80.522	ST2h	92.626	ST2h	85.807	ST2f	93.286	ST2f	80.589	ST2h	93.013	ST2h	85.007	ST2h
E12F MC25-5	0.48	86.250	67.090	92.379	ST2h	93.389	ST2g	80.522	ST2h	92.626	ST2h	85.807	ST2f	93.286	ST2f	80.589	ST2h	93.013	ST2h	85.007	ST2h
E12F MP195-1	0.48	86.250	67.090	91.808	ST2h	92.824	ST2g	79.865	ST2h	92.056	ST2h	85.191	ST2f	92.720	ST2f	79.933	ST2h	92.445	ST2h	84.385	ST2h
E14 MCC	0.48	86.250	67.090	92.465	ST2h	93.474	ST2g	80.613	ST2h	92.712	ST2h	85.896	ST2f	93.371	ST2f	80.680	ST2h	93.098	ST2h	85.095	ST2h
E14 MC1-1	0.48	86.250	67.090	93.420	ST3c	94.554	ST3c	81.732	ST3c	93.650	ST3c	88.212	ST3b	94.559	ST3c	81.799	ST3c	94.028	ST3c	86.022	ST3c
E14 MC1-1LS	0.48	86.250	67.090	91.965	ST2h	92.980	ST2g	80.038	ST2h	92.213	ST2h	85.356	ST2f	92.876	ST2f	80.106	ST2h	92.602	ST2h	84.551	ST2h
E15 MCC	0.48	86.250	67.090	92.572	ST2h	93.581	ST2g	80.737	ST2h	92.819	ST2h	86.011	ST2f	93.478	ST2f	80.804	ST2h	93.205	ST2h	85.212	ST2h
E16A MCC	0.48	89.800	67.090	92.443	ST2h	93.451	ST2g	80.619	ST2h	92.690	ST2h	85.889	ST2f	93.348	ST2f	80.686	ST2h	93.076	ST2h	85.091	ST2h
E16A MP274-1	0.48	86.250	67.090	92.148	ST2h	93.152	ST2g	80.362	ST2h	92.394	ST2h	85.614	ST2f	93.050	ST2f	80.428	ST2h	92.778	ST2h	84.819	ST2h
E16A XY1	0.48	85.000		92.396	ST2h	93.403	ST2g	80.578	ST2h	92.642	ST2h	85.845	ST2f	93.300	ST2f	80.645	ST2h	93.028	ST2h	85.047	ST2h
E16A XY3	0.48	85.000		92.377	ST2h	93.383	ST2g	80.561	ST2h	92.623	ST2h	85.827	ST2f	93.280	ST2f	80.628	ST2h	93.008	ST2h	85.029	ST2h
E16B MCC	0.48	90.300	67.090	92.427	ST2h	93.434	ST2g	80.605	ST2h	92.673	ST2h	85.874	ST2f	93.331	ST2f	80.672	ST2h	93.059	ST2h	85.076	ST2h
E16B MP273-1	0.48	86.250	67.090	92.264	ST2h	93.269	ST2g	80.462	ST2h	92.509	ST2h	85.722	ST2f	93.166	ST2f	80.529	ST2h	92.894	ST2h	84.925	ST2h
E2 480V SWGR	0.48			89.291	ST3c	90.317	ST3c	78.758	ST3c	89.499	ST3c	86.947	ST3c	90.322	ST3c	78.818	ST3c	89.510	ST3c	86.940	ST3c
E21A MCC	0.48			88.707	ST3c	89.730	ST3c	78.204	ST3c	88.914	ST3c	86.370	ST3c	89.734	ST3c	78.264	ST3c	88.925	ST3c	86.363	ST3c
E21B MCC	0.48			88.677	ST3c	89.699	ST3c	78.177	ST3c	88.884	ST3c	86.340	ST3c	89.704	ST3c	78.237	ST3c	88.895	ST3c	86.334	ST3c
E21C MCC	0.48			88.183	ST3c	89.202	ST3c	77.714	ST3c	88.389	ST3c	85.854	ST3c	89.207	ST3c	77.773	ST3c	88.400	ST3c	85.847	ST3c
E21D MCC	0.48			88.707	ST3c	89.730	ST3c	78.204	ST3c	88.914	ST3c	86.370	ST3c	89.734	ST3c	78.264	ST3c	88.925	ST3c	86.363	ST3c
E22A MCC	0.48			88.404	ST3c	89.426	ST3c	77.906	ST3c	88.611	ST3c	86.068	ST3c	89.430	ST3c	77.966	ST3c	88.622	ST3c	86.062	ST3c
E22B MCC	0.48			88.391	ST3c	89.413	ST3c	77.894	ST3c	88.598	ST3c	86.056	ST3c	89.417	ST3c	77.954	ST3c	88.609	ST3c	86.049	ST3c

Table 6. Scenarios ST2 and ST3 Large Motor Starting Transient Minimum Bus VOltages (Sheet 2 of 3)

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=0		T=1		T=2		T=3		T=4		T=5		T=6		T=7		T=8	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
E23A MCC	0.48			88.767	ST3c	89.794	ST3c	78.221	ST3c	88.975	ST3c	86.421	ST3c	89.798	ST3c	78.281	ST3c	88.986	ST3c	86.414	ST3c
E23B MCC	0.48			88.275	ST3c	89.300	ST3c	77.741	ST3c	88.483	ST3c	85.932	ST3c	89.305	ST3c	77.801	ST3c	88.493	ST3c	85.925	ST3c
E3 480V SWGR	0.48			90.111	ST2h	91.196	ST2h	79.342	ST2h	90.337	ST2h	87.713	ST2h	91.201	ST2h	79.402	ST2h	90.348	ST2h	87.705	ST2h
E31A MCC	0.48			88.417	ST2h	89.505	ST2h	77.605	ST2h	88.643	ST2h	86.012	ST2h	89.510	ST2h	77.666	ST2h	88.654	ST2h	86.005	ST2h
E31B MCC	0.48			88.328	ST2h	89.417	ST2h	77.503	ST2h	88.554	ST2h	85.920	ST2h	89.422	ST2h	77.564	ST2h	88.565	ST2h	85.913	ST2h
E32A MCC	0.48			90.009	ST2h	91.094	ST2h	79.241	ST2h	90.234	ST2h	87.611	ST2h	91.099	ST2h	79.302	ST2h	90.245	ST2h	87.604	ST2h
E32B MCC	0.48			89.512	ST2h	90.598	ST2h	78.729	ST2h	89.738	ST2h	87.111	ST2h	90.603	ST2h	78.790	ST2h	89.748	ST2h	87.104	ST2h
E33A MCC	0.48			89.476	ST2h	90.565	ST2h	78.655	ST2h	89.702	ST2h	87.067	ST2h	90.570	ST2h	78.716	ST2h	89.713	ST2h	87.060	ST2h
E33B MCC	0.48			89.476	ST2h	90.565	ST2h	78.655	ST2h	89.702	ST2h	87.067	ST2h	90.570	ST2h	78.716	ST2h	89.713	ST2h	87.060	ST2h
E4 480V SWGR	0.48			91.202	ST2h	92.292	ST2h	80.393	ST2h	91.428	ST2h	88.793	ST2h	92.297	ST2h	80.454	ST2h	91.439	ST2h	88.786	ST2h
E41A MCC	0.48			90.860	ST2h	91.948	ST2h	80.070	ST2h	91.086	ST2h	88.456	ST2h	91.953	ST2h	80.131	ST2h	91.097	ST2h	88.449	ST2h
E41B MCC	0.48			90.570	ST2h	91.658	ST2h	79.778	ST2h	90.796	ST2h	88.166	ST2h	91.663	ST2h	79.838	ST2h	90.807	ST2h	88.158	ST2h
E42 MCC	0.48			91.083	ST2h	92.010	ST2g	80.018	ST2h	91.314	ST2h	84.937	ST2f	91.933	ST2f	80.081	ST2h	91.677	ST2h	84.191	ST2h
E43 MCC	0.48			91.202	ST2h	92.292	ST2h	80.393	ST2h	91.428	ST2h	88.793	ST2h	92.297	ST2h	80.454	ST2h	91.439	ST2h	88.786	ST2h
E6 480V SWGR	0.48			93.275	ST2h	94.359	ST2h	82.546	ST2h	93.500	ST2h	90.880	ST2h	94.364	ST2h	82.606	ST2h	93.511	ST2h	90.873	ST2h
E61 MCC	0.48			93.275	ST2h	94.359	ST2h	82.546	ST2h	93.500	ST2h	90.880	ST2h	94.364	ST2h	82.606	ST2h	93.511	ST2h	90.873	ST2h
E62 MCC	0.48			93.275	ST2h	94.359	ST2h	82.546	ST2h	93.500	ST2h	90.880	ST2h	94.364	ST2h	82.606	ST2h	93.511	ST2h	90.873	ST2h
E63 MCC	0.48			93.275	ST2h	94.359	ST2h	82.546	ST2h	93.500	ST2h	90.880	ST2h	94.364	ST2h	82.606	ST2h	93.511	ST2h	90.873	ST2h
EF12C MCC	0.48	86.250	67.090	91.967	ST2h	92.982	ST2g	80.051	ST2h	92.215	ST2h	85.364	ST2f	92.878	ST2f	80.118	ST2h	92.604	ST2h	84.560	ST2h
EF12C MF15-3	0.48	86.250	67.090	91.967	ST2h	92.982	ST2g	80.051	ST2h	92.215	ST2h	85.364	ST2f	92.878	ST2f	80.118	ST2h	92.604	ST2h	84.560	ST2h
EF12D MCC	0.48	86.250	67.090	92.441	ST2h	93.450	ST2g	80.596	ST2h	92.688	ST2h	85.875	ST2f	93.347	ST2f	80.663	ST2h	93.074	ST2h	85.076	ST2h
EF41 AE4	0.48			91.202	ST2h	92.292	ST2h	80.393	ST2h	91.428	ST2h	88.793	ST2h	92.297	ST2h	80.454	ST2h	91.439	ST2h	88.786	ST2h
EF41 BF4	0.48			92.104	ST2h	93.176	ST2h	81.494	ST2h	92.330	ST2h	89.707	ST2h	93.195	ST2h	81.420	ST2h	92.338	ST2h	89.730	ST2h
F1 480V SWGR	0.48	86.250	67.090	93.259	ST2h	93.717	ST2g	81.569	ST2h	93.865	ST2h	85.915	ST2h	93.676	ST2f	81.487	ST2h	93.515	ST2h	86.222	ST2f
F1 MP56-2	0.48	86.250	67.090	92.051	ST2h	92.514	ST2g	80.181	ST2h	92.664	ST2h	84.600	ST2h	92.473	ST2f	80.097	ST2h	92.310	ST2h	84.911	ST2f
F11A MCC	0.48	87.100	67.090	92.928	ST2h	93.387	ST2g	81.208	ST2h	93.536	ST2h	85.566	ST2h	93.346	ST2f	81.125	ST2h	93.185	ST2h	85.874	ST2f
F11A MC21-2	0.48	86.250	67.090	92.256	ST2h	92.718	ST2g	80.436	ST2h	92.868	ST2h	84.835	ST2h	92.677	ST2f	80.353	ST2h	92.514	ST2h	85.145	ST2f
F11A MC62-2	0.48	86.250	67.090	92.928	ST2h	93.387	ST2g	81.208	ST2h	93.536	ST2h	85.566	ST2h	93.346	ST2f	81.125	ST2h	93.185	ST2h	85.874	ST2f
F11A MC75-2	0.48	86.250	67.090	91.719	ST2h	92.184	ST2g	79.817	ST2h	92.335	ST2h	84.249	ST2h	92.143	ST2f	79.733	ST2h	91.979	ST2h	84.562	ST2f
F11A MRE5328	0.48	86.250	67.090	92.686	ST2h	93.146	ST2g	80.930	ST2h	93.295	ST2h	85.303	ST2h	93.105	ST2f	80.847	ST2h	92.943	ST2h	85.611	ST2f
F11A MS3321	0.48	86.250	67.090	92.185	ST2h	92.648	ST2g	80.355	ST2h	92.798	ST2h	84.758	ST2h	92.607	ST2f	80.271	ST2h	92.444	ST2h	85.068	ST2f
F11A MV4907	0.48	85.000	67.090	90.997	ST2h	91.465	ST2g	78.979	ST2h	91.617	ST2h	83.458	ST2h	91.424	ST2f	78.893	ST2h	91.258	ST2h	83.774	ST2f
F11B MCC	0.48	87.100	67.090	92.928	ST2h	93.387	ST2g	81.208	ST2h	93.536	ST2h	85.566	ST2h	93.346	ST2f	81.125	ST2h	93.185	ST2h	85.874	ST2f
F11C MCC	0.48	87.100	67.090	92.910	ST2h	93.369	ST2g	81.186	ST2h	93.517	ST2h	85.546	ST2h	93.328	ST2f	81.104	ST2h	93.166	ST2h	85.853	ST2f
F11C MP37-2B	0.48	86.250	67.090	92.910	ST2h	93.369	ST2g	81.186	ST2h	93.517	ST2h	85.546	ST2h	93.328	ST2f	81.104	ST2h	93.166	ST2h	85.853	ST2f
F11C MP37-2D	0.48	86.250	67.090	92.470	ST2h	92.931	ST2g	80.683	ST2h	93.080	ST2h	85.068	ST2h	92.890	ST2f	80.599	ST2h	92.728	ST2h	85.377	ST2f
F11D MCC	0.48	87.100	67.090	92.877	ST2h	93.336	ST2g	81.149	ST2h	93.485	ST2h	85.510	ST2h	93.295	ST2f	81.066	ST2h	93.134	ST2h	85.818	ST2f
F11D DBC2PN	0.48	82.000		92.877	ST2h	93.336	ST2g	81.149	ST2h	93.485	ST2h	85.510	ST2h	93.295	ST2f	81.066	ST2h	93.134	ST2h	85.818	ST2f
F11D MC31-3	0.48	86.250	67.090	92.535	ST2h	92.996	ST2g	80.757	ST2h	93.145	ST2h	85.139	ST2h	92.955	ST2f	80.674	ST2h	92.793	ST2h	85.448	ST2f
F11D MP89-2A	0.48	86.250	67.090	92.119	ST2h	92.582	ST2g	80.279	ST2h	92.732	ST2h	84.686	ST2h	92.541	ST2f	80.195	ST2h	92.378	ST2h	84.997	ST2f
F11D MP89-2B	0.48	86.250	67.090	92.877	ST2h	93.336	ST2g	81.149	ST2h	93.485	ST2h	85.510	ST2h	93.295	ST2f	81.066	ST2h	93.134	ST2h	85.818	ST2f
F11E MCC	0.48	86.250	67.090	92.626	ST2h	93.085	ST2g	80.877	ST2h	93.234	ST2h	85.247	ST2h	93.044	ST2f	80.794	ST2h	92.882	ST2h	85.555	ST2f
F11E MC31-1	0.48	86.250	67.090	90.582	ST2h	91.053	ST2g	78.517	ST2h	91.205	ST2h	83.016	ST2h	91.011	ST2f	78.431	ST2h	90.845	ST2h	83.333	ST2f
F11E MC31-2	0.48	86.250	67.090	89.665	ST2h	90.141	ST2g	77.443	ST2h	90.294	ST2h	82.007	ST2h	90.098	ST2f	77.356	ST2h	89.931	ST2h	82.328	ST2f
F11F MCC	0.48	86.250	67.090	92.590	ST2h	93.050	ST2g	80.846	ST2h	93.199	ST2h	85.215	ST2h	93.009	ST2f	80.763	ST2h	92.847	ST2h	85.523	ST2f
F12A MCC	0.48	90.000	67.090	93.126	ST2h	93.584	ST2g	81.430	ST2h	93.732	ST2h	85.779	ST2h	93.544	ST2f	81.348	ST2h	93.382	ST2h	86.086	ST2f
F12A DBC2N	0.48	82.000		93.029	ST2h	93.488	ST2g	81.332	ST2h	93.636	ST2h	85.681	ST2h	93.447	ST2f	81.249	ST2h	93.285	ST2h	85.988	ST2f
F12A DBC2P	0.48	82.000		93.029	ST2h	93.488	ST2g	81.332	ST2h	93.636	ST2h	85.681	ST2h	93.447	ST2f	81.249	ST2h	93.285	ST2h	85.988	ST2f
F12A MC133	0.48	86.250	67.090	91.957	ST2h	92.421	ST2g	80.087	ST2h	92.571	ST2h	84.506	ST2h	92.380	ST2f	80.003	ST2h	92.216	ST2h	84.817	ST2f
F12A MC30-2	0.48	86.250	67.090	92.746	ST2h	93.206	ST2g	80.995	ST2h	93.354	ST2h	85.365	ST2h	93.165	ST2f	80.911	ST2h	93.003	ST2h	85.674	ST2f
F12A MC73-2	0.48	86.250	67.090	90.804	ST2h	91.274	ST2g	78.748	ST2h	91.426	ST2h	83.243	ST2h	91.232	ST2f	78.663	ST2h	91.067	ST2h	83.560	ST2f
F12A MP195-2	0.48	86.250	67.090	92.593	ST2h	93.053	ST2g	80.819	ST2h	93.202	ST2h	85.198	ST2h	93.012	ST2f	80.735	ST2h	92.850	ST2h	85.507	ST2f
F12A MP198-1	0.48	86.250	67.090	92.479	ST2h	92.940	ST2g	80.687	ST2h	93.089	ST2h	85.074	ST2h	92.899	ST2f	80.604	ST2h	92.736	ST2h	85.383	ST2f
F12A MS61-2	0.48	86.250	67.090	91.080	ST2h	91.549	ST2g	79.069	ST2h	91.701	ST2h	83.546	ST2h	91.507	ST2f	78.984	ST2h	91.342	ST2h	83.861	ST2f
F12A MV5598	0.48	85.000	67.090	91.721	ST2h	92.187	ST2g	79.814	ST2h	92.337	ST2h	84.248	ST2h	92.145	ST2f	79.730	ST2h	91.981	ST2h	84.561	ST2f
F12A YRF2	0.48	90.000		92.961	ST2h	93.419	ST2g	81.286	ST2h	93.566	ST2h	85.627	ST2h	93.378	ST2f	81.204	ST2h	93.217	ST2h	85.933	ST2f
F12A YRF4	0.48	90.000		92.891	ST2h	93.348	ST2g	81.224	ST2h	93.495	ST2h	85.562	ST2h	93.307	ST2f	81.142	ST2h	93.146	ST2h	85.868	ST2f
F12B MCC	0.48	87.100	67.090	93.105	ST2h	93.564	ST2g	81.396	ST2h	93.712	ST2h	85.750	ST2h	93.523	ST2f	81.314	ST2h	93.361	ST2h	86.057	ST2f
F12B MC25-3	0.48	86.250	67.090	92.458	ST2h	92.920	ST2g	80.654	ST2h	93.069	ST2h	85.046	ST2h	92.879	ST2f	80.571	ST2h	92.716	ST2h	85.356	ST2f
F12B MC25-4	0.48	86.250	67.090	92.155	ST2h	92.618	ST2g	80.305	ST2h	92.768	ST2h	84.716	ST2h	92.577	ST2f	80.222	ST2h	92.414	ST2h	85.027	ST2f
F12B MC78-2	0.48	86.250	67.090	92.810	ST2h	93.270	ST2g	81.058	ST2h	93.419	ST2h	85.429	ST2h	93.229	ST2f	80.975	ST2h	93.067	ST2h	85.737	ST2f
F12B MP147-2	0.48	86.250	67.090	92.794	ST2h	93.254	ST2g	81.040	ST2h	93.403	ST2h	85.412	ST2h	93.213	ST2f	80.957	ST2h	93.051	ST2h	85.720	ST2f
F12B MP147-4	0.48	86.250	67.090	93.009	ST2h	93.468	ST2g	81.286	ST2h	93.616	ST2h	85.645	ST2h	93.427	ST2f	81.203	ST2h	93.265	ST2h	85.952	ST2f
F12B YF1	0.48	81.600		93.068	ST2h	93.526	ST2g	81.354	ST2h	93.675	ST2h	85.709	ST2h	93.485	ST2f	81.271	ST2h	93.324	ST2h	86.016	ST2f
F12C MCC	0.48	87.100	67.090	92.838	ST2h	93.298	ST2g	81.100	ST2h	93.446	ST2h	85.465	ST2h	93.257	ST2f	81.017	ST2h	93.095	ST2h	85.773	ST2f
F12C MF15-2	0.48	87.100	67.090	92.626	ST2h	93.086	ST2g	80.856	ST2h	93.235	ST2h	85.234	ST2h	93.045	ST2f	80.773	ST2h	92.883	ST2h	85.543	ST2f
F12D MCC	0.48	86.250	67.090	92.757	ST2h	93.217	ST2g	81.006	ST2h	93.366	ST2h	85.377	ST2h	93.176	ST2f	80.923	ST2h	93.014	ST2h	85.685	ST2f
F12D MC99-3	0.48	86.250	67.090	92.046	ST2h	92.510	ST2g	80.190	ST2h	92.659	ST2h	84.603	ST2h	92.468	ST2f	80.106	ST2h	92.305	ST2h	84.914	ST2f
F12D MC99-4	0.48	86.250	67.090	91.902	ST2h	92.366	ST2g	80.023	ST2h	92.516	ST2h	84.445	ST2h	92.324	ST2f	79.939	ST2h	92.161	ST2h	84.757	ST2f
F13 MCC	0.48	86.250	67.090	92.557	ST2h	92.997	ST2g	81.349	ST2h	93.140	ST2h	85.508	ST2h	92.946	ST2f	81.270	ST2h	92.803	ST2h	85.789	ST2f
F14 MCC	0.48	86.250	67.090	93.133	ST2h	93.591	ST2g	81.424	ST2h	93.740	ST2h	85.777	ST2h	93.550	ST2f	81.342	ST2h	93.389	ST2h	86.085	ST2f
F14 MC1-2	0.48	86.250	67.090	94.192	ST3c	95.315	ST3c	82.629	ST3c	94.773	ST3c	86.792	ST3c	95.334	ST3c	82.544	ST3c	94.431	ST3c	88.417	ST3b
F14 MC1-2LS	0.48	86.250	67.090	92.576	ST2h	93.037	ST2g	80.786	ST2h	93.186	ST2h	85.172	ST2h	92.996	ST2f	80.702	ST2h	92.833	ST2h	85.481	ST2f
F15 MCC	0.48	86.250	67.090	93.259	ST2h	93.717	ST2g	81.569	ST2h	93.865	ST2h	85.915	ST2h	93.676	ST2f	81.487	ST2h	93.515	ST2h	86.222	ST2f
F16A MCC	0.48	89.700	67.090	93.233	ST2h	93.691	ST2g	81.546	ST2h	93.838	ST2h	85.891	ST2h	93.650	ST2f	81.464	ST2h	93.488	ST2h	86.197	ST2f
F16A MC25-6	0.48	86.250	67.090	93.233	ST2h	93.691	ST2g	81.546	ST2h	93.838	ST2h	85.891	ST2h	93.650	ST2f	81.464	ST2h	93.488	ST2h	86.197	ST2f
F16A MP274-3	0.48	86.250	67.090	92.995	ST2h	93.452	ST2g	81.338	ST2h	93.599	ST2h	85.671	ST2h	93.411	ST2f	81.256	ST2h	93.250	ST2h	85.977	ST2f
F16A XY2	0.48	85.000		93.221	ST2h	93.678	ST2g	81.536	ST2h	93.826	ST2h	85.879	ST2h	93.637	ST2f	81.453	ST2h	93.476	ST2h	86.186	ST2f
F16A XY4	0.48	85.000		93.203	ST2h	93.660	ST2g	81.520	ST2h	93.808	ST2h	85.863	ST2h	93.620	ST2f	81.438	ST2h	93.458	ST2h	86.170	ST2f
F16B MCC	0.48	90.500	67.090	93.217	ST2h	93.675	ST2g	81.533	ST2h	93.823	ST2h	85.876	ST2h	93.634	ST2f	81.450	ST2h	93.473	ST2h	86.183	ST2f
F16B MP273-4	0.48	86.250	67.090	92.695	ST2h	93.150	ST2g	81.076	ST2h	93.297	ST2h	85.395	ST2h	93.110	ST2f	80.994	ST2h	92.949	ST2h	85.700	ST2f
F2 480V SWGR	0.48			90.094	ST3c	91.130	ST3c	79.452	ST3c	90.306	ST3c	87.695	ST3c	91.147	ST3c	79.374	ST3c	90.315	ST3c	87.720	ST3c
F21A MCC	0.48			89.804	ST3c	90.838	ST3c	79.179	ST3c	90.016	ST3c	87.410	ST3c	90.856	ST3c	79.102	ST3c	90.024	ST3c	87.434	ST3c
F21B MCC	0.48			89.703	ST3c	90.736	ST3c	79.091	ST3c	89.915	ST3c	87.312	ST3c	90.754	ST3c	79.013	ST3c	89.923	ST3c	87.336	ST3c
F21C MCC	0.48			89.801	ST3c	90.835	ST3c	79.177	ST3c	90.013	ST3c	87.407	ST3c	90.853	ST3c	79.099	ST3c	90.022	ST3c	87.432	ST3c
F22 MCC	0.48			88.730	ST3c	89.780	ST3c	77.916	ST3c	88.945	ST3c	86.297	ST3c	89.798	ST3c	77.837	ST3c	88.954	ST3c	86.322	ST3c
F23A MCC	0.48			89.503	ST3c	90.541	ST3c	78.824	ST3c	89.716	ST3c	87.097	ST3c	90.559	ST3c	78.746	ST3c	89.724	ST3c	87.122	ST3c
F23B MCC	0.48			88.623	ST3c	89.666	ST3c	77.887	ST3c	88.837	ST3c	86.207	ST3c	89.684	ST3c	77.809	ST3c	88.845	ST3c	86.231	ST3c
F3 480V SWGR	0.48			90.059	ST2h	91.120	ST2h	79.537	ST2h	90.282	ST2h	87.683	ST2h	91.139	ST2h	79.463	ST2h	90.290	ST2h	87.706	ST2h
F31A MCC	0.48			89.513	ST2h	90.570	ST2h	79.041	ST2h	89.735	ST2h	87.149	ST2h	90.588	ST2h	78.967	ST2h	89.743	ST2h	87.172	ST2h
F31B MCC	0.48			88.437	ST2h	89.484	ST2h	78.061	ST2h	88.657	ST2h	86.095	ST2h	89.502	ST2h	77.989	ST2h	88.665	ST2h	86.118	ST2h
F32A MCC	0.48			89.830	ST2h	90.894	ST2h	79.293	ST2h	90.054	ST2h	87.452	ST2h	90.912	ST2h	79.219	ST2h	90.062	ST2h	87.475	ST2h
F32B MCC	0.48			89.323	ST2h	90.392	ST2h	78.717	ST2h	89.547	ST2h	86.930	ST2h	90.410	ST2h	78.643	ST2h	89.556	ST2h	86.953	ST2h

Table 6. Scenarios ST2 and ST3 Large Motor Starting Transient Minimum Bus VOltages (Sheet 3 of 3)

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=0		T=1		T=2		T=3		T=4		T=5		T=6		T=7		T=8	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
F33A MCC	0.48			89.520	ST2h	90.578	ST2h	79.034	ST2h	89.742	ST2h	87.153	ST2h	90.596	ST2h	78.960	ST2h	89.750	ST2h	87.176	ST2h
F33B MCC	0.48			89.454	ST2h	90.512	ST2h	78.963	ST2h	89.677	ST2h	87.086	ST2h	90.530	ST2h	78.890	ST2h	89.685	ST2h	87.109	ST2h
F4 480V SWGR	0.48			92.104	ST2h	93.176	ST2h	81.494	ST2h	92.330	ST2h	89.707	ST2h	93.195	ST2h	81.420	ST2h	92.338	ST2h	89.730	ST2h
F41A MCC	0.48			91.736	ST2h	92.806	ST2h	81.143	ST2h	91.961	ST2h	89.342	ST2h	92.824	ST2h	81.068	ST2h	91.969	ST2h	89.366	ST2h
F41B MCC	0.48			91.717	ST2h	92.787	ST2h	81.122	ST2h	91.942	ST2h	89.323	ST2h	92.806	ST2h	81.047	ST2h	91.950	ST2h	89.346	ST2h
F4A LOAD CTR	0.48			92.888	ST2h	93.961	ST2h	82.264	ST2h	93.113	ST2h	90.486	ST2h	93.980	ST2h	82.189	ST2h	93.122	ST2h	90.509	ST2h
F6 480V SWGR	0.48			93.272	ST2h	94.350	ST2h	82.604	ST2h	93.498	ST2h	90.860	ST2h	94.368	ST2h	82.530	ST2h	93.507	ST2h	90.884	ST2h
F61 MCC	0.48			93.272	ST2h	94.350	ST2h	82.604	ST2h	93.498	ST2h	90.860	ST2h	94.368	ST2h	82.530	ST2h	93.507	ST2h	90.884	ST2h
F62 MCC	0.48			93.272	ST2h	94.350	ST2h	82.604	ST2h	93.498	ST2h	90.860	ST2h	94.368	ST2h	82.530	ST2h	93.507	ST2h	90.884	ST2h
F63 MCC	0.48			93.272	ST2h	94.350	ST2h	82.604	ST2h	93.498	ST2h	90.860	ST2h	94.368	ST2h	82.530	ST2h	93.507	ST2h	90.884	ST2h
F7 480V SWGR	0.48			92.897	ST2h	93.337	ST2g	81.704	ST2h	93.479	ST2h	85.856	ST2h	93.286	ST2f	81.625	ST2h	93.142	ST2h	86.137	ST2f
F71 MCC	0.48			92.863	ST2h	93.302	ST2g	81.673	ST2h	93.444	ST2h	85.824	ST2h	93.251	ST2f	81.594	ST2h	93.108	ST2h	86.105	ST2f
M22A MCC	0.48			90.059	ST2h	91.120	ST2h	79.537	ST2h	90.282	ST2h	87.683	ST2h	91.139	ST2h	79.463	ST2h	90.290	ST2h	87.706	ST2h
YE2 MCC	0.24	87.080	65.000	94.437	ST2h	95.477	ST2g	82.222	ST2h	94.691	ST2h	87.668	ST2f	95.371	ST2f	82.291	ST2h	95.090	ST2h	86.844	ST2h
YE2 MV5443C	0.24	85.000	67.090	94.260	ST2h	95.302	ST2g	82.019	ST2h	94.515	ST2h	87.478	ST2f	95.196	ST2f	82.088	ST2h	94.914	ST2h	86.651	ST2h
YF2 MCC	0.24	86.780	65.000	95.162	ST2h	95.634	ST2g	83.120	ST2h	95.786	ST2h	87.598	ST2h	95.592	ST2f	83.035	ST2h	95.426	ST2h	87.915	ST2f
YF2 MV5444C	0.24	85.000	67.090	95.002	ST2h	95.474	ST2g	82.936	ST2h	95.627	ST2h	87.424	ST2h	95.432	ST2f	82.851	ST2h	95.266	ST2h	87.741	ST2f

Table 7. Scenarios LF6 and LF12: Post-Accident Loading with Degraded Offsite Power Minimum and Maximum Bus Voltages (Sheet 1 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
A 13.8KV SWGR	13.8	86.090	93.184	LF6g	105.210	97.635	LF6j
A MP2-1	13.8	86.090	93.142	LF6g	105.210	97.594	LF6j
A MP2-3	13.8	86.090	93.149	LF6g	105.210	97.601	LF6j
A MP36-1	13.8	86.090	93.141	LF6g	105.210	97.593	LF6j
A MP36-4	13.8	86.090	93.164	LF6g	105.210	97.615	LF6j
B 13.8KV SWGR	13.8	86.090	93.182	LF6g	105.210	97.690	LF6i
B MP2-2	13.8	86.090	93.127	LF6g	105.210	97.638	LF6i
B MP2-4	13.8	86.090	93.134	LF6g	105.210	97.645	LF6i
B MP36-2	13.8	86.090	93.132	LF6g	105.210	97.642	LF6i
B MP36-3	13.8	86.090	93.162	LF6g	105.210	97.671	LF6i
BF81 MCC	0.48	86.250	93.191	LF6g	105.410	97.047	LF6a
BF81 DBCSBOP	0.48	82.000	93.112	LF6g	110.000	96.964	LF6a
C1 4160 SWGR	4.16	91.010	93.228	LF6g	105.760	96.956	LF12a
C1 MP3-1	4.16	86.540	93.052	LF6g	105.760	96.786	LF12a
C1 MP37-1A	4.16	86.540	93.141	LF6g	105.760	96.956	LF12a
C1 MP42-1	4.16	86.540	93.160	LF6g	105.760	96.890	LF12a
C1 MP43-1	4.16	86.540	93.170	LF6g	105.760	96.899	LF12a
C1 MP58-1	4.16	86.540	93.082	LF6g	105.760	96.815	LF12a
C2 4160 SWGR	4.16	86.540	93.238	LF6g	105.760	96.963	LF12a
D1 4160 SWGR	4.16	91.010	93.916	LF6g	105.760	97.786	LF6a
D1 MP3-2	4.16	86.540	93.706	LF6g	105.760	97.585	LF6a
D1 MP37-2A	4.16	86.540	93.916	LF6g	105.760	97.786	LF6a
D1 MP42-2	4.16	86.540	93.863	LF6g	105.760	97.736	LF6a
D1 MP43-2	4.16	86.540	93.857	LF6g	105.760	97.729	LF6a
D1 MP58-2	4.16	86.540	93.828	LF6g	105.760	97.702	LF6a
D2 4160 SWGR	4.16	86.540	93.922	LF6g	105.760	97.793	LF6a
D3 4160 SWGR	4.16	86.540	93.915	LF6g	105.760	97.785	LF6a
E1 480V SWGR	0.48	86.250	91.867	LF6g	105.410	96.206	LF12a
E1 MP56-1	0.48	86.250	90.566	LF6g	105.410	94.966	LF12a
E11A MCC	0.48	87.100	91.242	LF6g	105.410	95.953	LF12a
E11A MC62-1	0.48	86.250	91.242	LF6g	105.410	95.953	LF12a
E11A MP89-1A	0.48	86.250	91.242	LF6g	105.410	95.343	LF12a
E11A MP89-1B	0.48	86.250	91.242	LF6g	105.410	95.953	LF12a
E11A MP89-3A	0.48	86.250	91.242	LF6g	105.410	94.859	LF12a
E11A MP89-3B	0.48	86.250	91.242	LF6g	105.410	95.953	LF12a
E11B MCC	0.48	87.100	91.168	LF6g	105.410	95.911	LF12a
E11B MC56-1	0.48	86.250	90.286	LF6g	105.410	95.074	LF12a
E11C MCC	0.48	87.100	91.159	LF6g	105.410	95.944	LF12a
E11C MC75-1	0.48	86.250	89.039	LF6g	105.410	93.937	LF12a
E11D MCC	0.48	86.770	91.226	LF6g	105.410	95.926	LF12a
E11D DBC1PN	0.48	82.000	91.226	LF6g	110.000	95.926	LF12a
E11D MP37-1B	0.48	86.250	90.882	LF6g	105.410	95.926	LF12a
E11D MRE5327	0.48	86.250	91.226	LF6g	105.410	95.634	LF12a
E11E MCC	0.48	87.100	91.069	LF6g	105.410	95.940	LF12a
E11E MV49060	0.48	85.000	89.067	LF6g	105.410	94.045	LF12a
E12A MCC	0.48	90.000	91.758	LF6g	105.410	96.077	LF12a

Table 7. Scenarios LF6 and LF12: Post-Accident Loading with Degraded Offsite Power Minimum and Maximum Bus Voltages (Sheet 2 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
E12A DBC1N	0.48	82.000	91.690	LF6g	110.000	96.009	LF12a
E12A DBC1P	0.48	82.000	91.697	LF6g	110.000	96.017	LF12a
E12A MC21-1	0.48	86.250	91.758	LF6g	105.410	95.366	LF6a
E12A MC30-1	0.48	86.250	91.535	LF6g	105.410	95.864	LF12a
E12A MC71-1	0.48	86.250	91.558	LF6g	105.410	95.886	LF12a
E12A MC73-1	0.48	86.250	91.053	LF6g	105.410	95.405	LF12a
E12A MS3311	0.48	86.250	91.758	LF6g	105.410	95.366	LF6a
E12A MS61-1	0.48	86.250	91.758	LF6g	105.410	95.366	LF6a
E12A MV5597	0.48	85.000	89.817	LF6g	105.410	94.228	LF12a
E12A YRF1	0.48	90.000	91.618	LF6g	110.000	95.931	LF12a
E12A YRF3	0.48	90.000	91.537	LF6g	110.000	95.846	LF12a
E12B MCC	0.48	87.100	91.553	LF6g	105.410	96.037	LF12a
E12B MC25-1	0.48	86.250	90.465	LF6g	105.410	95.001	LF12a
E12B MC25-2	0.48	86.250	90.740	LF6g	105.410	95.262	LF12a
E12B MC78-1	0.48	86.250	91.077	LF6g	105.410	95.583	LF12a
E12B MP147-1	0.48	86.250	91.251	LF6g	105.410	95.749	LF12a
E12B MP147-3	0.48	86.250	91.466	LF6g	105.410	95.954	LF12a
E12B YE1	0.48	82.100	91.515	LF6g	105.410	96.000	LF12a
E12C MCC	0.48	87.100	91.280	LF6g	105.410	95.658	LF12a
E12C MC99-1	0.48	86.250	90.234	LF6g	105.410	94.661	LF12a
E12C MC99-2	0.48	86.250	90.664	LF6g	105.410	95.071	LF12a
E12C MF15-1	0.48	86.250	91.044	LF6g	105.410	95.433	LF12a
E12D MCC	0.48	86.250	91.255	LF6g	105.410	95.634	LF12a
E12E MCC	0.48	87.100	91.667	LF6g	105.410	95.716	LF12a
E12E MC31-4	0.48	86.250	91.667	LF6g	105.410	95.274	LF6a
E12E MC31-5	0.48	86.250	91.667	LF6g	105.410	95.274	LF6a
E12E MP197-1	0.48	86.250	91.277	LF6g	105.410	95.343	LF12a
E12F MCC	0.48	86.250	91.418	LF6g	105.410	96.018	LF12a
E12F MC25-5	0.48	86.250	91.418	LF6g	105.410	96.018	LF12a
E12F MP195-1	0.48	86.250	90.841	LF6g	105.410	95.469	LF12a
E14 MCC	0.48	86.250	91.759	LF6g	105.410	96.103	LF12a
E14 MC1-1	0.48	86.250			105.410		
E14 MC1-1LS	0.48	86.250	91.254	LF6g	105.410	95.622	LF12a
E15 MCC	0.48	86.250	91.867	LF6g	105.410	96.206	LF12a
E16A MCC	0.48	89.800	91.739	LF6g	105.410	96.074	LF12a
E16A MP274-1	0.48	86.250	91.446	LF6g	105.410	95.767	LF12a
E16A XY1	0.48	85.000	91.692	LF6g	110.000	96.025	LF12a
E16A XY3	0.48	85.000	91.672	LF6g	110.000	96.004	LF12a
E16B MCC	0.48	90.300	91.722	LF6g	105.410	96.057	LF12a
E16B MP273-1	0.48	86.250	91.560	LF6g	105.410	95.887	LF12a
E2 480V SWGR	0.48		89.652	LF6g		94.069	LF6j
E21A MCC	0.48		89.066	LF6g		93.470	LF6j
E21B MCC	0.48		89.036	LF6g		93.438	LF6j
E21C MCC	0.48		88.541	LF6g		92.929	LF6j
E21D MCC	0.48		89.066	LF6g		93.470	LF6j
E22A MCC	0.48		88.763	LF6g		93.163	LF6j

Table 7. Scenarios LF6 and LF12: Post-Accident Loading with Degraded Offsite Power Minimum and Maximum Bus Voltages (Sheet 3 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
E22B MCC	0.48		88.750	LF6g		93.150	LF6j
E23A MCC	0.48		89.220	LF6g		93.635	LF6j
E23B MCC	0.48		88.727	LF6g		93.136	LF6j
E3 480V SWGR	0.48		89.963	LF6g		94.417	LF6j
E31A MCC	0.48		88.269	LF6g		92.732	LF6j
E31B MCC	0.48		88.180	LF6g		92.647	LF6j
E32A MCC	0.48		89.854	LF6g		94.307	LF6j
E32B MCC	0.48		89.357	LF6g		93.814	LF6j
E33A MCC	0.48		89.327	LF6g		93.798	LF6j
E33B MCC	0.48		89.327	LF6g		93.798	LF6j
E4 480V SWGR	0.48		91.111	LF6g		95.582	LF6j
E41A MCC	0.48		90.769	LF6g		95.232	LF6j
E41B MCC	0.48		90.479	LF6g		94.941	LF6j
E42 MCC	0.48		90.833	LF6g		94.497	LF12a
E43 MCC	0.48		91.111	LF6g		95.582	LF6j
E6 480V SWGR	0.48		93.184	LF6g		97.635	LF6j
E61 MCC	0.48		93.184	LF6g		97.635	LF6j
E62 MCC	0.48		93.184	LF6g		97.635	LF6j
E63 MCC	0.48		93.184	LF6g		97.635	LF6j
EF12C MCC	0.48	86.250	91.242	LF6g	105.410	95.622	LF12a
EF12C MF15-3	0.48	86.250	91.242	LF6g	105.410	95.622	LF12a
EF12D MCC	0.48	86.250	91.758	LF6g	105.410	96.077	LF12a
EF41 AE4	0.48		91.111	LF6g		95.582	LF6j
EF41 BF4	0.48		92.015	LF6g		96.496	LF6i
F1 480V SWGR	0.48	86.250	92.725	LF6g	105.410	97.213	LF12a
F1 MP56-2	0.48	86.250	91.509	LF6g	105.410	96.055	LF12a
F11A MCC	0.48	87.100	92.253	LF6g	105.410	96.891	LF12a
F11A MC21-2	0.48	86.250	92.253	LF6g	105.410	96.251	LF6a
F11A MC62-2	0.48	86.250	92.253	LF6g	105.410	96.891	LF12a
F11A MC75-2	0.48	86.250	91.035	LF6g	105.410	95.732	LF12a
F11A MRE5328	0.48	86.250	92.253	LF6g	105.410	96.658	LF12a
F11A MS3321	0.48	86.250	92.253	LF6g	105.410	96.251	LF6a
F11A MV4907	0.48	85.000	90.307	LF6g	105.410	95.042	LF12a
F11B MCC	0.48	87.100	92.192	LF6g	105.410	96.891	LF12a
F11C MCC	0.48	87.100	92.188	LF6g	105.410	96.873	LF12a
F11C MP37-2B	0.48	86.250	91.859	LF6g	105.410	96.873	LF12a
F11C MP37-2D	0.48	86.250	92.188	LF6g	105.410	96.451	LF12a
F11D MCC	0.48	87.100	91.972	LF6g	105.410	96.841	LF12a
F11D DBC2PN	0.48	82.000	91.972	LF6g	110.000	96.841	LF12a
F11D MC31-3	0.48	86.250	91.972	LF6g	105.410	96.514	LF12a
F11D MP89-2A	0.48	86.250	91.972	LF6g	105.410	96.115	LF12a
F11D MP89-2B	0.48	86.250	91.972	LF6g	105.410	96.841	LF12a
F11E MCC	0.48	86.250	92.186	LF6g	105.410	96.595	LF12a
F11E MC31-1	0.48	86.250	92.186	LF6g	105.410	96.180	LF6a
F11E MC31-2	0.48	86.250	92.186	LF6g	105.410	96.180	LF6a
F11F MCC	0.48	86.250	92.151	LF6g	105.410	96.558	LF12a

Table 7. Scenarios LF6 and LF12: Post-Accident Loading with Degraded Offsite Power Minimum and Maximum Bus Voltages (Sheet 4 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
F12A MCC	0.48	90.000	92.590	LF6g	105.410	97.082	LF12a
F12A DBC2N	0.48	82.000	92.493	LF6g	110.000	96.985	LF12a
F12A DBC2P	0.48	82.000	92.493	LF6g	110.000	96.985	LF12a
F12A MC133	0.48	86.250	91.414	LF6g	105.410	95.961	LF12a
F12A MC30-2	0.48	86.250	92.207	LF6g	105.410	96.717	LF12a
F12A MC73-2	0.48	86.250	90.254	LF6g	105.410	94.860	LF12a
F12A MP195-2	0.48	86.250	92.053	LF6g	105.410	96.570	LF12a
F12A MP198-1	0.48	86.250	91.938	LF6g	105.410	96.461	LF12a
F12A MS61-2	0.48	86.250	92.590	LF6g	105.410	96.597	LF6a
F12A MV5598	0.48	85.000	91.177	LF6g	105.410	95.736	LF12a
F12A YRF2	0.48	90.000	92.426	LF6g	110.000	96.910	LF12a
F12A YRF4	0.48	90.000	92.356	LF6g	110.000	96.836	LF12a
F12B MCC	0.48	87.100	92.429	LF6g	105.410	97.064	LF12a
F12B MC25-3	0.48	86.250	91.777	LF6g	105.410	96.444	LF12a
F12B MC25-4	0.48	86.250	91.472	LF6g	105.410	96.154	LF12a
F12B MC78-2	0.48	86.250	92.132	LF6g	105.410	96.781	LF12a
F12B MP147-2	0.48	86.250	92.115	LF6g	105.410	96.766	LF12a
F12B MP147-4	0.48	86.250	92.332	LF6g	105.410	96.972	LF12a
F12B YF1	0.48	81.600	92.391	LF6g	105.410	97.028	LF12a
F12C MCC	0.48	87.100	92.258	LF6g	105.410	96.806	LF12a
F12C MF15-2	0.48	87.100	92.044	LF6g	105.410	96.602	LF12a
F12D MCC	0.48	86.250	92.176	LF6g	105.410	96.728	LF12a
F12D MC99-3	0.48	86.250	91.461	LF6g	105.410	96.047	LF12a
F12D MC99-4	0.48	86.250	91.315	LF6g	105.410	95.909	LF12a
F13 MCC	0.48	86.250	93.465	LF6g	105.410	97.318	LF6a
F14 MCC	0.48	86.250	92.598	LF6g	105.410	97.092	LF12a
F14 MC1-2	0.48	86.250			105.410		
F14 MC1-2LS	0.48	86.250	92.038	LF6g	105.410	96.558	LF12a
F15 MCC	0.48	86.250	92.725	LF6g	105.410	97.213	LF12a
F16A MCC	0.48	89.700	92.699	LF6g	105.410	97.186	LF12a
F16A MC25-6	0.48	86.250	92.699	LF6g	105.410	97.186	LF12a
F16A MP274-3	0.48	86.250	92.462	LF6g	105.410	96.938	LF12a
F16A XY2	0.48	85.000	92.687	LF6g	110.000	97.173	LF12a
F16A XY4	0.48	85.000	92.669	LF6g	110.000	97.154	LF12a
F16B MCC	0.48	90.500	92.683	LF6g	105.410	97.169	LF12a
F16B MP273-4	0.48	86.250	92.164	LF6g	105.410	96.625	LF12a
F2 480V SWGR	0.48		90.417	LF6g		94.960	LF6i
F21A MCC	0.48		90.127	LF6g		94.662	LF6i
F21B MCC	0.48		90.026	LF6g		94.555	LF6i
F21C MCC	0.48		90.125	LF6g		94.659	LF6i
F22 MCC	0.48		89.625	LF6g		94.200	LF6i
F23A MCC	0.48		89.827	LF6g		94.382	LF6i
F23B MCC	0.48		88.949	LF6g		93.521	LF6i
F3 480V SWGR	0.48		89.914	LF6g		94.355	LF6i
F31A MCC	0.48		89.369	LF6g		93.789	LF6i
F31B MCC	0.48		88.294	LF6g		92.672	LF6i

Table 7. Scenarios LF6 and LF12: Post-Accident Loading with Degraded Offsite Power Minimum and Maximum Bus Voltages (Sheet 5 of 5)

ID From	NomkV	Acceptance Criteria for Min %kV	Minimum %kV	Case with Minimum	Acceptance Criteria for Max %kV	Maximum %kV	Case with Maximum
F32A MCC	0.48		89.667	LF6g		94.114	LF6i
F32B MCC	0.48		89.158	LF6g		93.630	LF6i
F33A MCC	0.48		89.376	LF6g		93.801	LF6i
F33B MCC	0.48		89.310	LF6g		93.736	LF6i
F4 480V SWGR	0.48		92.015	LF6g		96.496	LF6i
F41A MCC	0.48		91.646	LF6g		96.120	LF6i
F41B MCC	0.48		91.628	LF6g		96.102	LF6i
F4A LOAD CTR	0.48		92.798	LF6g		97.288	LF6i
F6 480V SWGR	0.48		93.182	LF6g		97.690	LF6i
F61 MCC	0.48		93.182	LF6g		97.690	LF6i
F62 MCC	0.48		93.182	LF6g		97.690	LF6i
F63 MCC	0.48		93.182	LF6g		97.690	LF6i
F7 480V SWGR	0.48		93.590	LF6g		97.448	LF6a
F71 MCC	0.48		93.555	LF6g		97.412	LF6a
M22A MCC	0.48		89.914	LF6g		94.355	LF6i
YE2 MCC	0.24	87.080	92.495	LF6g	105.410	98.184	LF12a
YE2 MV5443C	0.24	85.000	92.314	LF6g	105.410	98.014	LF12a
YF2 MCC	0.24	86.780	93.829	LF6g	105.410	99.232	LF12a
YF2 MV5444C	0.24	85.000	93.666	LF6g	105.410	99.078	LF12a

Table 8. Scenario ST4 Post-Accident Loading at DVR Trip Setpoint Analytical Limit Minimum Bus Voltages (Sheet 1 of 4)

IDFrom	Acceptance Criteria for Min %kV (Continuous	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=3		T=4	
			Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
A 13.8KV SWGR	86.090	76.530	89.286	ST4b	89.149	ST4b	89.260	ST4b	89.285	ST4b
A MP2-1	86.090	76.530	89.242	ST4b	89.105	ST4b	89.216	ST4b	89.241	ST4b
A MP2-3	86.090	76.530	89.249	ST4b	89.112	ST4b	89.223	ST4b	89.248	ST4b
A MP36-1	86.090	76.530	89.241	ST4b	89.104	ST4b	89.215	ST4b	89.240	ST4b
A MP36-4	86.090	76.530	89.265	ST4b	89.127	ST4b	89.238	ST4b	89.263	ST4b
B 13.8KV SWGR	86.090	76.530	89.625	ST4b	89.487	ST4b	89.598	ST4b	89.624	ST4b
B MP2-2	86.090	76.530	89.569	ST4b	89.431	ST4b	89.542	ST4b	89.568	ST4b
B MP2-4	86.090	76.530	89.576	ST4b	89.438	ST4b	89.549	ST4b	89.575	ST4b
B MP36-2	86.090	76.530	89.574	ST4b	89.436	ST4b	89.547	ST4b	89.573	ST4b
B MP36-3	86.090	76.530	89.605	ST4b	89.467	ST4b	89.578	ST4b	89.604	ST4b
BF81 MCC	86.250	76.670	89.493	ST4b	89.112	ST4b	89.419	ST4b	89.492	ST4b
BF81 DBCSBOP	82.000		89.417	ST4b	89.036	ST4b	89.343	ST4b	89.416	ST4b
C1 4160 SWGR		67.310	88.950	ST4a4	88.933	ST4b	88.950	ST4a4	88.950	ST4a4
C1 MP3-1	86.540	67.310	88.765	ST4a4	88.748	ST4b	88.765	ST4a4	88.765	ST4a4
C1 MP37-1A	86.540	76.930	88.950	ST4a4	88.933	ST4b	88.950	ST4a4	88.950	ST4a4
C1 MP42-1	86.540	67.310	88.879	ST4a4	88.861	ST4b	88.879	ST4a4	88.879	ST4a4
C1 MP43-1	86.540	67.310	88.889	ST4a4	88.872	ST4b	88.889	ST4a4	88.889	ST4a4
C1 MP58-1	86.540	67.310	88.797	ST4a4	88.779	ST4b	88.797	ST4a4	88.797	ST4a4
C2 4160 SWGR	86.540	76.930	89.321	ST4b	88.943	ST4b	89.250	ST4b	89.320	ST4b
D1 4160 SWGR		67.310	88.950	ST4a4	88.950	ST4a4	88.950	ST4a4	88.950	ST4a4
D1 MP3-2	86.540	67.310	88.728	ST4a4	88.728	ST4a4	88.728	ST4a4	88.728	ST4a4
D1 MP37-2A	86.540	76.930	88.950	ST4a4	88.950	ST4a4	88.950	ST4a4	88.950	ST4a4
D1 MP42-2	86.540	67.310	88.894	ST4a4	88.894	ST4a4	88.894	ST4a4	88.894	ST4a4
D1 MP43-2	86.540	67.310	88.887	ST4a4	88.887	ST4a4	88.887	ST4a4	88.887	ST4a4
D1 MP58-2	86.540	67.310	88.857	ST4a4	88.857	ST4a4	88.857	ST4a4	88.857	ST4a4
D2 4160 SWGR	86.540	76.930	90.211	ST4b	89.828	ST4b	90.137	ST4b	90.210	ST4b
D3 4160 SWGR	86.540	76.930	90.204	ST4b	89.821	ST4b	90.130	ST4b	90.202	ST4b
E1 480V SWGR	86.250	67.090	87.814	ST4a4	85.252	ST4b	87.503	ST4a5	87.814	ST4a4
E1 MP56-1	86.250	67.090	86.451	ST4a4	83.847	ST4b	86.136	ST4a5	86.451	ST4a4
E11A MCC	87.100	67.090	87.535	ST4a4	83.459	ST4b	87.048	ST4a5	87.535	ST4a4
E11A MC62-1	86.250	67.090	87.535	ST4a4	83.459	ST4b	87.049	ST4a5	87.535	ST4a4
E11A MP89-1A	86.250	67.090	86.866	ST4a4	82.757	ST4b	86.376	ST4a5	86.866	ST4a4
E11A MP89-1B	86.250	67.090	87.535	ST4a4	83.459	ST4b	87.048	ST4a5	87.535	ST4a4
E11A MP89-3A	86.250	67.090	86.333	ST4a4	82.196	ST4b	85.840	ST4a5	86.333	ST4a4
E11A MP89-3B	86.250	67.090	87.535	ST4a4	83.459	ST4b	87.048	ST4a5	87.535	ST4a4
E11B MCC	87.100	67.090	87.490	ST4a4	83.349	ST4b	87.003	ST4a5	87.490	ST4a4
E11B MC56-1	86.250	67.090	86.570	ST4a4	82.383	ST4b	86.078	ST4a5	86.570	ST4a4
E11C MCC	87.100	67.090	87.526	ST4a4	83.138	ST4b	86.988	ST4a5	87.526	ST4a4
E11C MC75-1	86.250	67.090	**85.313**	ST4a4	80.800	ST4b	84.760	ST4a5	85.313	ST4a4
E11D MCC	86.770	67.090	87.506	ST4a4	83.149	ST4b	87.012	ST4b	87.506	ST4a4
E11D DBC1PN	82.000		87.506	ST4a4	83.149	ST4b	87.012	ST4b	87.506	ST4a4
E11D MP37-1B	86.250	67.090	87.506	ST4a4	83.149	ST4b	87.012	ST4b	87.506	ST4a4
E11D MRE5327	86.250	67.090	87.186	ST4a4	82.812	ST4b	86.690	ST4b	87.186	ST4a4
E11E MCC	87.100	67.090	87.522	ST4a4	83.134	ST4b	86.984	ST4a5	87.522	ST4a4
E11E MV49060	85.000	67.090	85.434	ST4a4	80.928	ST4b	84.882	ST4a5	85.434	ST4a4
E12A MCC	87.100	67.090	87.679	ST4a4	85.116	ST4b	87.369	ST4a5	87.679	ST4a4
E12A DBC1N	82.000		87.611	ST4a4	85.048	ST4b	87.301	ST4a5	87.611	ST4a4
E12A DBC1P	82.000		87.619	ST4a4	85.055	ST4b	87.308	ST4a5	87.619	ST4a4
E12A MC21-1	86.250	67.090	**85.982**	ST4a4	83.365	ST4b	85.665	ST4a5	85.982	ST4a4
E12A MC30-1	86.250	67.090	87.446	ST4a4	84.875	ST4b	87.134	ST4a5	87.446	ST4a4
E12A MC71-1	86.250	67.090	87.470	ST4a4	84.900	ST4b	87.158	ST4a5	87.470	ST4a4

Table 8. Scenario ST4 Post-Accident Loading at DVR Trip Setpoint Analytical Limit Minimum Bus Voltages (Sheet 2 of 4)

IDFrom	Acceptance Criteria for Min %kV (Continuous	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=3		T=4	
			Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
E12A MC73-1	86.250	67.090	86.941	ST4a4	84.355	ST4b	86.628	ST4a5	86.941	ST4a4
E12A MS3311	86.250	67.090	86.378	ST4a4	83.774	ST4b	86.063	ST4a5	86.378	ST4a4
E12A MS61-1	86.250	67.090	**85.107**	ST4a4	82.460	ST4b	84.786	ST4a5	85.107	ST4a4
E12A MV5597	85.000	67.090	85.643	ST4a4	83.014	ST4b	85.325	ST4a5	85.643	ST4a4
E12A YRF1	85.000		87.546	ST4a4	84.987	ST4b	87.236	ST4a5	87.546	ST4a4
E12A YRF3	85.000		87.469	ST4a4	84.911	ST4b	87.159	ST4a5	87.469	ST4a4
E12B MCC	87.100	67.090	87.633	ST4a4	84.946	ST4b	87.322	ST4a5	87.633	ST4a4
E12B MC25-1	86.250	67.090	86.495	ST4a4	83.771	ST4b	86.180	ST4a5	86.495	ST4a4
E12B MC25-2	86.250	67.090	86.783	ST4a4	84.068	ST4b	86.469	ST4a5	86.783	ST4a4
E12B MC78-1	86.250	67.090	87.135	ST4a4	84.432	ST4b	86.823	ST4a5	87.135	ST4a4
E12B MP147-1	86.250	67.090	87.317	ST4a4	84.620	ST4b	87.005	ST4a5	87.317	ST4a4
E12B MP147-3	86.250	67.090	87.543	ST4a4	84.853	ST4b	87.231	ST4a5	87.543	ST4a4
E12B YE1	82.100		87.593	ST4a4	84.905	ST4b	87.282	ST4a5	87.593	ST4a4
E12C MCC	87.100	67.090	87.219	ST4a4	84.641	ST4b	86.907	ST4a5	87.219	ST4a4
E12C MC99-1	86.250	67.090	**86.123**	ST4a4	83.511	ST4b	85.806	ST4a5	86.123	ST4a4
E12C MC99-2	86.250	67.090	86.574	ST4a4	83.976	ST4b	86.259	ST4a5	86.574	ST4a4
E12C MF15-1	86.250	67.090	86.972	ST4a4	84.387	ST4b	86.658	ST4a5	86.972	ST4a4
E12D MCC	86.250	67.090	87.193	ST4a4	84.614	ST4b	86.880	ST4a5	87.193	ST4a4
E12E MCC	87.100	67.090	87.282	ST4a4	84.707	ST4b	86.970	ST4a5	87.282	ST4a4
E12E MC31-4	86.250	67.090	**85.511**	ST4a4	82.879	ST4b	85.192	ST4a5	85.511	ST4a4
E12E MC31-5	86.250	67.090	**86.008**	ST4a4	83.392	ST4b	85.691	ST4a5	86.008	ST4a4
E12E MP197-1	86.250	67.090	86.873	ST4a4	84.284	ST4b	86.559	ST4a5	86.873	ST4a4
E12F MCC	86.250	67.090	87.613	ST4a4	84.925	ST4b	87.302	ST4a5	87.613	ST4a4
E12F MC25-5	86.250	67.090	87.613	ST4a4	84.925	ST4b	87.302	ST4a5	87.613	ST4a4
E12F MP195-1	86.250	67.090	87.010	ST4a4	84.303	ST4b	86.697	ST4a5	87.010	ST4a4
E14 MCC	86.250	67.090	87.700	ST4a4	85.136	ST4b	87.390	ST4a5	87.700	ST4a4
E14 MC1-1	86.250	67.090								
E14 MC1-1LS	86.250	67.090	87.173	ST4a4	84.591	ST4b	86.860	ST4a5	87.173	ST4a4
E15 MCC	86.250	67.090	87.814	ST4a4	85.252	ST4b	87.503	ST4a5	87.814	ST4a4
E16A MCC	89.800	67.090	**87.689**	ST4a4	85.112	ST4b	87.379	ST4a5	87.689	ST4a4
E16A MP274-1	86.250	67.090	87.409	ST4a4	84.840	ST4b	87.100	ST4a5	87.409	ST4a4
E16A XY1	85.000		87.645	ST4a4	85.068	ST4b	87.335	ST4a5	87.645	ST4a4
E16A XY3	85.000		87.626	ST4a4	85.050	ST4b	87.316	ST4a5	87.626	ST4a4
E16B MCC	90.300	67.090	**87.674**	ST4a4	84.966	ST4b	87.364	ST4a5	87.674	ST4a4
E16B MP273-1	86.250	67.090	87.519	ST4a4	84.815	ST4b	87.209	ST4a5	87.519	ST4a4
E2 480V SWGR			85.777	ST4b	85.573	ST4b	85.725	ST4b	85.750	ST4b
E21A MCC			85.203	ST4b	84.999	ST4b	85.151	ST4b	85.176	ST4b
E21B MCC			85.174	ST4b	84.970	ST4b	85.122	ST4b	85.147	ST4b
E21C MCC			84.690	ST4b	84.488	ST4b	84.639	ST4b	84.663	ST4b
E21D MCC			85.203	ST4b	84.999	ST4b	85.151	ST4b	85.176	ST4b
E22A MCC			84.902	ST4b	84.623	ST4b	84.831	ST4b	84.856	ST4b
E22B MCC			84.889	ST4b	84.611	ST4b	84.818	ST4b	84.843	ST4b
E23A MCC			85.345	ST4b	85.141	ST4b	85.293	ST4b	85.318	ST4b
E23B MCC			84.857	ST4b	84.654	ST4b	84.805	ST4b	84.830	ST4b
E3 480V SWGR			86.114	ST4b	85.977	ST4b	86.088	ST4b	86.113	ST4b
E31A MCC			84.409	ST4b	84.271	ST4b	84.382	ST4b	84.408	ST4b
E31B MCC			84.315	ST4b	84.177	ST4b	84.289	ST4b	84.314	ST4b
E32A MCC			86.013	ST4b	85.876	ST4b	85.987	ST4b	86.012	ST4b
E32B MCC			85.512	ST4b	85.374	ST4b	85.485	ST4b	85.510	ST4b
E33A MCC			85.462	ST4b	85.324	ST4b	85.436	ST4b	85.461	ST4b
E33B MCC			85.462	ST4b	85.324	ST4b	85.436	ST4b	85.461	ST4b

Table 8. Scenario ST4 Post-Accident Loading at DVR Trip Setpoint Analytical Limit Minimum Bus Voltages (Sheet 3 of 4)

IDFrom	Acceptance Criteria for Min %kV (Continuous	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=3		T=4	
			Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
E4 480V SWGR			87.189	ST4b	87.051	ST4b	87.162	ST4b	87.187	ST4b
E41A MCC			86.854	ST4b	86.716	ST4b	86.828	ST4b	86.853	ST4b
E41B MCC			86.564	ST4b	86.426	ST4b	86.537	ST4b	86.563	ST4b
E42 MCC			86.980	ST4b	86.608	ST4b	86.910	ST4b	86.979	ST4b
E43 MCC			87.189	ST4b	87.051	ST4b	87.162	ST4b	87.187	ST4b
E6 480V SWGR			89.286	ST4b	89.149	ST4b	89.260	ST4b	89.285	ST4b
E61 MCC			89.286	ST4b	89.149	ST4b	89.260	ST4b	89.285	ST4b
E62 MCC			89.286	ST4b	89.149	ST4b	89.260	ST4b	89.285	ST4b
E63 MCC			89.286	ST4b	89.149	ST4b	89.260	ST4b	89.285	ST4b
EF12C MCC	86.250	67.090	87.179	ST4a4	84.600	ST4b	86.867	ST4a5	87.179	ST4a4
EF12C MF15-3	86.250	67.090	87.179	ST4a4	84.600	ST4b	86.867	ST4a5	87.179	ST4a4
EF12D MCC	86.250	67.090	87.679	ST4a4	85.116	ST4b	87.369	ST4a5	87.679	ST4a4
EF41 AE4			87.189	ST4b	87.051	ST4b	87.162	ST4b	87.187	ST4b
EF41 BF4			88.479	ST4b	88.342	ST4b	88.452	ST4b	88.478	ST4b
F1 480V SWGR	86.250	67.090	87.964	ST4a4	86.270	ST4b	87.660	ST4a5	87.964	ST4a4
F1 MP56-2	86.250	67.090	86.681	ST4a4	84.960	ST4b	86.372	ST4a5	86.681	ST4a4
F11A MCC	87.100	67.090	87.621	ST4a4	84.890	ST4b	87.202	ST4a5	87.621	ST4a4
F11A MC21-2	86.250	67.090	86.907	ST4a4	84.152	ST4b	86.485	ST4a5	86.907	ST4a4
F11A MC62-2	86.250	67.090	87.621	ST4a4	84.890	ST4b	87.202	ST4a5	87.621	ST4a4
F11A MC75-2	86.250	67.090	86.336	ST4a4	83.562	ST4b	85.911	ST4a5	86.336	ST4a4
F11A MRE5328	86.250	67.090	87.364	ST4a4	84.624	ST4b	86.944	ST4a5	87.364	ST4a4
F11A MS3321	86.250	67.090	86.832	ST4a4	84.075	ST4b	86.409	ST4a5	86.832	ST4a4
F11A MV4907	85.000	67.090	85.565	ST4a4	82.764	ST4b	85.136	ST4a5	85.565	ST4a4
F11B MCC	87.100	67.090	87.621	ST4a4	84.890	ST4b	87.202	ST4a5	87.621	ST4a4
F11C MCC	87.100	67.090	87.601	ST4a4	84.387	ST4b	87.182	ST4a5	87.601	ST4a4
F11C MP37-2B	86.250	67.090	87.601	ST4a4	84.387	ST4b	87.182	ST4a5	87.601	ST4a4
F11C MP37-2D	86.250	67.090	87.135	ST4a4	83.902	ST4b	86.714	ST4a5	87.135	ST4a4
F11D MCC	87.100	67.090	87.567	ST4a4	83.296	ST4b	86.889	ST4a5	87.567	ST4a4
F11D DBC2PN	82.000		87.567	ST4a4	83.296	ST4b	86.889	ST4a5	87.567	ST4a4
F11D MC31-3	86.250	67.090	87.204	ST4a4	82.915	ST4b	86.524	ST4a5	87.204	ST4a4
F11D MP89-2A	86.250	67.090	86.762	ST4a4	82.449	ST4b	86.078	ST4a5	86.762	ST4a4
F11D MP89-2B	86.250	67.090	87.567	ST4a4	83.296	ST4b	86.889	ST4a5	87.567	ST4a4
F11E MCC	86.250	67.090	87.307	ST4a4	84.569	ST4b	86.887	ST4a5	87.307	ST4a4
F11E MC31-1	86.250	67.090	**85.132**	ST4a4	82.319	ST4b	84.701	ST4a5	85.132	ST4a4
F11E MC31-2	86.250	67.090	**84.150**	ST4a4	81.300	ST4b	83.714	ST4a5	84.150	ST4a4
F11F MCC	86.250	67.090	87.274	ST4a4	84.537	ST4b	86.854	ST4a5	87.274	ST4a4
F12A MCC	87.100	67.090	87.829	ST4a4	86.134	ST4b	87.525	ST4a5	87.829	ST4a4
F12A DBC2N	82.000		87.732	ST4a4	86.036	ST4b	87.427	ST4a5	87.732	ST4a4
F12A DBC2P	82.000		87.732	ST4a4	86.036	ST4b	87.427	ST4a5	87.732	ST4a4
F12A MC133	86.250	67.090	86.587	ST4a4	84.866	ST4b	86.278	ST4a5	86.587	ST4a4
F12A MC30-2	86.250	67.090	87.426	ST4a4	85.722	ST4b	87.119	ST4a5	87.426	ST4a4
F12A MC73-2	86.250	67.090	**85.357**	ST4a4	83.609	ST4b	85.043	ST4a5	85.357	ST4a4
F12A MP195-2	86.250	67.090	87.263	ST4a4	85.556	ST4b	86.956	ST4a5	87.263	ST4a4
F12A MP198-1	86.250	67.090	87.141	ST4a4	85.432	ST4b	86.834	ST4a5	87.141	ST4a4
F12A MS61-2	86.250	67.090	**85.652**	ST4a4	83.910	ST4b	85.339	ST4a5	85.652	ST4a4
F12A MV5598	85.000	67.090	86.336	ST4a4	84.610	ST4b	86.026	ST4a5	86.336	ST4a4
F12A YRF2	85.000		87.674	ST4a4	85.981	ST4b	87.370	ST4a5	87.674	ST4a4
F12A YRF4	85.000		87.607	ST4a4	85.916	ST4b	87.303	ST4a5	87.607	ST4a4
F12B MCC	87.100	67.090	87.803	ST4a4	85.977	ST4b	87.497	ST4a5	87.803	ST4a4
F12B MC25-3	86.250	67.090	87.116	ST4a4	85.275	ST4b	86.808	ST4a5	87.116	ST4a4
F12B MC25-4	86.250	67.090	86.793	ST4a4	84.946	ST4b	86.485	ST4a5	86.793	ST4a4

Table 8. Scenario ST4 Post-Accident Loading at DVR Trip Setpoint Analytical Limit Minimum Bus Voltages (Sheet 4 of 4)

IDFrom	Acceptance Criteria for Min %kV (Continuous	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=3		T=4	
			Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
F12B MC78-2	86.250	67.090	87.489	ST4a4	85.657	ST4b	87.183	ST4a5	87.489	ST4a4
F12B MP147-2	86.250	67.090	87.472	ST4a4	85.640	ST4b	87.166	ST4a5	87.472	ST4a4
F12B MP147-4	86.250	67.090	87.700	ST4a4	85.872	ST4b	87.395	ST4a5	87.700	ST4a4
F12B YF1	81.600		87.763	ST4a4	85.936	ST4b	87.458	ST4a5	87.763	ST4a4
F12C MCC	87.100	67.090	87.523	ST4a4	85.822	ST4b	87.218	ST4a5	87.523	ST4a4
F12C MF15-2	87.100	67.090	87.298	ST4a4	85.591	ST4b	86.991	ST4a5	87.298	ST4a4
F12D MCC	86.250	67.090	87.437	ST4a4	85.733	ST4b	87.131	ST4a5	87.437	ST4a4
F12D MC99-3	86.250	67.090	86.682	ST4a4	84.963	ST4b	86.373	ST4a5	86.682	ST4a4
F12D MC99-4	86.250	67.090	86.528	ST4a4	84.806	ST4b	86.219	ST4a5	86.528	ST4a4
F13 MCC	86.250	67.090	88.737	ST4b	88.351	ST4b	88.662	ST4b	88.735	ST4b
F14 MCC	86.250	67.090	87.830	ST4a4	86.133	ST4b	87.525	ST4a5	87.830	ST4a4
F14 MC1-2	86.250	67.090								
F14 MC1-2LS	86.250	67.090	87.239	ST4a4	85.530	ST4b	86.932	ST4a5	87.239	ST4a4
F15 MCC	86.250	67.090	87.964	ST4a4	86.270	ST4b	87.660	ST4a5	87.964	ST4a4
F16A MCC	89.700	67.090	**87.940**	ST4a4	86.235	ST4b	87.635	ST4a5	87.940	ST4a4
F16A MC25-6	86.250	67.090	87.940	ST4a4	86.235	ST4b	87.635	ST4a5	87.940	ST4a4
F16A MP274-3	86.250	67.090	87.715	ST4a4	86.015	ST4b	87.412	ST4a5	87.715	ST4a4
F16A XY2	85.000		87.928	ST4a4	86.224	ST4b	87.624	ST4a5	87.928	ST4a4
F16A XY4	85.000		87.911	ST4a4	86.208	ST4b	87.607	ST4a5	87.911	ST4a4
F16B MCC	90.500	67.090	**87.925**	ST4a4	86.221	ST4b	87.620	ST4a5	87.925	ST4a4
F16B MP273-4	86.250	67.090	87.433	ST4a4	85.738	ST4b	87.130	ST4a5	87.433	ST4a4
F2 480V SWGR			86.827	ST4b	86.614	ST4b	86.775	ST4b	86.801	ST4b
F21A MCC			86.543	ST4b	86.266	ST4b	86.475	ST4b	86.501	ST4b
F21B MCC			86.445	ST4b	86.169	ST4b	86.378	ST4b	86.404	ST4b
F21C MCC			86.540	ST4b	86.264	ST4b	86.472	ST4b	86.498	ST4b
F22 MCC			86.007	ST4b	85.793	ST4b	85.955	ST4b	85.981	ST4b
F23A MCC			86.226	ST4b	86.013	ST4b	86.174	ST4b	86.201	ST4b
F23B MCC			85.331	ST4b	85.117	ST4b	85.279	ST4b	85.306	ST4b
F3 480V SWGR			86.465	ST4b	86.330	ST4b	86.439	ST4b	86.464	ST4b
F31A MCC			85.937	ST4b	85.802	ST4b	85.911	ST4b	85.936	ST4b
F31B MCC			84.894	ST4b	84.760	ST4b	84.868	ST4b	84.893	ST4b
F32A MCC			86.233	ST4b	86.097	ST4b	86.206	ST4b	86.232	ST4b
F32B MCC			85.703	ST4b	85.567	ST4b	85.677	ST4b	85.702	ST4b
F33A MCC			85.939	ST4b	85.804	ST4b	85.913	ST4b	85.938	ST4b
F33B MCC			85.872	ST4b	85.737	ST4b	85.846	ST4b	85.871	ST4b
F4 480V SWGR			88.479	ST4b	88.342	ST4b	88.452	ST4b	88.478	ST4b
F41A MCC			88.116	ST4b	87.979	ST4b	88.090	ST4b	88.115	ST4b
F41B MCC			88.097	ST4b	87.960	ST4b	88.070	ST4b	88.096	ST4b
F4A LOAD CTR			89.256	ST4b	89.119	ST4b	89.229	ST4b	89.255	ST4b
F6 480V SWGR			89.625	ST4b	89.487	ST4b	89.598	ST4b	89.624	ST4b
F61 MCC			89.625	ST4b	89.487	ST4b	89.598	ST4b	89.624	ST4b
F62 MCC			89.625	ST4b	89.487	ST4b	89.598	ST4b	89.624	ST4b
F63 MCC			89.625	ST4b	89.487	ST4b	89.598	ST4b	89.624	ST4b
F7 480V SWGR			89.080	ST4b	88.696	ST4b	89.006	ST4b	89.079	ST4b
F71 MCC			89.047	ST4b	88.663	ST4b	88.973	ST4b	89.046	ST4b
M22A MCC			86.465	ST4b	86.330	ST4b	86.439	ST4b	86.464	ST4b
YE2 MCC	87.080	65.000	89.528	ST4a4	85.271	ST4b	89.028	ST4a5	89.528	ST4a4
YE2 MV5443C	85.000	67.090	89.342	ST4a4	85.076	ST4b	88.840	ST4a5	89.342	ST4a4
YF2 MCC	86.780	65.000	89.710	ST4a4	86.903	ST4b	89.280	ST4a5	89.710	ST4a4
YF2 MV5444C	85.000	67.090	89.540	ST4a4	86.728	ST4b	89.108	ST4a5	89.540	ST4a4

Table 9. Scenario ST5: Mode 5 and 6 Design Basis Accident Transient Minimum Bus Voltage (Sheet 1 of 3)

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=1		T=2		T=3		T=4	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
A 13.8KV SWGR	13.80	86.090	76.530	94.409	ST5b	92.674	ST5b	93.793	ST5b	94.056	ST5b	94.258	ST5b	94.323	ST5b
A MP2-1	13.80	86.090	76.530	94.367	ST5b	92.632	ST5b	93.751	ST5b	94.014	ST5b	94.216	ST5b	94.281	ST5b
A MP2-3	13.80	86.090	76.530	94.374	ST5b	92.638	ST5b	93.758	ST5b	94.020	ST5b	94.223	ST5b	94.287	ST5b
A MP36-1	13.80	86.090	76.530												
A MP36-4	13.80	86.090	76.530	96.863	ST5a	95.043	ST5a	96.200	ST5a	96.489	ST5a	96.709	ST5a	96.779	ST5a
B 13.8KV SWGR	13.80	86.090	76.530	94.416	ST5b	92.685	ST5e	93.803	ST5b	94.065	ST5b	94.266	ST5b	94.330	ST5b
B MP2-2	13.80	86.090	76.530	94.362	ST5b	92.631	ST5e	93.749	ST5b	94.011	ST5b	94.212	ST5b	94.276	ST5b
B MP2-4	13.80	86.090	76.530	94.369	ST5b	92.638	ST5e	93.756	ST5b	94.018	ST5b	94.219	ST5b	94.283	ST5b
B MP36-2	13.80	86.090	76.530												
B MP36-3	13.80	86.090	76.530	96.870	ST5a	95.051	ST5c	96.212	ST5a	96.499	ST5a	96.718	ST5a	96.787	ST5a
BF81 MCC	0.48	86.250	76.670	93.659	ST5b	88.550	ST5b	91.887	ST5b	92.586	ST5b	93.170	ST5b	93.355	ST5b
BF81 DBCSBOP	0.48	82.000		93.579	ST5b	88.474	ST5b	91.808	ST5b	92.507	ST5b	93.091	ST5b	93.275	ST5b
C1 4160 SWGR	4.16	91.010	67.310	94.378	ST5b	89.218	ST5b	92.585	ST5b	93.292	ST5b	93.883	ST5b	94.069	ST5b
C1 MP3-1	4.16	86.540	67.310	94.204	ST5b	89.034	ST5b	92.408	ST5b	93.116	ST5b	93.708	ST5b	93.895	ST5b
C1 MP37-1A	4.16	86.540	76.930	94.292	ST5b	89.127	ST5b	92.498	ST5b	93.205	ST5b	93.796	ST5b	93.983	ST5b
C1 MP42-1	4.16	86.540	67.310	94.320	ST5b	89.156	ST5b	92.526	ST5b	93.233	ST5b	93.824	ST5b	94.011	ST5b
C1 MP43-1	4.16	86.540	67.310	94.378	ST5b	89.020	ST5b	92.527	ST5b	93.233	ST5b	93.825	ST5b	94.011	ST5b
C1 MP58-1	4.16	86.540	67.310	94.378	ST5b	89.218	ST5b	92.585	ST5b	93.292	ST5b	93.883	ST5b	94.069	ST5b
C2 4160 SWGR	4.16	86.540	76.930	94.383	ST5b	89.234	ST5b	92.595	ST5b	93.300	ST5b	93.890	ST5b	94.076	ST5b
D1 4160 SWGR	4.16	91.010	67.310	94.399	ST5b	89.271	ST5b	92.620	ST5b	93.322	ST5b	93.909	ST5b	94.094	ST5b
D1 MP3-2	4.16	86.540	67.310	94.191	ST5b	89.051	ST5b	92.407	ST5b	93.111	ST5b	93.699	ST5b	93.884	ST5b
D1 MP37-2A	4.16	86.540	76.930	94.399	ST5b	89.271	ST5b	92.620	ST5b	93.322	ST5b	93.909	ST5b	94.094	ST5b
D1 MP42-2	4.16	86.540	67.310	94.399	ST5b	89.105	ST5b	92.574	ST5b	93.276	ST5b	93.863	ST5b	94.048	ST5b
D1 MP43-2	4.16	86.540	67.310	94.340	ST5b	89.209	ST5b	92.560	ST5b	93.262	ST5b	93.849	ST5b	94.034	ST5b
D1 MP58-2	4.16	86.540	67.310	94.399	ST5b	89.271	ST5b	92.620	ST5b	93.322	ST5b	93.909	ST5b	94.094	ST5b
D2 4160 SWGR	4.16	86.540	76.930	94.392	ST5b	89.264	ST5b	92.613	ST5b	93.315	ST5b	93.901	ST5b	94.087	ST5b
D3 4160 SWGR	4.16	86.540	76.930	94.385	ST5b	89.257	ST5b	92.605	ST5b	93.307	ST5b	93.894	ST5b	94.079	ST5b
E1 480V SWGR	0.48	86.250	67.090	91.966	ST5b	81.695	ST5b	85.072	ST5b	88.139	ST5b	90.843	ST5b	91.715	ST5b
E1 MP56-1	0.48	86.250	67.090	91.966	ST5b	81.695	ST5b	85.072	ST5b	88.139	ST5b	90.843	ST5b	91.715	ST5b
E11A MCC	0.48	87.100	67.090	91.735	ST5b	79.884	ST5b	83.207	ST5b	86.231	ST5b	90.187	ST5b	91.482	ST5b
E11A MC62-1	0.48	86.250	67.090	91.735	ST5b	79.884	ST5b	83.207	ST5b	86.231	ST5b	90.187	ST5b	91.482	ST5b
E11A MP89-1A	0.48	86.250	67.090	91.735	ST5b	79.884	ST5b	83.207	ST5b	86.231	ST5b	90.187	ST5b	91.482	ST5b
E11A MP89-1B	0.48	86.250	67.090	91.735	ST5b	79.884	ST5b	83.207	ST5b	86.231	ST5b	90.187	ST5b	91.482	ST5b
E11A MP89-3A	0.48	86.250	67.090	91.735	ST5b	79.884	ST5b	83.207	ST5b	86.231	ST5b	90.187	ST5b	91.482	ST5b
E11A MP89-3B	0.48	86.250	67.090	91.735	ST5b	79.884	ST5b	83.207	ST5b	86.231	ST5b	90.187	ST5b	91.482	ST5b
E11B MCC	0.48	87.100	67.090	91.705	ST5b	79.786	ST5b	83.108	ST5b	86.131	ST5b	90.127	ST5b	91.452	ST5b
E11B MC56-1	0.48	86.250	67.090	91.177	ST5b	79.178	ST5b	82.524	ST5b	85.569	ST5b	89.589	ST5b	90.922	ST5b
E11C MCC	0.48	87.100	67.090	91.727	ST5b	79.523	ST5b	82.832	ST5b	85.844	ST5b	90.105	ST5b	91.473	ST5b
E11C MC75-1	0.48	86.250	67.090	89.622	ST5b	77.070	ST5b	80.484	ST5b	83.584	ST5b	87.959	ST5b	89.362	ST5b
E11D MCC	0.48	86.770	67.090	91.623	ST5b	79.737	ST5b	83.065	ST5b	86.093	ST5b	90.065	ST5b	91.370	ST5b
E11D DBC1PN	0.48	82.000		91.623	ST5b	79.737	ST5b	83.065	ST5b	86.093	ST5b	90.065	ST5b	91.370	ST5b
E11D MP37-1B	0.48	86.250	67.090	91.281	ST5b	79.344	ST5b	82.687	ST5b	85.729	ST5b	89.717	ST5b	91.027	ST5b
E11D MRE5327	0.48	86.250	67.090	91.623	ST5b	79.737	ST5b	83.065	ST5b	86.093	ST5b	90.065	ST5b	91.370	ST5b
E11E MCC	0.48	87.100	67.090	91.727	ST5b	79.191	ST5b	82.486	ST5b	85.501	ST5b	90.016	ST5b	91.469	ST5b
E11E MV49060	0.48	85.000	67.090	91.727	ST5b	70.084	ST5b	73.000	ST5b	83.357	ST5b	87.990	ST5b	89.477	ST5b
E12A MCC	0.48	90.000	67.090	91.870	ST5b	81.544	ST5b	84.919	ST5b	88.021	ST5b	90.733	ST5b	91.611	ST5b
E12A DBC1N	0.48	82.000		91.803	ST5b	81.475	ST5b	84.851	ST5b	87.953	ST5b	90.665	ST5b	91.543	ST5b
E12A DBC1P	0.48	82.000		91.810	ST5b	81.483	ST5b	84.858	ST5b	87.960	ST5b	90.673	ST5b	91.551	ST5b
E12A MC21-1	0.48	86.250	67.090	91.870	ST5b	81.544	ST5b	84.919	ST5b	88.021	ST5b	90.733	ST5b	91.611	ST5b
E12A MC30-1	0.48	86.250	67.090	91.870	ST5b	80.815	ST5b	84.160	ST5b	87.788	ST5b	90.507	ST5b	91.387	ST5b
E12A MC71-1	0.48	86.250	67.090	91.671	ST5b	81.319	ST5b	84.703	ST5b	87.812	ST5b	90.531	ST5b	91.411	ST5b
E12A MC73-1	0.48	86.250	67.090	91.167	ST5b	80.749	ST5b	84.157	ST5b	87.286	ST5b	90.020	ST5b	90.905	ST5b
E12A MS3311	0.48	86.250	67.090	91.870	ST5b	81.544	ST5b	84.919	ST5b	88.021	ST5b	90.733	ST5b	91.611	ST5b
E12A MS61-1	0.48	86.250	67.090	91.870	ST5b	81.544	ST5b	84.919	ST5b	88.021	ST5b	90.733	ST5b	91.611	ST5b
E12A MV5597	0.48	85.000	67.090	91.870	ST5b	72.355	ST5b	75.350	ST5b	85.963	ST5b	88.769	ST5b	89.667	ST5b
E12A YRF1	0.48	90.000		91.731	ST5b	81.420	ST5b	84.790	ST5b	87.887	ST5b	90.595	ST5b	91.472	ST5b
E12A YRF3	0.48	90.000		91.650	ST5b	81.348	ST5b	84.715	ST5b	87.809	ST5b	90.515	ST5b	91.391	ST5b
E12B MCC	0.48	87.100	67.090	91.846	ST5b	80.703	ST5b	84.219	ST5b	87.721	ST5b	90.527	ST5b	91.429	ST5b
E12B MC25-1	0.48	86.250	67.090	91.846	ST5b	76.836	ST5b	80.184	ST5b	86.584	ST5b	89.427	ST5b	90.339	ST5b
E12B MC25-2	0.48	86.250	67.090	91.846	ST5b	77.796	ST5b	81.186	ST5b	86.871	ST5b	89.705	ST5b	90.614	ST5b
E12B MC78-1	0.48	86.250	67.090	91.372	ST5b	80.162	ST5b	83.701	ST5b	87.224	ST5b	90.046	ST5b	90.952	ST5b
E12B MP147-1	0.48	86.250	67.090	91.545	ST5b	80.360	ST5b	83.890	ST5b	87.405	ST5b	90.222	ST5b	91.126	ST5b
E12B MP147-3	0.48	86.250	67.090	91.760	ST5b	80.605	ST5b	84.125	ST5b	87.630	ST5b	90.440	ST5b	91.342	ST5b
E12B YE1	0.48	82.100		91.808	ST5b	80.660	ST5b	84.178	ST5b	87.681	ST5b	90.489	ST5b	91.390	ST5b
E12C MCC	0.48	87.100	67.090	91.432	ST5b	80.963	ST5b	84.355	ST5b	87.470	ST5b	90.251	ST5b	91.171	ST5b
E12C MC99-1	0.48	86.250	67.090	90.388	ST5b	79.778	ST5b	83.220	ST5b	86.377	ST5b	89.192	ST5b	90.124	ST5b
E12C MC99-2	0.48	86.250	67.090	90.817	ST5b	80.267	ST5b	83.687	ST5b	86.827	ST5b	89.628	ST5b	90.555	ST5b
E12C MF15-1	0.48	86.250	67.090	91.196	ST5b	80.696	ST5b	84.099	ST5b	87.224	ST5b	90.012	ST5b	90.935	ST5b
E12D MCC	0.48	86.250	67.090	91.407	ST5b	80.934	ST5b	84.327	ST5b	87.444	ST5b	90.225	ST5b	91.146	ST5b
E12E MCC	0.48	87.100	67.090	91.870	ST5b	81.247	ST5b	84.609	ST5b	87.845	ST5b	90.643	ST5b	91.587	ST5b
E12E MC31-4	0.48	86.250	67.090	91.870	ST5b	81.247	ST5b	84.609	ST5b	87.845	ST5b	90.643	ST5b	91.587	ST5b
E12E MC31-5	0.48	86.250	67.090	91.870	ST5b	81.247	ST5b	84.609	ST5b	87.845	ST5b	90.643	ST5b	91.587	ST5b
E12E MP197-1	0.48	86.250	67.090	91.870	ST5b	78.441	ST5b	81.688	ST5b	87.438	ST5b	90.249	ST5b	91.197	ST5b
E12F MCC	0.48	86.250	67.090	91.827	ST5b	80.291	ST5b	84.072	ST5b	87.580	ST5b	90.391	ST5b	91.294	ST5b
E12F MC25-5	0.48	86.250	67.090	91.827	ST5b	80.291	ST5b	84.072	ST5b	87.580	ST5b	90.391	ST5b	91.294	ST5b

Table 9. Scenario ST5: Mode 5 and 6 Design Basis Accident Transient Minimum Bus Voltage (Sheet 2 of 3)

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=1		T=2		T=3		T=4	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
E12F MP195-1	0.48	86.250	67.090	91.252	ST5b	79.633	ST5b	83.444	ST5b	86.977	ST5b	89.807	ST5b	90.716	ST5b
E14 MCC	0.48	86.250	67.090	91.701	ST5b	81.259	ST5b	84.617	ST5b	88.026	ST5b	90.733	ST5b	91.607	ST5b
E14 MC1-1	0.48	86.250	67.090	90.558	ST5b	81.259	ST5b	84.617	ST5b	88.026	ST5b	90.733	ST5b	91.607	ST5b
E14 MC1-1LS	0.48	86.250	67.090	91.701	ST5b	79.252	ST5b	82.527	ST5b	87.500	ST5b	90.223	ST5b	91.102	ST5b
E15 MCC	0.48	86.250	67.090	91.966	ST5b	81.695	ST5b	85.072	ST5b	88.139	ST5b	90.843	ST5b	91.715	ST5b
E16A MCC	0.48	89.800	67.090	91.838	ST5b	81.577	ST5b	84.950	ST5b	88.014	ST5b	90.715	ST5b	91.587	ST5b
E16A MP274-1	0.48	86.250	67.090	91.544	ST5b	81.316	ST5b	84.678	ST5b	87.733	ST5b	90.425	ST5b	91.295	ST5b
E16A XY1	0.48	85.000		91.791	ST5b	81.535	ST5b	84.906	ST5b	87.969	ST5b	90.669	ST5b	91.540	ST5b
E16A XY3	0.48	85.000		91.771	ST5b	81.518	ST5b	84.888	ST5b	87.950	ST5b	90.650	ST5b	91.521	ST5b
E16B MCC	0.48	90.300	67.090	91.822	ST5b	81.562	ST5b	84.935	ST5b	87.998	ST5b	90.699	ST5b	91.571	ST5b
E16B MP273-1	0.48	86.250	67.090	91.659	ST5b	81.418	ST5b	84.784	ST5b	87.843	ST5b	90.539	ST5b	91.409	ST5b
E2 480V SWGR	0.48			90.244	ST5b	88.924	ST5b	90.032	ST5b	90.293	ST5b	90.493	ST5b	90.557	ST5b
E21A MCC	0.48			89.657	ST5b	88.340	ST5b	89.446	ST5b	89.705	ST5b	89.905	ST5b	89.969	ST5b
E21B MCC	0.48			89.626	ST5b	88.310	ST5b	89.415	ST5b	89.674	ST5b	89.875	ST5b	89.938	ST5b
E21C MCC	0.48			89.129	ST5b	87.817	ST5b	88.919	ST5b	89.177	ST5b	89.377	ST5b	89.440	ST5b
E21D MCC	0.48			89.657	ST5b	88.340	ST5b	89.446	ST5b	89.705	ST5b	89.905	ST5b	89.969	ST5b
E22A MCC	0.48			89.100	ST5b	87.788	ST5b	88.890	ST5b	89.148	ST5b	89.347	ST5b	89.411	ST5b
E22B MCC	0.48			89.087	ST5b	87.775	ST5b	88.877	ST5b	89.135	ST5b	89.334	ST5b	89.398	ST5b
E23A MCC	0.48			89.721	ST5b	88.492	ST5b	89.600	ST5b	89.860	ST5b	90.061	ST5b	90.125	ST5b
E23B MCC	0.48			89.227	ST5b	88.000	ST5b	89.107	ST5b	89.366	ST5b	89.567	ST5b	89.630	ST5b
E3 480V SWGR	0.48			90.562	ST5b	88.325	ST5b	89.431	ST5b	90.153	ST5b	90.355	ST5b	90.419	ST5b
E31A MCC	0.48			88.706	ST5b	86.467	ST5b	87.574	ST5b	88.297	ST5b	88.499	ST5b	88.563	ST5b
E31B MCC	0.48			88.617	ST5b	86.376	ST5b	87.484	ST5b	88.208	ST5b	88.410	ST5b	88.474	ST5b
E32A MCC	0.48			90.401	ST5b	88.111	ST5b	89.216	ST5b	89.986	ST5b	90.187	ST5b	90.251	ST5b
E32B MCC	0.48			89.818	ST5b	87.529	ST5b	88.633	ST5b	89.404	ST5b	89.605	ST5b	89.669	ST5b
E33A MCC	0.48			89.928	ST5b	87.682	ST5b	88.793	ST5b	89.518	ST5b	89.721	ST5b	89.785	ST5b
E33B MCC	0.48			89.928	ST5b	87.682	ST5b	88.793	ST5b	89.518	ST5b	89.721	ST5b	89.785	ST5b
E4 480V SWGR	0.48			91.523	ST5b	89.786	ST5b	90.906	ST5b	91.169	ST5b	91.372	ST5b	91.437	ST5b
E41A MCC	0.48			91.176	ST5b	89.441	ST5b	90.560	ST5b	90.823	ST5b	91.025	ST5b	91.089	ST5b
E41B MCC	0.48			90.886	ST5b	89.151	ST5b	90.270	ST5b	90.532	ST5b	90.735	ST5b	90.799	ST5b
E42 MCC	0.48			90.986	ST5b	85.974	ST5b	89.246	ST5b	89.932	ST5b	90.506	ST5b	90.687	ST5b
E43 MCC	0.48			91.523	ST5b	89.786	ST5b	90.906	ST5b	91.169	ST5b	91.372	ST5b	91.437	ST5b
E6 480V SWGR	0.48			93.613	ST5b	91.984	ST5b	93.094	ST5b	93.355	ST5b	93.556	ST5b	93.620	ST5b
E61 MCC	0.48			93.308	ST5b	91.802	ST5b	92.910	ST5b	93.170	ST5b	93.371	ST5b	93.435	ST5b
E62 MCC	0.48			93.613	ST5b	91.984	ST5b	93.094	ST5b	93.355	ST5b	93.556	ST5b	93.620	ST5b
E63 MCC	0.48			93.613	ST5b	91.984	ST5b	93.094	ST5b	93.355	ST5b	93.556	ST5b	93.620	ST5b
EF12C MCC	0.48	86.250	67.090	91.394	ST5b	80.920	ST5b	84.313	ST5b	87.431	ST5b	90.212	ST5b	91.133	ST5b
EF12C MF15-3	0.48	86.250	67.090	91.394	ST5b	80.920	ST5b	84.313	ST5b	87.431	ST5b	90.212	ST5b	91.133	ST5b
EF12D MCC	0.48	86.250	67.090	91.870	ST5b	81.544	ST5b	84.919	ST5b	88.021	ST5b	90.733	ST5b	91.611	ST5b
EF41 AE4	0.48			91.523	ST5b	89.786	ST5b	90.906	ST5b	91.169	ST5b	91.372	ST5b	91.437	ST5b
EF41 BF4	0.48			92.617	ST5b	90.888	ST5e	92.005	ST5b	92.266	ST5b	92.468	ST5b	92.531	ST5b
F1 480V SWGR	0.48	86.250	67.090	92.171	ST5b	81.900	ST5b	85.321	ST5b	88.357	ST5b	91.071	ST5b	91.930	ST5b
F1 MP56-2	0.48	86.250	67.090	92.171	ST5b	81.900	ST5b	85.321	ST5b	88.357	ST5b	91.071	ST5b	91.930	ST5b
F11A MCC	0.48	87.100	67.090	91.968	ST5b	80.686	ST5b	84.070	ST5b	87.077	ST5b	90.600	ST5b	91.725	ST5b
F11A MC21-2	0.48	86.250	67.090	91.968	ST5b	80.686	ST5b	84.070	ST5b	87.077	ST5b	90.600	ST5b	91.725	ST5b
F11A MC62-2	0.48	86.250	67.090	91.968	ST5b	80.686	ST5b	84.070	ST5b	87.077	ST5b	90.600	ST5b	91.725	ST5b
F11A MC75-2	0.48	86.250	67.090	90.745	ST5b	79.286	ST5b	82.728	ST5b	85.783	ST5b	89.359	ST5b	90.499	ST5b
F11A MRE5328	0.48	86.250	67.090	91.968	ST5b	80.686	ST5b	84.070	ST5b	87.076	ST5b	90.600	ST5b	91.725	ST5b
F11A MS3321	0.48	86.250	67.090	91.968	ST5b	80.686	ST5b	84.070	ST5b	87.076	ST5b	90.600	ST5b	91.725	ST5b
F11A MV4907	0.48	85.000	67.090	91.968	ST5b	71.524	ST5b	74.523	ST5b	85.010	ST5b	88.616	ST5b	89.766	ST5b
F11B MCC	0.48	87.100	67.090	91.968	ST5b	80.529	ST5b	83.906	ST5b	86.907	ST5b	90.539	ST5b	91.725	ST5b
F11C MCC	0.48	87.100	67.090	91.968	ST5b	80.581	ST5b	83.960	ST5b	86.963	ST5b	90.543	ST5b	91.725	ST5b
F11C MP37-2B	0.48	86.250	67.090	91.968	ST5b	80.581	ST5b	83.960	ST5b	86.963	ST5b	90.543	ST5b	91.725	ST5b
F11C MP37-2D	0.48	86.250	67.090	91.968	ST5b	80.581	ST5b	83.960	ST5b	86.963	ST5b	90.543	ST5b	91.725	ST5b
F11D MCC	0.48	87.100	67.090	91.849	ST5b	79.065	ST5b	82.392	ST5b	85.348	ST5b	90.202	ST5b	91.606	ST5b
F11D DBC2PN	0.48	82.000		91.849	ST5b	79.065	ST5b	82.392	ST5b	85.348	ST5b	90.202	ST5b	91.606	ST5b
F11D MC31-3	0.48	86.250	67.090	91.849	ST5b	79.065	ST5b	82.392	ST5b	85.348	ST5b	90.202	ST5b	91.606	ST5b
F11D MP89-2A	0.48	86.250	67.090	91.849	ST5b	79.065	ST5b	82.392	ST5b	85.348	ST5b	90.202	ST5b	91.606	ST5b
F11D MP89-2B	0.48	86.250	67.090	91.849	ST5b	79.065	ST5b	82.392	ST5b	85.348	ST5b	90.202	ST5b	91.606	ST5b
F11E MCC	0.48	86.250	67.090	91.900	ST5b	80.627	ST5b	84.008	ST5b	87.013	ST5b	90.534	ST5b	91.658	ST5b
F11E MC31-1	0.48	86.250	67.090	91.900	ST5b	80.627	ST5b	84.008	ST5b	87.013	ST5b	90.534	ST5b	91.658	ST5b
F11E MC31-2	0.48	86.250	67.090	91.900	ST5b	80.627	ST5b	84.008	ST5b	87.013	ST5b	90.534	ST5b	91.658	ST5b
F11F MCC	0.48	86.250	67.090	91.865	ST5b	80.597	ST5b	83.976	ST5b	86.980	ST5b	90.499	ST5b	91.623	ST5b
F12A MCC	0.48	90.000	67.090	92.055	ST5b	81.701	ST5b	85.120	ST5b	88.202	ST5b	90.935	ST5b	91.802	ST5b
F12A DBC2N	0.48	82.000		91.958	ST5b	81.602	ST5b	85.022	ST5b	88.104	ST5b	90.838	ST5b	91.705	ST5b
F12A DBC2P	0.48	82.000		91.958	ST5b	81.602	ST5b	85.022	ST5b	88.104	ST5b	90.838	ST5b	91.705	ST5b
F12A MC133	0.48	86.250	67.090	90.871	ST5b	80.362	ST5b	83.837	ST5b	86.965	ST5b	89.737	ST5b	90.615	ST5b
F12A MC30-2	0.48	86.250	67.090	92.055	ST5b	80.487	ST5b	83.855	ST5b	87.800	ST5b	90.546	ST5b	91.416	ST5b
F12A MC73-2	0.48	86.250	67.090	89.704	ST5b	79.028	ST5b	82.563	ST5b	85.741	ST5b	88.553	ST5b	89.444	ST5b
F12A MP195-2	0.48	86.250	67.090	91.515	ST5b	81.091	ST5b	84.535	ST5b	87.638	ST5b	90.389	ST5b	91.261	ST5b
F12A MP198-1	0.48	86.250	67.090	92.055	ST5b	77.034	ST5b	80.258	ST5b	87.517	ST5b	90.272	ST5b	91.145	ST5b
F12A MS61-2	0.48	86.250	67.090	92.055	ST5b	81.701	ST5b	85.120	ST5b	88.202	ST5b	90.935	ST5b	91.802	ST5b
F12A MV5598	0.48	85.000	67.090	92.055	ST5b	74.704	ST5b	77.830	ST5b	86.708	ST5b	89.495	ST5b	90.376	ST5b
F12A YRF2	0.48	90.000		91.892	ST5b	81.556	ST5b	84.969	ST5b	88.046	ST5b	90.774	ST5b	91.639	ST5b
F12A YRF4	0.48	90.000		91.822	ST5b	81.494	ST5b	84.905	ST5b	87.979	ST5b	90.705	ST5b	91.570	ST5b

Table 9. Scenario ST5: Mode 5 and 6 Design Basis Accident Transient Minimum Bus Voltage (Sheet 3 of 3)

IDFrom	Nom kV	Acceptance Criteria for Min %kV (Continuous)	Acceptance Criteria for Min %kV (Starting)	T=-1		T=0		T=1		T=2		T=3		T=4	
				Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV	Min %kV	Case with min %kV
F12B MCC	0.48	87.100	67.090	92.074	ST5b	80.898	ST5b	84.504	ST5b	87.954	ST5b	90.772	ST5b	91.663	ST5b
F12B MC25-3	0.48	86.250	67.090	92.074	ST5b	78.532	ST5b	82.032	ST5b	87.268	ST5b	90.109	ST5b	91.006	ST5b
F12B MC25-4	0.48	86.250	67.090	92.074	ST5b	77.925	ST5b	81.398	ST5b	86.947	ST5b	89.797	ST5b	90.697	ST5b
F12B MC78-2	0.48	86.250	67.090	91.776	ST5b	80.558	ST5b	84.178	ST5b	87.641	ST5b	90.470	ST5b	91.363	ST5b
F12B MP147-2	0.48	86.250	67.090	91.759	ST5b	80.539	ST5b	84.160	ST5b	87.625	ST5b	90.453	ST5b	91.347	ST5b
F12B MP147-4	0.48	86.250	67.090	91.976	ST5b	80.787	ST5b	84.397	ST5b	87.852	ST5b	90.674	ST5b	91.565	ST5b
F12B YF1	0.48	81.600		92.036	ST5b	80.855	ST5b	84.462	ST5b	87.914	ST5b	90.734	ST5b	91.625	ST5b
F12C MCC	0.48	87.100	67.090	91.763	ST5b	81.279	ST5b	84.707	ST5b	87.797	ST5b	90.599	ST5b	91.510	ST5b
F12C MF15-2	0.48	87.100	67.090	91.548	ST5b	81.035	ST5b	84.474	ST5b	87.573	ST5b	90.381	ST5b	91.294	ST5b
F12D MCC	0.48	86.250	67.090	91.681	ST5b	81.185	ST5b	84.618	ST5b	87.711	ST5b	90.515	ST5b	91.427	ST5b
F12D MC99-3	0.48	86.250	67.090	90.962	ST5b	80.371	ST5b	83.837	ST5b	86.959	ST5b	89.786	ST5b	90.706	ST5b
F12D MC99-4	0.48	86.250	67.090	90.815	ST5b	80.204	ST5b	83.678	ST5b	86.805	ST5b	89.638	ST5b	90.559	ST5b
F13 MCC	0.48	86.250	67.090	93.563	ST5b	88.436	ST5b	91.785	ST5b	92.486	ST5b	93.073	ST5b	93.258	ST5b
F14 MCC	0.48	86.250	67.090	91.858	ST5b	81.384	ST5b	84.783	ST5b	88.224	ST5b	90.941	ST5b	91.802	ST5b
F14 MC1-2	0.48	86.250	67.090	90.642	ST5b	81.384	ST5b	84.783	ST5b	88.224	ST5b	90.941	ST5b	91.802	ST5b
F14 MC1-2LS	0.48	86.250	67.090	91.858	ST5b	79.134	ST5b	82.440	ST5b	87.635	ST5b	90.371	ST5b	91.236	ST5b
F15 MCC	0.48	86.250	67.090	92.171	ST5b	81.900	ST5b	85.321	ST5b	88.357	ST5b	91.071	ST5b	91.930	ST5b
F16A MCC	0.48	89.700	67.090	92.145	ST5b	81.877	ST5b	85.297	ST5b	88.333	ST5b	91.045	ST5b	91.904	ST5b
F16A MC25-6	0.48	86.250	67.090	92.145	ST5b	81.877	ST5b	85.297	ST5b	88.333	ST5b	91.045	ST5b	91.904	ST5b
F16A MP274-3	0.48	86.250	67.090	91.910	ST5b	81.668	ST5b	85.079	ST5b	88.107	ST5b	90.813	ST5b	91.669	ST5b
F16A XY2	0.48	85.000		92.133	ST5b	81.866	ST5b	85.286	ST5b	88.321	ST5b	91.033	ST5b	91.892	ST5b
F16A XY4	0.48	85.000		92.116	ST5b	81.851	ST5b	85.270	ST5b	88.304	ST5b	91.016	ST5b	91.874	ST5b
F16B MCC	0.48	90.500	67.090	92.130	ST5b	81.863	ST5b	85.283	ST5b	88.318	ST5b	91.030	ST5b	91.888	ST5b
F16B MP273-4	0.48	86.250	67.090	91.614	ST5b	81.405	ST5b	84.805	ST5b	87.823	ST5b	90.520	ST5b	91.374	ST5b
F2 480V SWGR	0.48			91.065	ST5b	89.704	ST5e	90.829	ST5b	91.092	ST5b	91.294	ST5b	91.358	ST5b
F21A MCC	0.48			90.590	ST5b	89.234	ST5e	90.355	ST5b	90.617	ST5b	90.819	ST5b	90.883	ST5b
F21B MCC	0.48			90.489	ST5b	89.134	ST5e	90.254	ST5b	90.515	ST5b	90.717	ST5b	90.781	ST5b
F21C MCC	0.48			90.588	ST5b	89.232	ST5e	90.353	ST5b	90.614	ST5b	90.816	ST5b	90.880	ST5b
F22 MCC	0.48			89.715	ST5b	88.906	ST5e	90.039	ST5b	90.304	ST5b	90.508	ST5b	90.573	ST5b
F23A MCC	0.48			90.476	ST5b	89.111	ST5e	90.240	ST5b	90.503	ST5b	90.706	ST5b	90.771	ST5b
F23B MCC	0.48			89.601	ST5b	88.230	ST5e	89.363	ST5b	89.628	ST5b	89.832	ST5b	89.896	ST5b
F3 480V SWGR	0.48			90.907	ST5b	88.704	ST5e	89.796	ST5b	90.507	ST5b	90.705	ST5b	90.768	ST5b
F31A MCC	0.48			90.266	ST5b	88.075	ST5e	89.161	ST5b	89.868	ST5b	90.065	ST5b	90.127	ST5b
F31B MCC	0.48			89.183	ST5b	87.013	ST5e	88.089	ST5b	88.789	ST5b	88.983	ST5b	89.045	ST5b
F32A MCC	0.48			90.680	ST5b	88.325	ST5e	89.416	ST5b	90.261	ST5b	90.459	ST5b	90.522	ST5b
F32B MCC	0.48			90.177	ST5b	87.808	ST5e	88.906	ST5b	89.756	ST5b	89.955	ST5b	90.018	ST5b
F33A MCC	0.48			90.321	ST5b	88.127	ST5e	89.215	ST5b	89.922	ST5b	90.119	ST5b	90.182	ST5b
F33B MCC	0.48			90.255	ST5b	88.060	ST5e	89.149	ST5b	89.857	ST5b	90.054	ST5b	90.116	ST5b
F4 480V SWGR	0.48			92.617	ST5b	90.888	ST5e	92.005	ST5b	92.266	ST5b	92.468	ST5b	92.531	ST5b
F41A MCC	0.48			92.038	ST5b	90.310	ST5e	91.427	ST5b	91.688	ST5b	91.889	ST5b	91.953	ST5b
F41B MCC	0.48			92.020	ST5b	90.291	ST5e	91.408	ST5b	91.669	ST5b	91.870	ST5b	91.934	ST5b
F4A LOAD CTR	0.48			94.023	ST5b	92.300	ST5e	93.413	ST5b	93.673	ST5b	93.874	ST5b	93.937	ST5b
F6 480V SWGR	0.48			93.576	ST5b	91.921	ST5e	93.030	ST5b	93.289	ST5b	93.489	ST5b	93.552	ST5b
F61 MCC	0.48			93.372	ST5b	91.721	ST5e	92.827	ST5b	93.086	ST5b	93.285	ST5b	93.348	ST5b
F62 MCC	0.48			93.503	ST5b	91.921	ST5e	93.030	ST5b	93.289	ST5b	93.489	ST5b	93.552	ST5b
F63 MCC	0.48			93.576	ST5b	91.921	ST5e	93.030	ST5b	93.289	ST5b	93.489	ST5b	93.552	ST5b
F7 480V SWGR	0.48			93.768	ST5b	88.639	ST5b	91.988	ST5b	92.690	ST5b	93.277	ST5b	93.462	ST5b
F71 MCC	0.48			93.733	ST5b	88.606	ST5b	91.954	ST5b	92.656	ST5b	93.243	ST5b	93.428	ST5b
M22A MCC	0.48			90.907	ST5b	88.704	ST5e	89.796	ST5b	90.507	ST5b	90.705	ST5b	90.768	ST5b
YE2 MCC	0.24	87.080	65.000	93.880	ST5b	80.037	ST5b	83.386	ST5b	86.518	ST5b	91.434	ST5b	93.601	ST5b
YE2 MV5443C	0.24	85.000	67.090	93.880	ST5b	79.085	ST5b	82.394	ST5b	86.325	ST5b	91.251	ST5b	93.422	ST5b
YF2 MCC	0.24	86.780	65.000	94.190	ST5b	81.352	ST5b	84.775	ST5b	87.885	ST5b	92.142	ST5b	93.926	ST5b
YF2 MV5444C	0.24	85.000	67.090	94.190	ST5b	80.466	ST5b	83.853	ST5b	87.711	ST5b	91.976	ST5b	93.763	ST5b

Table 10. Maximum Transformer Voltages

Transformer	Secondary Winding Bus	NomkV	LF5a %kV	LF5b %kV	LF5c %kV	LF5c1 %kV
MAIN TRANSFORMER 1	MAIN GEN BUS	25.00	0.000	0.000	98.068	98.070
AUX TRANSFORMER 11	AUX 11 X	13.80	0.000	0.000	105.367	102.580
	AUX 11 Y	13.80	0.000	0.000	105.420	102.635
START-UP 01	STARTUP 01	13.80	105.347	102.701	103.300	103.300
START-UP 02	STARTUP 02	13.80	105.406	102.762	103.300	103.300
AC	XAC LV	4.16	107.290	104.576	107.309	104.448
BD	XBD LV	4.16	107.526	104.816	107.550	104.692
CE1-1/CE1-2	E1 480V SWGR	0.48	109.165	103.735	106.454	103.607
DF1-1/DF1-2	F1 480V SWGR	0.48	109.223	103.805	106.517	103.681
AE2/BE2	E2 480V SWGR	0.48	101.239	98.628	101.254	98.505
AE3/BE3	E3 480V SWGR	0.48	103.944	101.329	103.959	101.205
AE4	AE4 LV	0.48	102.591	99.950	102.607	99.825
AE6	E6 480V SWGR	0.48	105.342	102.696	105.358	102.571
BF2/AF2	BF2 LV	0.48	101.538	98.908	101.557	98.787
BF3/AF3	F3 480V SWGR	0.48	102.274	99.697	102.294	99.579
BF4	BF4 LV	0.48	103.593	100.957	103.613	100.836
BF6	F6 480V SWGR	0.48	105.397	102.753	105.417	102.632
XBF4A	F4A LOAD CTR	0.48	105.386	102.741	105.406	102.620
CE5	XCE5 LV	0.48	105.536	102.865	105.555	102.739
DF5	XDF5 LV	0.48	105.770	103.104	105.794	102.982
DF6	XDF6 LV	0.48	107.363	104.657	107.387	104.533
DF7	F7 480V SWGR	0.48	107.135	104.433	107.159	104.310
DF8	XDF8 LV	0.48	106.892	104.194	106.916	104.071
X3050	X3050 LV	0.48	105.238	102.574	105.256	102.449
X3051	X3051 LV	0.48	106.475	103.781	106.494	103.654
XBY1	XBY1-LV	0.48	105.912	103.224	105.931	103.097
XYE2A	XYE2A-LV	0.24	111.690	106.134	108.916	106.004
XYF2A	XYF2A-LV	0.24	111.701	106.160	108.934	106.034
XYE2	YE2 MCC	0.24	111.690	106.134	108.916	106.004
XYF2	YF2 MCC	0.24	111.701	106.160	108.934	106.034

Attachment F

Reliance Electric Action Guide, Table A

(1 page follows)

The abbreviations and acronyms listed below are used in Reliance Electric Action Guide, Table A.

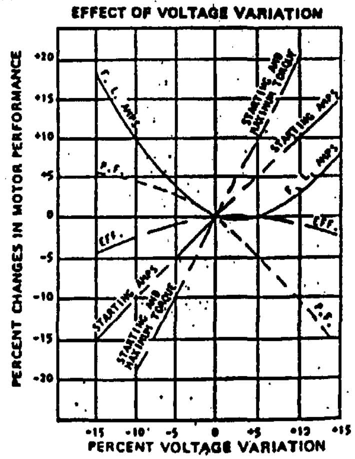
AMPS	amperes
P. L. AMPS	peak load amperes
HP	horsepower
EFF.	efficiency
P. F.	power factor
%	percent
°C	degrees centigrade

TABLE A – GENERAL EFFECT OF VOLTAGE AND FREQUENCY VARIATION ON INDUCTION-MOTOR CHARACTERISTICS

VARIATION	STARTING & MAX RUNNING TORQUE	SYNCHRONOUS SPEED	% SLIP	FULL-LOAD SPEED	EFFICIENCY			POWER FACTOR			FULL-LOAD CURRENT	STARTING CURRENT	TEMP RISE, FULL-LOAD	MAX OVERLOAD CAPACITY	MAGNETIC NOISE – NO LOAD IN PARTICULAR
					Full Load	3/4 Load	1/2 Load	Full Load	3/4 Load	1/2 Load					
Voltage variation: 120%	Increase 44%	No Change	Decrease 30%	Increase 1.5%	6-0% Decrease (1-75 HP) 0-.3% Increase (100-200 HP)	Decrease 1/2-2 points	Decrease 7-20 points	Decrease 5-15 points	Decrease 10-30 points	Decrease 15-40 points	Increase 12%	Increase 20%	Increase 5-6°C.	Increase 44%	Noticeable Increase
110% voltage	Increase 21%	No Change	Decrease 17%	Increase 1%	Slight Decrease	Practically no change	Decrease 1-2 points	Decrease 5-10 points	Decrease 5 points	Decrease 5-6 points	Increase 2-4%	Increase 10-12%	Increase 3-4°C.	Increase 21%	Increase Slightly
Functions of voltage	$(Voltage)^2$	Constant	$\frac{1}{(Voltage)^2}$	(Synchronous speed slip)								Voltage		$(Voltage)^2$	
90% voltage	Decrease 19%	No Change	Increase 23%	Decrease 1-1/2%	Decrease 2 points	Practically no change	Increase 1-2 points	Increase 5 points	Increase 2-3 points	Increase 4-5 points	Increase 10-11%	Decrease 10-12%	Increase 6-7°C.	Decrease 19%	Decrease Slightly
Freq. variation: 105% freq.	Decrease 10%	Increase 5%	Practically no change	Increase 5%	Slight Increase	Slight Increase	Slight Increase	Slight Increase	Slight Increase	Slight Increase	Decrease Slightly	Decrease 5-6%	Decrease Slightly	Decrease Slightly	Decrease Slightly
Function of frequency	$\frac{1}{(Frequency)^2}$	Frequency		(Synchronous speed slip)								$\frac{1}{frequency}$			
95% frequency	Increase 11%	Decrease 5%	Practically no change	Decrease 5%	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Slight Decrease	Increase Slightly	Increase 5-6%	Increase Slightly	Increase Slightly	Increase Slightly
1% Unbalance	Slight Decrease	Slight Decrease		Slight Decrease	2% Decrease			5-6% Decrease			1-1/2% Increase	Slight Decrease	2% Increase		
2% Unbalance	Slight Decrease	Slight Decrease		Slight Decrease	8% Decrease			7% Decrease			3% Increase	Slight Decrease	8% Increase		

NOTE: This table shows general effects, which will vary somewhat for specific ratings.

EFFECT OF VOLTAGE VARIATION



RELIANCE ELECTRIC ACtion Guide

Attachment G

ISTB3, Pump and Valve Basis Document, Volume III,
Stroke Time Basis

(33 pages follow)

The abbreviations and acronyms listed below are used in the ISTB3, Pump and Valve Basis Document, Volume III, Stroke Time Basis provided in Attachment G.

ASME	American Society of Mechanical Engineers	SOV	solenoid operated valve
AOV	air operated valve	SRO	senior reactor operator
(C)	close	IST	inservice test
CIV	containment isolation valve	SFAS	safety features actuation system
ECP	engineering change package	SFRCS	steam and feedwater rupture control system
ECR	engineering change request	SR	surveillance requirement
EDG	emergency diesel generator	TRM	Technical Requirements Manual
MOD	modification	USAR	Updated Safety Analysis Report
MOV	motor operated valve	WO	work order
MWO	maintenance work order	%	percent
(O)	open	≤	less than or equal to
OM	operations and maintenance	>	greater than
PCN	procedure change notice	=	equals
PORV	power operated relief valve	-	minus

ISTB3

Pump and Valve Basis Document

Volume III

Stroke Time Basis

Revision 48

Prepared by: **Luke M. Twarek** — Date: 14 MAY 2014

Reviewed by: Doug Hart — Date: 5/14/2014

Approved by: Stephen Sloanefick for T.A Hurline — Date: 5/14/14
Supervisor – Nuclear Engineering Programs

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Revision 23 incorporated by PCN T-0352.
Revision 24 incorporated by PCN T-0356.
Revision 25 incorporated by PCN T-0357.
Revision 26 incorporated by PCN T-0358.
Revision 27 incorporated by PCN T-0360.
Revision 28 incorporated by PCN T-0363.
Revision 29 incorporated by PCN T-0366.
Revision 30 incorporated by PCN T-0376.
Revision 31 incorporated by PCN T-0377.
Revision 32 incorporated by PCN T-0378.
Revision 33 incorporated by PCN T-0379.
Revision 34 incorporated by PCN T-0381.
Revision 35 incorporated by PCN T-0383.
Revision 36 incorporated by PCN T-0392.
Revision 37 incorporated by PCN T-0395.
Revision 38 incorporated by PCN T-0396.
Revision 39 incorporated by PCN T-0397.
Revision 40 incorporated by PCN T-0404.
Revision 41 incorporated by PCN T-0405.
Revision 42 incorporated by PCNs T-0408 & T-0409.
Revision 43 incorporated by PCN T-0410.
Revision 44 incorporated by PCN T-0411.
Revision 45 incorporated by PCN T-0416.
Revision 46 incorporated by PCN T-0423.
Revision 47 incorporated by PCN T-0429.
Revision 48 incorporated by PCN T-0433.

GENERAL INFORMATION

This document is divided into three sections. Section A is the narrative portion of this manual. Section B contains reference value information, as well as limiting values. Section C contains the information that is needed to support surveillance testing. Controlled copies of this manual may be obtained from FileNet. Hardcopies of this document are maintained with the Work Support Center SRO, the Control Room, and the Simulator Control Room.

Section C contains a field titled the 'Expected Stroke Time Range'. Under normal circumstances, it is expected that the measured stroke time be within this range. If a value is obtained that is outside of this range, the valve is immediately retested or declared inoperable, as directed by the associated surveillance test. This range appears only for the safety direction of travel for valves included in the IST Program.

This document contains some stroke time information for SFAS actuated ventilation dampers, but is not intended to be a complete list.

The absence of a valve from this document indicates that there is no 'Maximum Allowable Stroke Time' or 'Expected Stroke Time Range'. The absence of a value for a valve listed in this document indicates that no such value exists.

The Reference Value Information section includes some valves that are not in the IST Program and have no stroke time requirements. Some valves and dampers listed in this document are not IST Program components.

All acceptance criteria and stroke time limits are contained in Section C, Stroke Time Limits and Acceptance Criteria.

Some valves may have more than one set of reference values. The Reference Value Information section will indicate those valves, and the Stroke Time Limits and Acceptance Criteria will provide the appropriate values and situations under which each reference value is to be used.

If a valve has a 'Maximum Allowable Stroke Time' limited by other than SFAS, SFRCS, Containment Isolation, or Owner-specified degradation (IST) limits, an explanation will be provided in Section A of this document.

Stroke times will be plotted and trended in the IST computerized tracking program.

The unit of measurement for all stroke time values in this document is seconds.

STROKE TIME BASIS INFORMATION

The Code of Record for the Fourth Ten Year Interval IST Program is the ASME Code for Operation and Maintenance at Nuclear Power Plants, ASME OM Code-2004 with Addenda through 2006.

Stroke time testing is mandated by the Code in the safety direction of valve travel only. Stroke time testing may also be performed in the non-safety direction for information and trending purposes only.

The Owner must specify 'Maximum Allowable Stroke Time' values for each IST Program power operated valve in the safety direction of valve travel. Calculated acceptance criteria may be rounded off in the conservative direction only. Stroke times shall be measured to at least the nearest second.

Reference values have been established and owner-specified degradation (IST) limits created based upon these values. Limiting stroke time values that must be met to fulfill requirements of the Technical Specifications, SFAS, SFRCS, Containment Isolation, or any other design basis stroke time requirement are included in this document. The 'Maximum Allowable Stroke Time' is defined as the most limiting value among the design basis requirements and the owner-specified degradation limits.

If a stroke time value exceeds the 'Maximum Allowable Stroke Time', then the valve is immediately declared inoperable per TS 5.5.7 and a Condition Report (CR) is written.

The 'Expected Stroke Time Range' and 'Maximum Allowable Stroke Time' apply only in the safety direction of valve travel. If the initial stroke time value is outside of the 'Expected Stroke Time Range', and the 'Maximum Allowable Stroke Time' was not exceeded, then the valve is either declared inoperable, or immediately retested and the following apply:

- If the retest stroke time value is again outside of the 'Expected Stroke Time Range' but does not exceed the 'Maximum Allowable Stroke Time', then the valve remains operable pending an evaluation that must be performed within 96 hours. The CR should state that an evaluation must be performed within 96 hours, or the valve will be declared inoperable per TS 5.5.7.

- If the retest stroke time value is within the 'Expected Stroke Time Range', then the valve remains operable. A CR is initiated to prompt an evaluation of the condition whenever a value is obtained that is outside of the 'Expected Stroke Time Range'. All test data gathered should be included in the CR.

OWNER SPECIFIED STROKE TIME INFORMATION AND NOTES

1. For motor operated valves, the Owner-specified degradation limit is defined as 1.5 times the reference value.

2. For air-operated valves with a reference value ≤10 seconds, the Owner-specified degradation limit is defined as 3 times the reference value or 10 seconds (whichever is greater). This does not apply to valves that are classified as Rapid Acting Valves. (See Note 10)

3. For solenoid valves with a reference value ≤10 seconds, the Owner-specified degradation limit is defined as 3 times the reference value. This does not apply to valves that are classified as Rapid Acting Valves. (See Note 10)

4. For air-operated valves and solenoid valves with a reference value >10 seconds, the Owner-specified degradation limit is 2 times the reference value.

5. For MS5889A, a maximum value of 42 seconds to open, and for MS5889B a maximum value of 46 seconds to open was assigned. These values are based upon a comparison of valve stroke time to Auxiliary Feed Pump response time, to ensure the Auxiliary Feed Pump response time requirement of 40 seconds is met. Additionally, these valves have a minimum open stroke time of 25 seconds to prevent overspeed trip of the Auxiliary Feed Pump Turbine.

6. For SW1356, SW1357, and SW1358, these valves must travel to at least the 80% open position within 10 seconds per Calculation C-ME-011.06-008. The stroke time matrix conservatively uses a 10 second

time limit for these valves to fully open. These valves have an additional set of reference values. Refer to CR 04-07816.

7. DH7A/DH7B must close within 75 seconds, and DH9A/DH9B must open within 75 seconds as required by SR 3.5.2.8.

8. Since TRM 8.3.11 imposes a 40-second response time requirement on the Auxiliary Feed Pumps, associated auxiliary feedwater system valves have a 40-second limit to achieve their safety positions. Note that MS5889A, MS5889B, SW1382 and SW1383 are exceptions that have specific limits assigned.

9. SW1382 and SW1383 each have a maximum value of 13 seconds due to the Auxiliary Feed Pumps suction piping design change under ECP 08-0571.

10. Certain valves are classified as Rapid Acting Valves. These valves are assigned a 'Maximum Allowable Stroke Time' of 2 seconds and are exempt from the 'Expected Stroke Time Range' requirement of the Code of Record.

11. For SFRCS actuated valves, the maximum allowable SFRCS time is listed in the SFRCS column of Section B. SFRCS actuated component response times are given in TRM Table 8.3.11-1 and include SFRCS sensing time and logic. The SFRCS times listed in this document are calculated by subtracting 1 second from the values listed in the TRM.

12. For Containment Isolation Valves, the maximum allowable containment isolation times are obtained from USAR Table 6.2-23, and are shown in the CIV column of Section B.

13. For IST Program SFAS actuated valves, the maximum allowable SFAS time is listed in the SFAS column of Section B. SFAS actuated component response times are given in Technical Requirements Manual (TRM) Table 8.3.5-1. The TRM values include all of the pieces of the total response time, including SFAS sensing and logic, as well as EDG and sequencer delays. The SFAS times listed in this document is calculated by subtracting all of the pieces affecting total response time from the TRM values, except for the actual valve actuation time. The following equation illustrates this:

    SFAS Time = [TRM Table 8.3.5-1 Time] - [SFAS Sensing & Logic Time] - [EDG Time] – [SFAS Sequencer Time] – [EDG Underfrequency Correction Time]

    <u>[SFAS Sensing & Logic Time]</u> - This is conservatively assumed at 5 seconds, except in cases where limited margin exists. When limited margin exists, the most recent worst case SFAS sensing and logic response times, obtained via DB-SC-03109, DB-SC-03114, or DB-SC-03121 are utilized for the equation in lieu of 5 seconds.

    <u>[EDG Time]</u> - When EDG time is applicable to the component, the value is assumed conservatively at 10 seconds, except in cases where limited margin exists. In these cases, actual EDG time is used.

    <u>[SFAS Sequencer Time]</u> - When SFAS sequencer times are applicable to the component, the value is assumed at nominal sequencer delay time with a tolerance of 1 second.

    <u>[EDG Underfrequency Correction Time]</u> – When EDG time is applicable to the component, this value is determined by the method documented in CA-2012-03071-2 to account for effect of limiting EDG underfrequency on valve stroke times when compared with test times at nominal test frequency.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
AF599	36.489	36.561	DB-PF-09302	10/29/2011	Reference values established following maintenance under Order 200432025.
AF608	36.606	36.757	DB-PF-09302	10/22/2011	Reference values established following maintenance under Order 200432026.
AF3869	33.92	34.27	DB-PF-03272	11/16/1995	Reference values established following maintenance under MWO 2-93-0035-18.
AF3870	19.375	19.918	DB-PF-03272	5/29/2012	Reference values established following valve replacement under Order 200501242.
AF3871	33.54	33.8	DB-PF-03272	10/30/1995	Reference values established following maintenance under MWO 2-93-0035-19.
AF3872	26.68	27.22	DB-PF-03163	6/28/2000	Reference values established following maintenance under WO 99-004622-000.
AF6451	3.59	11.3	DB-SP-03161	5/9/1991	Reference values established based upon 5/9/91 test data. Information only.
AF6452	4.47	10.17	DB-SP-03152	5/16/1991	Reference values established based upon 5/16/91 test data. Information only.
CC1328	22.2	22.08	DB-PF-03071	11/1/2000	Reference values established following maintenance under WO 00-000603-000 and review of 11/1/00 test data.
CC1338	22.25	22.51	DB-PF-03272	4/5/2001	Reference values established following maintenance under WO 00-003421-000.
CC1407A	8.23	8.36	DB-PF-03100	5/9/1998	Reference values established following maintenance under MWO 3-98-0232-01.
CC1407B	9.86	9.97	DB-PF-03272	4/19/2000	Reference values established following maintenance under WO 99-003859-000.
CC1411A	9.87	9.88	DB-PF-03272	5/3/1996	Reference values established following maintenance under MWO 3-96-0222-01.
CC1411B	9.31	9.4	DB-PF-03272	5/7/1996	Reference values established following maintenance under MWO 3-96-0229-01.
CC1460	3.46	4.33	DB-PF-03071	12/26/2005	Reference values established based following maintenance under Order 200008518.
CC1467	30.36	13.98	DB-PF-03071	3/20/2014	Reference value established following valve replacement under Order 200597387.
CC1469	32.52	12.29	DB-PF-03070	2/26/2014	Reference values established following valve replacement under Order 200595028.
CC1495	14.28	24.42	DB-PF-03071	4/21/2014	Reference values established following valve replacement under Order 200499387.
CC1567A	9.63	9.01	DB-PF-03100	4/19/1993	Reference values established following review of test data obtained on 4/19/93 under DB-PF-03100.
CC1567B	9.07	9.22	DB-PF-03100	5/9/1998	Reference values established following maintenance under MWO 3-98-0231-01.
CC2645	60.33	60.56	DB-PF-03272	3/23/2000	Reference values established following maintenance under WO 00-000045-000.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
CC2649	61.42	61.23	DB-PF-03070	2/14/1996	Reference values established following maintenance under MWO 3-95-0288-01.
CC4100	12.41	12.57	DB-PF-03272	11/2/1994	Reference values established following maintenance under MWO 1-93-0695-07.
CC4200	12.26	12.31	DB-PF-03272	10/29/1994	Reference values established following maintenance under MWO 1-93-0695-08.
CC4300	12.79	13.05	DB-PF-03272	11/2/1994	Reference values established following maintenance under MWO 1-93-0695-09.
CC4400	13.6	13.74	DB-PF-03272	10/29/1994	Reference values established following maintenance under MWO 1-93-0695-10.
CC5095	102.77	102.86	DB-PF-03272	5/13/1996	Reference values established following maintenance under MWO 7-94-0326-01.
CC5096	101.79	101.2	DB-PF-03070	3/10/2000	Reference values established following maintenance under WO 99-006410-002.
CC5097	57.06	57.53	DB-PF-03272	5/13/1996	Reference values established following maintenance under MWO 1-95-0487-16.
CC5098	59.4	59.36	DB-PF-03272	11/19/1998	Reference values established following maintenance under MWO 2-97-0076-05.
CF1A	51.84	52.44	DB-PF-03272	5/8/2000	Reference values established following maintenance under WO 99-000403-000.
CF1B	52.2	52.7	DB-PF-03272	5/8/2000	Reference values established following maintenance under WO 99-003753-000.
CF2A	5.8	5.79	DB-PF-03811	5/25/1998	Reference values established following maintenance under MWO 3-98-0321-01 and review of test data obtained on 5/25/98 under DB-PF-03811.
CF2B	6	5.6	DB-PF-03811	5/25/1998	Reference values established following maintenance under MWO 3-98-0322-01 and review of test data obtained on 5/25/98 under DB-PF-03811.
CF5A	5.34	5.44	DB-PF-03272	4/24/1996	Reference values established following maintenance under MWO 3-96-0323-01.
CF5B	5.62	5.72	DB-PF-03272	5/4/1998	Reference values established following maintenance under MWO 3-98-0324-01.
CF1541	4.14	3.56	DB-PF-05061	3/29/2006	Reference values established following maintenance under Orders 200117189 and 200099359.
CF1542	6.46	6.35	DB-PF-05061	3/30/2006	Reference values established following maintenance under Orders 200079095 and 200120863.
CF1544	4.18	3.96	DB-PF-03272	3/29/2006	Reference values established following maintenance under Orders 200099360 and 200117187.
CF1545	3.49	3.24	DB-PF-03272	3/21/2002	Reference value established following maintenance under WO 00-002974-000.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
CS1530	18.793	19.02	DB-PF-09302	8/21/2013	Reference values following implementation of ECP 03-0359 under Order 200389245.
CS1531	20.741	20.838	DB-PF-03272	1/20/2014	Reference values established following modification under Order 200588933.
CV5005	33.19	6.73	DB-MI-05023	11/14/2003	Ref values established following maintenance under Order 200001129 & 200006595.
CV5006	17.59	9.64	DB-PF-03272	5/11/1998	Reference values established following maintenance under MWO 3-98-5316-01.
CV5007	16.03	8.84	DB-PF-03270	6/18/2002	Reference values established following maintenance under WO 02-003376-000.
CV5008	7.9	8.69	DB-MI-05023	11/16/2003	Ref values established following maintenance under Order 200001061 & 200006085.
CV5010A	9.93	10.03	DB-PF-03811	10/18/1998	Reference values established following maintenance under MWO 1-98-1161-00.
CV5010B	10.5	10.53	DB-PF-03811	3/2/2000	Reference values established following maintenance under WO 99-002295-000.
CV5010C	9.87	9.88	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003685-000.
CV5010D	10.24	10.3	DB-PF-03811	3/10/2000	Reference values established following maintenance under WO 99-002291-000.
CV5010E	10.15	10.33	DB-PF-09302	3/10/2010	Reference values established following maintenance under order 200000681.
CV5011A	11.6	11.6	DB-SP-03272	4/14/1990	Reference values established following maintenance under MWO 3-90-0750-01.
CV5011B	10.84	10.81	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003684-000.
CV5011C	10.14	10.17	DB-PF-03811	3/2/2000	Reference values established following maintenance under WO 99-005269-000.
CV5011D	9.94	10.15	DB-PF-03811	6/1/2000	Reference values established following maintenance under WO 99-003683-000.
CV5011E	10.21	10.5	DB-PF-09307	6/7/2004	Reference values established following maintenance under Order 200004259.
CV5037	48.54	48.5	DB-PF-03272	1/19/2000	Reference values established following maintenance under WO 99-004618-000.
CV5038	54.05	53.96	DB-PF-03272	3/21/2000	Reference values established following maintenance under WO 99-004837-000.
CV5065	56.12	56.19	DB-PF-03272	1/16/1995	Reference values established following maintenance under MWO 3-95-0753-01.
CV5070	10.01	10.11	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003696-000 and review of test data obtained on 5/25/00 under DB-PF-03811.
CV5071	9.62	9.63	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003695-000.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
CV5072	9.61	9.72	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003694-000.
CV5073	9.9	10	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003693-000.
CV5074	9.77	9.87	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003692-000.
CV5075	9.57	9.59	DB-PF-03272	4/11/2000	Reference values established following maintenance under WO 99-003691-000.
CV5076	10.27	10.37	DB-PF-03812	3/26/1993	Reference values established following maintenance under MWO 3-93-0782-01.
CV5077	10.43	10.43	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003689-000.
CV5078	10.07	10.09	DB-PF-03811	6/29/1996	Reference values established following maintenance under MWO 3-96-0780-03 and review of test data obtained on 6/29/96 under DB-PF-03811.
CV5079	10.43	10.42	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003687-000.
CV5090	56.31	56.26	DB-PF-03272	5/26/2000	Reference values established following maintenanc eunder WO 99-004838-000.
DH1A	9.18	9.17	DB-PF-03272	3/28/2011	Reference values established following maintenance under WO 200450011.
DH1B	9.007	8.061	DB-PF-03272	8/7/2010	Reference values established following maintenance under WO 200426129.
DH7A	66	66.3	DB-SP-03211	10/7/1991	Reference values established following maintenance under MWO 1-91-0974-01.
DH7B	65.94	65.81	DB-PF-03205	3/30/2000	Reference values established following maintenance under WO 99-003027-000 and review of test data obtained on 3/30/00 under DB-PF-03205.
DH9A	63.37	63.61	DB-PF-03272	4/30/1998	Reference values established following maintenance under MWO 3-98-0292-01.
DH9B	65.52	64.47	DB-SP-03208	10/14/1994	Reference values established following maintenance under MWO 1-93-0695-26.
DH11	55.83	56.74	DB-SP-03130	5/13/1996	Reference values established following maintenance under MWO 1-95-0487-02.
DH12	59.56	59.78	DB-SP-03130	5/13/1996	Reference values established following maintenance under MWO 2-93-0035-29.
DH13A	6.39	7.23	DB-MI-05023	4/2/2006	Reference values established following maintenance under Order 200104259.
DH13B	7.88	11.08	DB-PF-03205	1/13/2008	Reference values established following maintenance under Order 200067203.
DH14A	5.73	6.59	DB-PF-03206	1/16/2008	Reference values established following maintenance under Order 200067204.
DH14B	5.13	6.55	DB-MI-05023	1/13/2008	Reference values established following maintenance under Order 200067205.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
DH63	28.15	28.12	DB-PF-03272	10/24/2000	Reference values established following maintenance under WO 00-001510-000.
DH64	12.74	12.86	DB-PF-03272	9/8/2005	Reference values established following maintenance under Order 200104259.
DH830	41.9	41.46	DB-PF-03206	7/9/1998	Reference values established following maintenance under MWO 3-98-0296-01 and review of test data obtained on 7/9/98 under DB-PF-03206.
DH831	38.71	37.63	DB-PF-03205	6/22/2000	Reference values established following maintenance under WO 99-001209-000 and review of test data obtained on 6/22/00 under DB-PF-03205.
DH1517	15.5	16.22	DB-PF-03205	6/26/2000	Reference values established following maintenance under WO 99-004337-002.
DH1518	14.21	14.14	DB-PF-03206	6/6/2000	Reference values established following maintenance under WO 99-004337-006.
DH2733	111.91	112.34	DB-PF-09302	1/12/2008	Reference values established following maintenance under Order 200091807.
DH2734	112.48	112.06	DB-PF-03206	6/6/2000	Reference values established following maintenance under WO 98-002735-000 and review of test data obtained on 6/6/00 under DB-PF-03206.
DH2735	16.47	16.39	DB-PF-03812	5/11/1998	Reference values established following maintenance under MWO 3-98-0301-01 and review of test data obtained on 5/17/98 under DB-PF-03812.
DH2736	39.75	39.8	DB-PF-03272	4/26/2000	Reference values established following maintenance under WO 99-004337-013.
DR2012A	8.04	8.24	DB-PF-03811	6/1/2000	Reference values established following maintenance under WO 99-003635-000.
DR2012B	8.74	8.35	DB-PF-03811	12/17/1999	Reference values established following maintenance under WO 99-002021-000.
DW2643	4.81	5.9	DB-PF-05061	6/4/2004	Reference values established following maintenance under Order 200011311.
DW6831A	7.62	1.42	DB-PF-03272	6/7/2003	Open value changed due to Order 200002323. Previous close value retained from DB-PF-03811 on 10/18/98 following WO 99-005780-000.
DW6831B	9.42	1.56	DB-PF-03272	6/6/2003	Open value changed due to WO 02-001457-000. Previous close value retained from DB-PF-03811 on 2/10/94 following MWO 7-93-0477-01.
FW601	13.2	14.1	DB-PF-03272	5/6/1999	Reference values established following maintenance under WO 99-002535-000.
FW612	12.09	13.11	DB-PF-03272	5/6/2000	Reference values established following maintenance under WO 99-003729-000.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
HA5439	56.21	56.24	DB-PF-03811	2/2/2001	Reference values established following maintenance under WO 00-001511-000 and based upon review of test data obtained on 2/2/01 under DB-PF-03811.
HA5440	55.15	55.03	DB-PF-03811	4/3/1999	Reference values established following maintenance under WO 98-001409-000 and based upon review of test data obtained on 4/3/99 under DB-PF-03811.
HA5441	54.89	55.05	DB-PF-03811	2/9/2001	Reference values established following maintenance under WO 00-003582-000 and based upon review of test data obtained on 2/9/01 under DB-PF-03811.
HA5442	58.4	58.36	DB-PF-03811	2/9/2001	Reference values established following maintenance under WO 00-001512-000 and based upon review of test data obtained on 2/9/01 under DB-PF-03811.
HP2A	8.53	8.7	DB-PF-03272	5/1/1998	Reference values established following maintenance under MWO 3-97-0271-01).
HP2B	9.06	9.12	DB-PF-03206	6/6/2000	Reference values established following maintenance under WO 99-003744-000 and based upon review of test data obtained on 6/6/00 under DB-PF-03206.
HP2C	8.87	8.97	DB-PF-03205	5/28/1998	Reference values established following maintenance under MWO 3-98-0272-01 and based upon review of test data obtained on 5/28/98 under DB-PF-03205.
HP2D	8.82	8.34	DB-PF-03205	3/30/2000	Reference values established following maintenance under WO 99-004365-000 and based upon review of test data obtained on 3/30/00 under DB-PF-03205.
HP31	28.94	27.59	DB-SP-03219	9/7/1995	Reference values established following maintenance under MWO 7-95-0237-01.
HP32	28.55	28.45	DB-SP-03218	5/1/1995	Reference values established following maintenance under MWO 3-95-2070-01.
IA2011	2.58	2.42	DB-PF-03811	7/16/2003	Reference values established following maintenance under Order 200002505.
ICS11A	8	4.94	99-000913-001	5/9/2000	Reference values established per DB-PF-03440 on 5/9/00 following valve/actuator replacement under MOD 92-0008.
ICS11B	8.75	5.72	DB-PF-03440	4/19/2006	Reference values established following maintenance under Order 200116976. Refer to CR 06-01971.
MS100		4.3	DB-SP-03445	5/18/1998	Reference values established following maintenance under MWO 2-97-0008-01 & 2-98-0013-01.
MS100-1	4.58	19.18	DB-PF-03811	7/20/2006	Reference values established following maintenance under Order 200117177.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
MS101		4.4	DB-SP-03444	5/12/2000	Reference values established during 5/12/00 test using a stopwatch.
MS101-1	4.24	19.95	DB-PF-03811	2/23/2008	Reference values established following maintenance under Order 200237626.
MS106	17.956	18.03	DB-PF-09302	11/8/2011	Reference values established following maintenance under WO 200432019.
MS106A	29.286	29.469	DB-PF-09302	11/9/2011	Reference values established following maintenance under WO 200432020.
MS107	28.183	28.377	DB-PF-09302	11/7/2011	Reference values established following maintenance under WO 200432021.
MS107A	26.76	26.912	DB-PF-09302	11/8/2011	Reference values established following maintenance under WO 200432022.
MS375	4.66	7.6	DB-PF-03811	2/23/2002	Reference values established following maintenance under WO 01-000413-000.
MS394	6	7.48	DB-PF-03811	2/23/2002	Reference values established following maintenance under WO 01-000425-000.
MS603	61.24	61.55	DB-PF-03272	4/27/2000	Reference values established following maintenance under WO 99-003962-000.
MS611	60.19	60.52	DB-PF-03272	4/20/1998	Reference values established following maintenance under MWO 3-98-0256-01.
MS5889A	34.23	6.54	DB-SP-03151	6/1/1995	Reference values established following maintenance under MWO 7-94-0473-02.
MS5889B	36.56	5.46	DB-SP-03166	6/25/2010	Reference values established following maintenance under Order 200421064.
MU1A	9.26	9.59	DB-PF-03272	5/10/1999	Reference values established following maintenance under WO 99-000269-005.
MU1B	9.21	9.3	DB-PF-03272	5/9/1996	Reference values established following maintenance under MWO 2-93-0035-22 & 1-95-0487-05.
MU2A	9.76	9.86	DB-PF-03272	5/13/1996	Reference values established following maintenance under MWO 2-93-0035-20 & 3-96-0184-01.
MU2B	9.63	9.79	DB-PF-03272	10/25/1994	Reference values established following maintenance under MWO 1-92-1078-50.
MU3	4.12	4.88	DB-PF-03386	8/16/2003	Reference values established following actuator replacement under ECR 03-0111-00
MU38	1.16	0.7	DB-PF-03386	2/27/2014	Reference values established following actuator replacement under Order 200595089.
MU59A	15.81	15.96	DB-PF-03272	4/30/2000	Reference values established following maintenance under WO 99-003848-000.
MU59B	15.18	15.25	DB-PF-03272	4/30/2000	Reference values established following maintenance under WO 99-003849-000.
MU59C	14.13	14.24	DB-PF-03272	4/27/2000	Reference values established following maintenance under WO 99-003850-000.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
MU59D	15.77	15.9	DB-PF-03272	4/27/2000	Reference values established following maintenance under WO 99-003851-000.
MU66A	2.84	1.67	DB-PF-03386	3/1/2014	Reference values established following actuator replacement under Order 200595464.
MU66B	4.15	2.95	DB-PF-05061	3/16/2003	Reference values established following maintenance under WO 03-003956-000 and because of new test methodology.
MU66C	3.46	2.67	DB-PF-05061	3/17/2003	Reference values established following maintenance under WO 03-003957-000 and because of new test methodology.
MU66D	4.01	2.94	DB-PF-05061	3/17/2003	Reference values established following maintenance under WO 02-002306-000 and because of new test methodology.
MU3971	15.97	16.09	DB-PF-03272	5/20/1996	Reference values established following maintenance under MWO 1-96-0356-00.
MU6405	15.54	15.56	DB-PF-03272	5/28/1996	Reference values established following maintenance under MWO 1-96-0357-01
MU6420	14.03	14.11	DB-PF-03272	4/30/1998	Reference values established following maintenance under MWO 3-96-4640-02.
MU6419	27.43	27.98	DB-PF-03272	4/17/2002	Reference values established following maintenance under Work Orders 01-005662-000 and 01-002465-000.
MU6421	14.05	13.65	DB-PF-03811	5/25/2000	Reference values established following maintenance under WO 99-003347-000 and based upon review of test data obtained on 5/25/00 under DB-PF-03811.
MU6422	13.17	13.25	DB-PF-03272	10/18/1994	Reference values established following maintenance under MWO 1-93-0659-22.
NN236	3.87	2.49	DB-PF-03272	4/5/2006	Reference values established following maintenance under Order 200117034.
RC2	6.85	6.48	DB-PF-03272	5/10/1999	Reference values established following maintenance under WO 98-000373-005.
RC2A	0.48	0.38	DB-SP-03366	11/18/2011	Reference values established following maintenance under Order 200353901.
RC10	11.29	11.37	DB-PF-03272	11/7/1994	Reference values established following maintenance under MWO 2-90-0046-02.
RC11	17.27	17.4	DB-PF-03272	5/18/1996	Reference values established following maintenance under MWO2-96-0001-01.
RC200	10.95	10.87	DB-PF-03272	10/18/1994	Reference values established following maintenance under MWO 1-93-0659-24.
RC229A	10	2.74	DB-PF-03811	11/24/1994	Reference values established following maintenance under MWO 3-94-4488-01 and based upon review of test data obtained on 11/24/94 under DB-PF-03811.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
RC229B	7.21	1.56	DB-PF-03811	7/16/2003	Reference values established following maintenance under Order 200003596.
RC232	8.86	4.83	DB-SP-03272	4/6/1993	Reference values established following maintenance under MWO 3-93-4486-01.
RC239A	12.94	13.03	DB-PF-03272	4/10/2000	Reference values established following maintenance under WO 99-003809-000.
RC240A	12.08	12	DB-PF-03272	4/20/1998	Reference values established following maintenance under MWO 3-96-0042-01.
RC240B	12.01	11.93	DB-PF-03811	12/9/1992	Reference values established following maintenance under MWO 1-92-1078-27.
RC1719A	4.45	2.87	DB-PF-03811	6/29/1996	Reference values established following maintenance under MWO 3-96-3916-01.
RC1719B	6.41	4.15	DB-PF-03272	4/5/2006	Reference values established following maintenance under Order 200117186.
RC1773A	3.12	1.67	DB-PF-03272	3/21/2002	Reference values established following maintenance under WO 00-003763-000 and WO 01-009132-000.
RC1773B	3.3	2	DB-PF-03272	3/13/2002	Reference values established following maintenance under WO 01-009679-000.
RC4608A	0.94	0.61	DB-SP-03366	11/2/1994	Reference values established following maintenance under MWO 2-86-0175-14.
RC4608B	0.54	0.33	DB-SP-03366	11/2/1994	Reference values established following maintenance under MWO 2-86-0175-14.
RC4610A	0.47	0.35	DB-SP-03366	4/13/1993	Reference values established following maintenance under MWO 2-86-0175-11.
RC4610B	0.24	0.24	DB-SP-03366	4/13/1993	Reference values established following maintenance under MWO 2-86-0175-11.
SA2010	2.98	4.44	DB-PF-03272	4/12/2006	Reference values established following maintenance under Order 200200915.
SP6A		5.96	DB-MI-03232	5/6/1999	Reference values established following maintenance under WO 98-000830-000.
SP6B		6	DB-MI-03232	5/2/2000	Reference values established following maintenance under WO 99-004053-000.
SP7A		3.96	DB-MI-03233	5/6/2000	Reference values established following maintenance under WO 99-003442-000.
SP7B		3	DB-MI-03233	5/4/2000	Reference values established following maintenance under WO 99-003706-000.
SS235A	2.47	2.87	DB-PF-03272	3/29/2003	Reference values established following maintenance under WO 03-001810-000.
SS235B	1.18	0.63	DB-PF-03272	3/31/2006	Reference values established following maintenance under Order 200006644.
SS598	2.12	4.24	DB-PF-03811	7/16/2003	Reference values established following implementation of ECR 03-0096. Refer to CR 03-00890.
SS607	2.96	2.97	DB-PF-03272	3/31/1999	Reference values established following maintenance under WO 98-001512-000.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
SW1356	5.29	6.99	DB-PF-03020	8/23/2013	Reference values following implementation of ECR 04-0272 under Order 200099230. (Refer to Order 200574209)
SW1357	3.87	8.107	DB-PF-03027	9/12/2013	Reference values following implementation of ECR 04-0272 under Order 200099231. (Refer to Order 200576869)
SW1358	4	6.26	DB-PF-03020	11/1/2013	Reference values following implementation of ECR 04-0272 under Order 200099232. (Refer to Order 200582224)
SW1366	20.1	20.1	DB-PF-03272	11/14/1996	Reference values established following maintenance under MWO3-97-0934-01
SW1367	19.24	19.26	DB-PF-03272	6/24/1992	Reference values established following maintenance under MWO 2-88-0109-04.
SW1368	19.43	19.41	DB-PF-03027	5/18/1992	Reference values established following maintenance under MWO 2-88-0109-03.
SW1379	29.84	29.96	DB-PF-09302	4/2/2006	Reference values established following maintenance under Order 200007803.
SW1380	27.89	28.05	DB-PF-09302	4/2/2006	Reference values established following maintenance under Order 200007801.
SW1381	30.09	30.2	DB-PF-09302	4/14/2006	Reference values established following maintenance under Order 200007816.
SW1382	10.38	10.45	DB-PF-09302	3/8/2010	Reference values established following maintenance under order 200354089 and ECP 08-0571.
SW1383	10.22	10.26	DB-PF-09302	3/8/2010	Reference values established following maintenance under order 200354090 and ECP 08-0571.
SW1395	30.68	31.08	DB-PF-03027	5/8/2000	Reference values established following maintenance under WO 98-000615-000.
SW1399	30.71	30.88	DB-PF-03020	5/4/2000	Reference values established following maintenance under WO 98-000656-000.
SW1424	4.78	26.23	DB-PF-05061	9/6/2003	Reference values established following implementation of ECR 03-0299 and Order 200036280.
SW1429	5.12	23.6	DB-MI-05023	9/5/2003	Reference values established following implementation of ECR 03-0299 and Order 200036281.
SW1434	4.79	25.49	DB-PF-05061	9/10/2003	Reference values established following implementation of ECR 03-0299.
SW2927	18.98	18.46	DB-PF-03020	12/2/1998	Reference values established following maintenance under MWO 3-98-0948-01 and based upon review of test data obtained on 12/2/98 under DB-PF-03020.
SW2928	18.27	17.26	DB-PF-03027	5/4/2000	Reference values established following maintenance under WO 99-005611-000 and based upon review of test data obtained on 5/4/00 under DB-PF-03027.

REFERENCE VALUE INFORMATION

Valve	Reference Value Open	Reference Value Closed	Reference Test Procedure	Reference Test Date	Reference Comments
SW2929	59.35	59.55	DB-PF-03272	3/31/2006	Reference values established following maintenance under Order 200162373.
SW2930	50.44	50.68	DB-PF-03272	3/30/2006	Reference values established following maintenance under Order 200163414.
SW2931	56.33	56.58	DB-PF-03272	3/31/2006	Reference values established following maintenance under Order 200163415.
SW2932	51.41	51.49	DB-PF-03027	10/21/1999	Reference values established following maintenance under WO 99-004180-000.
SW5067	10.86	9.8	DB-PF-03020	1/26/2000	Reference values established following maintenance under WO 99-001844-000.
SW5068	19.34	18.78	DB-PF-03027	5/4/2000	Reference values established following maintenance under WO 99-004754-000 and based upon review of test data obtained on 5/4/00 under DB-PF-03027.

STROKE TIME LIMITING VALUES

VALVE	REFERENCE (O)	REFERENCE (C)	TRM (O)	TRM (C)	SFAS (O)	SFAS (C)	CIV (C)	SFRCS (C)	FIXED (O)	FIXED (C)	IST (O)	IST (C)	MAX ALLOWABLE (O)	MAX ALLOWABLE (C)
AF599	36.489	36.561									54.73	54.84	54.73	54.84
AF608	36.606	36.757									54.9	55.13	54.9	55.13
AF3869	33.92	34.27							40	40	50.88	51.4	40	40
AF3870	19.375	19.918							40	40	29.06	29.87	29.06	29.87
AF3871	33.54	33.8							40	40	50.31	50.7	40	40
AF3872	26.68	27.22							40	40	40.02	40.83	40	40
CC1328	22.2	22.08		35		24.5						33.12		24.5
CC1338	22.25	22.51		35		24.53						33.76		24.53
CC1407A	8.23	8.36		30		19.65	15					12.54		12.54
CC1407B	9.86	9.97		30		19.8	15					14.95		14.95
CC1411A	9.87	9.88		30		19.65	15					14.82		14.82
CC1411B	9.31	9.4		30		19.8	15					14.1		14.1
CC1460	3.46	4.33		90		85						12.99		12.99
CC1467	30.36	13.98									60.72		60.72	
CC1469	32.52	12.29									65.04		65.04	
CC1495	14.28	24.42		90		85						48.84		48.84
CC1567A	9.63	9.01		35		19.36	15					13.51		13.51
CC1567B	9.07	9.22		35		19.36	15					13.83		13.83
CC2645	60.33	60.56										90.84		90.84
CC2649	61.42	61.23										91.84		91.84
CC4100	12.41	12.57										18.85		18.85
CC4200	12.26	12.31										18.46		18.46
CC4300	12.79	13.05										19.57		19.57
CC4400	13.6	13.74										20.61		20.61
CC5095	102.77	102.86										154.29		154.29
CC5096	101.79	101.2										151.8		151.8
CC5097	57.06	57.53										86.29		86.29
CC5098	59.4	59.36										89.04		89.04
CF1541	4.14	3.56		15		10	10					10.68		10
CF1542	6.46	6.35		15		10	10					19.05		10
CF1544	4.18	3.96		15		10	10					11.88		10
CF1545	3.49	3.24		15		10	10					10		10
CS1530	18.793	19.02	80		63.9						28.18	28.53	28.18	28.53
CS1531	20.741	20.838	80		63.9						31.11	31.25	31.11	31.25
CV5004				75		70								70
CV5005	33.19	6.73										20.19		20.19
CV5006	17.59	9.64										28.92		28.92
CV5007	16.03	8.84										26.52		26.52
CV5008	7.9	8.69										26.07		26.07
CV5009				75		70								70
CV5010A	9.93	10.03		30		14.52	15				14.89	15.04	14.89	14.52

STROKE TIME LIMITING VALUES

VALVE	REFERENCE (O)	REFERENCE (C)	TRM (O)	TRM (C)	SFAS (O)	SFAS (C)	CIV (C)	SFRCS (C)	FIXED (O)	FIXED (C)	IST (O)	IST (C)	MAX ALLOWABLE (O)	MAX ALLOWABLE (C)
CV5010B	10.5	10.53		30		14.52	15				15.75	15.79	15.75	14.52
CV5010C	9.87	9.88		30		14.52	15				14.8	14.82	14.8	14.52
CV5010D	10.24	10.3		30		14.52	15				15.36	15.45	15.36	14.52
CV5010E	10.15	10.33		30		14.52	15				15.22	15.49	15.22	14.52
CV5011A	11.6	11.6		30		14.52	15				17.4	17.4	17.4	14.52
CV5011B	10.84	10.81		30		14.52	15				16.26	16.21	16.26	14.52
CV5011C	10.14	10.17		30		14.52	15				15.21	15.25	15.21	14.52
CV5011D	9.94	10.15		30		14.52	15				14.91	15.22	14.91	14.52
CV5011E	10.21	10.5		30		14.52	15				15.31	15.75	15.31	14.52
CV5016				75		70								70
CV5021				75		70								70
CV5024				75		60								60
CV5025				75		60								60
CV5037	48.54	48.5		75		58.9	60				72.81	72.75	72.81	58.9
CV5038	54.05	53.96		75		58.9	60				81.07	80.94	81.07	58.9
CV5065	56.12	56.19		75		58.9	60				84.18	84.28	84.18	58.9
CV5070	10.01	10.11		30		14.52	15					15.16		14.52
CV5071	9.62	9.63		30		14.52	15					14.44		14.44
CV5072	9.61	9.72		30		14.52	15					14.58		14.52
CV5073	9.9	10		30		14.52	15					15		14.52
CV5074	9.77	9.87		30		14.52	15					14.8		14.52
CV5075	9.57	9.59		30		14.52	15					14.38		14.38
CV5076	10.27	10.37		30		14.52	15					15.55		14.52
CV5077	10.43	10.43		30		14.52	15					15.64		14.52
CV5078	10.07	10.09		30		14.52	15					15.13		14.52
CV5079	10.43	10.42		30		14.52	15					15.63		14.52
CV5090	56.31	56.26		75		58.9	60				84.46	84.39	84.46	58.9
DH1A	9.18	9.17									13.77	13.75	13.77	13.75
DH1B	9.007	8.061									13.51	12.09	13.51	12.09
DH7A	66	66.3								75	99	99.45	99	75
DH7B	65.94	65.81								75	98.91	98.71	98.91	75
DH9A	63.37	63.61					71		75		95.05	95.41	75	71
DH9B	65.52	64.47					71		75		98.28	96.7	75	71
DH11	55.83	56.74									83.74	85.11	83.74	85.11
DH12	59.56	59.78									89.34	89.67	89.34	89.67
DH13A	6.39	7.23										21.69		21.69
DH13B	7.88	11.08										22.16		22.16
DH14A	5.73	6.59									17.19		17.19	
DH14B	5.13	6.55									15.39		15.39	
DH63	28.15	28.12									42.22	42.18	42.22	42.18
DH64	12.74	12.86									19.11	19.29	19.11	19.29

STROKE TIME LIMITING VALUES

VALVE	REFERENCE		TRM		SFAS		CIV	SFRCS	FIXED		IST		MAX ALLOWABLE	
	(O)	(C)	(O)	(C)	(O)	(C)	(C)	(C)	(O)	(C)	(O)	(C)	(O)	(C)
DH830	41.9	41.46										62.19		62.19
DH831	38.71	37.63										56.44		56.44
DH1517	15.5	16.22									23.25	24.33	23.25	24.33
DH1518	14.21	14.14									21.31	21.21	21.31	21.21
DH2733	111.91	112.34									167.86	168.51	167.86	168.51
DH2734	112.48	112.06									168.72	168.09	168.72	168.09
DH2735	16.47	16.39									24.7	24.58	24.7	24.58
DH2736	39.75	39.8									59.62	59.7	59.62	59.7
DR2012A	8.04	8.24		30		19.25	15					12.36		12.36
DR2012B	8.74	8.35		30		19.38	15					12.52		12.52
DW2643	4.81	5.9										17.7		17.7
DW6831A	7.62	1.42		15		10	10					10		10
DW6831B	9.42	1.56		15		10	10					10		10
FW601	13.2	14.1		16				15				21.15		15
FW612	12.09	13.11		16				15				19.66		15
HA5439	56.21	56.24		75		60								60
HA5440	55.15	55.03		75		60								60
HA5441	54.89	55.05		75		60								60
HA5442	58.4	58.36		75		60								60
HA5715A				75		70								70
HA5715B				75		70								70
HA5716A				75		70								70
HA5716B				75		70								70
HP2A	8.53	8.7	30		13.5						12.79	13.05	12.79	13.05
HP2B	9.06	9.12	30		13.45						13.59	13.68	13.45	13.68
HP2C	8.87	8.97	30		13.5						13.3	13.45	13.3	13.45
HP2D	8.82	8.34	30		13.5						13.23	12.51	13.23	12.51
HP31	28.94	27.59										41.38		41.38
HP32	28.55	28.45										42.67		42.67
IA2011	2.58	2.42		15		10	10					10		10
ICS11A	8	4.94									24	14.82	24	14.82
ICS11B	8.75	5.72									26.25	17.16	26.25	17.16
MS100	0	4.3		6				5				12.9		5
MS100-1	4.58	19.18										38.36		38.36
MS101	0	4.4		6				5				13.2		5
MS101-1	4.24	19.95										39.9		39.9
MS106	17.956	18.03							40	40	26.93	27.04	26.93	27.04
MS106A	29.286	29.469							40	40	43.92	44.2	40	40
MS107	28.183	28.377							40	40	42.27	42.56	40	40
MS107A	26.76	26.912							40	40	40.14	40.36	40	40
MS375	4.66	7.6										22.8		22.8

STROKE TIME LIMITING VALUES

VALVE	REFERENCE		TRM		SFAS		CIV	SFRCS	FIXED		IST		MAX ALLOWABLE	
	(O)	(C)	(O)	(C)	(O)	(C)	(C)	(C)	(O)	(C)	(O)	(C)	(O)	(C)
MS394	6	7.48										22.44		22.44
MS603	61.24	61.55										92.32		92.32
MS611	60.19	60.52										90.78		90.78
MS5889A	34.23	6.54							42		68.46		42	
MS5889B	36.56	5.46							46		73.12		46	
MU1A	9.26	9.59										14.38		14.38
MU1B	9.21	9.3										13.95		13.95
MU2A	9.76	9.86		30		14.52	15					14.79		14.52
MU2B	9.63	9.79										14.68		14.68
MU3	4.12	4.88		30		25	10					14.64		10
MU38	1.16	0.7		45		40	12			2				2
MU59A	15.81	15.96		45		29.15	30					23.94		23.94
MU59B	15.18	15.25		45		29.15	30					22.87		22.87
MU59C	14.13	14.24		45		29.15	30					21.36		21.36
MU59D	15.77	15.9		45		29.15	30					23.85		23.85
MU66A	2.84	1.67		17		12	12					10		10
MU66B	4.15	2.95		17		12	12					10		10
MU66C	3.46	2.67		17		12	12					10		10
MU66D	4.01	2.94		17		12	12					10		10
MU3971	15.97	16.09										24.13		24.13
MU6405	15.54	15.56										23.34		23.34
MU6421	14.05	13.65										20.47		20.47
MU6422	13.17	13.25										19.87		19.87
NN236	3.87	2.49		15		10	10					10		10
RC2A	0.48	0.38							2	2			2	2
RC10	11.29	11.37										17.05		17.05
RC11	17.27	17.4									25.9	26.1	25.9	26.1
RC200	10.95	10.87									16.42	16.3	16.42	16.3
RC229A	10	2.74		15		10	10					10		10
RC229B	7.21	1.56		15		10	10					10		10
RC232	8.86	4.83		15		10	10					14.49		10
RC239A	12.94	13.03									19.41	19.54	19.41	19.54
RC240A	12.08	12		45		29.15	30				18.12	18	18.12	18
RC240B	12.01	11.93		45		29.15	30					17.89		17.89
RC1719A	4.45	2.87		15		10	10					10		10
RC1719B	6.41	4.15		15		10	10					12.45		10
RC1773A	3.12	1.67		15		10	10					10		10
RC1773B	3.3	2		15		10	10					10		10
RC4608A	0.94	0.61							2	2			2	2
RC4608B	0.54	0.33							2	2			2	2
RC4610A	0.47	0.35							2	2			2	2

STROKE TIME LIMITING VALUES

VALVE	REFERENCE (O)	REFERENCE (C)	TRM (O)	TRM (C)	SFAS (O)	SFAS (C)	CIV (C)	SFRCS (C)	FIXED (O)	FIXED (C)	IST (O)	IST (C)	MAX ALLOWABLE (O)	MAX ALLOWABLE (C)
RC4610B	0.24	0.24							2	2			2	2
SA2010	2.98	4.44		15		10	10					13.32		10
SP6A		5.96		8				7						7
SP6B		6		8				7						7
SP7A		3.96		13				12						12
SP7B		3		13				12						12
SS235A	2.47	2.87		35		30	30					10		10
SS235B	1.18	0.63		35		30	30			2				2
SS598	2.12	4.24		15		10	10					12.72		10
SS607	2.96	2.97		15		10	10					10		10
SW1356	5.29	6.99							10		15.87	20.97	10	20.97
SW1357	3.87	8.107							10		11.61	24.32	10	24.32
SW1358	4	6.26							10		12	18.78	10	18.78
SW1366	20.1	20.1									30.15	30.15	30.15	30.15
SW1367	19.24	19.26									28.86	28.89	28.86	28.89
SW1368	19.43	19.41									29.14	29.11	29.14	29.11
SW1379	29.84	29.96									44.76	44.94	44.76	44.94
SW1380	27.89	28.05									41.83	42.07	41.83	42.07
SW1381	30.09	30.2									45.13	45.3	45.13	45.3
SW1382	10.38	10.45							13		15.57		13	
SW1383	10.22	10.26							13		15.33		13	
SW1395	30.68	31.08		45		34.15						46.62		34.15
SW1399	30.71	30.88		45		34						46.32		34
SW1424	4.78	26.23									14.34		14.34	
SW1429	5.12	23.6									15.36		15.36	
SW1434	4.79	25.49									14.37		14.37	
SW2927	18.98	18.46									28.47		28.47	
SW2928	18.27	17.26									27.4		27.4	
SW2929	59.35	59.55									89.02	89.32	89.02	89.32
SW2930	50.44	50.68									75.66	76.02	75.66	76.02
SW2931	56.33	56.58										84.87		84.87
SW2932	51.41	51.49										77.23		77.23
SW5067	10.86	9.8									16.29		16.29	
SW5068	19.34	18.78									29.01		29.01	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range	Maximum Allowable Stroke Time	Comments
AF599	MOV	Open	36.489	31.02 - 41.96	**54.73**	
		Closed	36.561	31.08 - 42.04	**54.84**	
AF608	MOV	Open	36.606	31.12 - 42.09	**54.9**	
		Closed	36.757	31.25 - 42.27	**55.13**	
AF3869	MOV	Open	33.92	28.84 - 39	**40**	
		Closed	34.27	29.13 - 39.41	**40**	
AF3870	MOV	Open	19.375	16.47 - 22.28	**29.06**	
		Closed	19.918	16.94 - 22.9	**29.87**	
AF3871	MOV	Open	33.54	28.51 - 38.57	**40**	
		Closed	33.8	28.73 - 38.87	**40**	
AF3872	MOV	Open	26.68	22.68 - 30.68	**40**	
		Closed	27.22	23.14 - 31.3	**40**	
CC1328	MOV	Open	22.2			
		Closed	22.08	18.77 - 24.5	**24.5**	
CC1338	MOV	Open	22.25			
		Closed	22.51	19.14 - 24.53	**24.53**	
CC1407A	MOV	Open	8.23			
		Closed	8.36	6.27 - 10.45	**12.54**	
CC1407B	MOV	Open	9.86			
		Closed	9.97	7.48 - 12.46	**14.95**	
CC1411A	MOV	Open	9.87			
		Closed	9.88	7.41 - 12.35	**14.82**	
CC1411B	MOV	Open	9.31			
		Closed	9.4	7.05 - 11.75	**14.1**	
CC1460	AOV	Open	3.46			
		Closed	4.33	2.17 - 6.49	**12.99**	Fail position closed.
CC1467	AOV	Open	30.36	22.77 - 37.95	**60.72**	Fail position open.
		Closed	13.98			
CC1469	AOV	Open	32.52	24.39 - 40.65	**65.04**	Fail position open.
		Closed	12.29			
CC1495	AOV	Open	14.28			
		Closed	24.42	18.32 - 30.52	**48.84**	Fail position closed.
CC1567A	MOV	Open	9.63			
		Closed	9.01	6.76 - 11.26	**13.51**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range			Maximum Allowable Stroke Time	Comments
CC1567B	MOV	Open	9.07					
		Closed	9.22	6.92	-	11.52	**13.83**	
CC2645	MOV	Open	60.33					
		Closed	60.56	51.48	-	69.64	**90.84**	
CC2649	MOV	Open	61.42					
		Closed	61.23	52.05	-	70.41	**91.84**	
CC4100	MOV	Open	12.41					
		Closed	12.57	10.69	-	14.45	**18.85**	
CC4200	MOV	Open	12.26					
		Closed	12.31	10.47	-	14.15	**18.46**	
CC4300	MOV	Open	12.79					
		Closed	13.05	11.1	-	15	**19.57**	
CC4400	MOV	Open	13.6					
		Closed	13.74	11.68	-	15.8	**20.61**	
CC5095	MOV	Open	102.77					
		Closed	102.86	87.44	-	118.28	**154.29**	
CC5096	MOV	Open	101.79					
		Closed	101.2	86.02	-	116.38	**151.8**	
CC5097	MOV	Open	57.06					
		Closed	57.53	48.91	-	66.15	**86.29**	
CC5098	MOV	Open	59.4					
		Closed	59.36	50.46	-	68.26	**89.04**	
CF1541	AOV	Open	4.14					
		Closed	3.56	1.78	-	5.34	**10**	Fail position closed.
CF1542	AOV	Open	6.46					
		Closed	6.35	3.18	-	9.52	**10**	Fail position closed.
CF1544	AOV	Open	4.18					
		Closed	3.96	1.98	-	5.94	**10**	Fail position closed.
CF1545	AOV	Open	3.49					
		Closed	3.24	1.62	-	4.86	**10**	Fail position closed.
CS1530	MOV	Open	18.793	15.98	-	21.61	**28.18**	
		Closed	19.02	16.17	-	21.87	**28.53**	
CS1531	MOV	Open	20.741	17.63	-	23.85	**31.11**	
		Closed	20.838	17.72	-	23.96	**31.25**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range			Maximum Allowable Stroke Time	Comments
CV5004	AOV	Open						
		Closed					**70**	Fail position closed.
CV5005	AOV	Open	33.19					
		Closed	6.73	3.37	-	10.09	**20.19**	Fail position closed.
CV5006	AOV	Open	17.59					
		Closed	9.64	4.82	-	14.46	**28.92**	Fail position closed.
CV5007	AOV	Open	16.03					
		Closed	8.84	4.42	-	13.26	**26.52**	Fail position closed.
CV5008	AOV	Open	7.9					
		Closed	8.69	4.35	-	13.03	**26.07**	Fail position closed.
CV5009	AOV	Open						
		Closed					**70**	Fail position closed.
CV5010A	MOV	Open	9.93	7.45	-	12.41	**14.89**	
		Closed	10.03	8.53	-	11.53	**14.52**	
CV5010B	MOV	Open	10.5	8.93	-	12.07	**15.75**	
		Closed	10.53	8.96	-	12.1	**14.52**	
CV5010C	MOV	Open	9.87	7.41	-	12.33	**14.8**	
		Closed	9.88	7.41	-	12.35	**14.52**	
CV5010D	MOV	Open	10.24	8.71	-	11.77	**15.36**	
		Closed	10.3	8.76	-	11.84	**14.52**	
CV5010E	MOV	Open	10.15	8.63	-	11.67	**15.22**	
		Closed	10.33	8.79	-	11.87	**14.52**	
CV5011A	MOV	Open	11.6	9.86	-	13.34	**17.4**	
		Closed	11.6	9.86	-	13.34	**14.52**	
CV5011B	MOV	Open	10.84	9.22	-	12.46	**16.26**	
		Closed	10.81	9.19	-	12.43	**14.52**	
CV5011C	MOV	Open	10.14	8.62	-	11.66	**15.21**	
		Closed	10.17	8.65	-	11.69	**14.52**	
CV5011D	MOV	Open	9.94	7.46	-	12.42	**14.91**	
		Closed	10.15	8.63	-	11.67	**14.52**	
CV5011E	MOV	Open	10.21	8.68	-	11.74	**15.31**	
		Closed	10.5	8.93	-	12.07	**14.52**	
CV5016	AOV	Open						
		Closed					**70**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range	Maximum Allowable Stroke Time	Comments
CV5021	AOV	Open				
		Closed			**70**	
CV5024	MOV	Open				
		Closed			**60**	
CV5025	MOV	Open				
		Closed			**60**	
CV5037	MOV	Open	48.54	41.26 - 55.82	**72.81**	
		Closed	48.5	41.23 - 55.77	**58.9**	
CV5038	MOV	Open	54.05	45.95 - 62.15	**81.07**	
		Closed	53.96	45.87 - 58.9	**58.9**	
CV5065	MOV	Open	56.12	47.71 - 64.53	**84.18**	
		Closed	56.19	47.77 - 58.9	**58.9**	
CV5070	MOV	Open	10.01			
		Closed	10.11	8.6 - 11.62	**14.52**	
CV5071	MOV	Open	9.62			
		Closed	9.63	7.23 - 12.03	**14.44**	
CV5072	MOV	Open	9.61			
		Closed	9.72	7.29 - 12.15	**14.52**	
CV5073	MOV	Open	9.9			
		Closed	10	7.5 - 12.5	**14.52**	
CV5074	MOV	Open	9.77			
		Closed	9.87	7.41 - 12.33	**14.52**	
CV5075	MOV	Open	9.57			
		Closed	9.59	7.2 - 11.98	**14.38**	
CV5076	MOV	Open	10.27			
		Closed	10.37	8.82 - 11.92	**14.52**	
CV5077	MOV	Open	10.43			
		Closed	10.43	8.87 - 11.99	**14.52**	
CV5078	MOV	Open	10.07			
		Closed	10.09	8.58 - 11.6	**14.52**	
CV5079	MOV	Open	10.43			
		Closed	10.42	8.86 - 11.98	**14.52**	
CV5090	MOV	Open	56.31	47.87 - 64.75	**84.46**	
		Closed	56.26	47.83 - 58.9	**58.9**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range			Maximum Allowable Stroke Time	Comments
DH1A	MOV	Open	9.18	6.89	-	11.47	**13.77**	
		Closed	9.17	6.88	-	11.46	**13.75**	
DH1B	MOV	Open	9.007	6.76	-	11.25	**13.51**	
		Closed	8.061	6.05	-	10.07	**12.09**	
DH7A	MOV	Open	66	56.1	-	75.9	**99**	
		Closed	66.3	56.36	-	75	**75**	
DH7B	MOV	Open	65.94	56.05	-	75.83	**98.91**	
		Closed	65.81	55.94	-	75	**75**	
DH9A	MOV	Open	63.37	53.87	-	72.87	**75**	
		Closed	63.61	54.07	-	71	**71**	
DH9B	MOV	Open	65.52	55.7	-	75	**75**	
		Closed	64.47	54.8	-	71	**71**	
DH11	MOV	Open	55.83	47.46	-	64.2	**83.74**	
		Closed	56.74	48.23	-	65.25	**85.11**	
DH12	MOV	Open	59.56	50.63	-	68.49	**89.34**	
		Closed	59.78	50.82	-	68.74	**89.67**	
DH13A	AOV	Open	6.39					
		Closed	7.23	3.62	-	10.84	**21.69**	Fail position closed.
DH13B	AOV	Open	7.88					
		Closed	11.08	8.31	-	13.85	**22.16**	Fail position closed.
DH14A	AOV	Open	5.73	2.87	-	8.59	**17.19**	Fail position open.
		Closed	6.59					
DH14B	AOV	Open	5.13	2.57	-	7.69	**15.39**	Fail position open.
		Closed	6.55					
DH63	MOV	Open	28.15	23.93	-	32.37	**42.22**	
		Closed	28.12	23.91	-	32.33	**42.18**	
DH64	MOV	Open	12.74	10.83	-	14.65	**19.11**	
		Closed	12.86	10.94	-	14.78	**19.29**	
DH830	MOV	Open	41.9					
		Closed	41.46	35.25	-	47.67	**62.19**	
DH831	MOV	Open	38.71					
		Closed	37.63	31.99	-	43.27	**56.44**	
DH1517	MOV	Open	15.5	13.18	-	17.82	**23.25**	
		Closed	16.22	13.79	-	18.65	**24.33**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range	Maximum Allowable Stroke Time	Comments
DH1518	MOV	Open	14.21	12.08 - 16.34	**21.31**	
		Closed	14.14	12.02 - 16.26	**21.21**	
DH2733	MOV	Open	111.91	95.13 - 128.69	**167.86**	
		Closed	112.34	95.49 - 129.19	**168.51**	
DH2734	MOV	Open	112.48	95.61 - 129.35	**168.72**	
		Closed	112.06	95.26 - 128.86	**168.09**	
DH2735	MOV	Open	16.47	14 - 18.94	**24.7**	
		Closed	16.39	13.94 - 18.84	**24.58**	
DH2736	MOV	Open	39.75	33.79 - 45.71	**59.62**	
		Closed	39.8	33.83 - 45.77	**59.7**	
DR2012A	MOV	Open	8.04			
		Closed	8.24	6.18 - 10.3	**12.36**	
DR2012B	MOV	Open	8.74			
		Closed	8.35	6.27 - 10.43	**12.52**	
DW2643	AOV	Open	4.81			
		Closed	5.9	2.95 - 8.85	**17.7**	Fail position closed.
DW6831A	AOV	Open	7.62			
		Closed	1.42	0.71 - 2.13	**10**	Fail position closed.
DW6831B	AOV	Open	9.42			
		Closed	1.56	0.78 - 2.34	**10**	Fail position closed.
FW601	MOV	Open	13.2			
		Closed	14.1	11.99 - 15	**15**	
FW612	MOV	Open	12.09			
		Closed	13.11	11.15 - 15	**15**	
HA5439	MOV	Open	56.21			
		Closed	56.24		**60**	
HA5440	MOV	Open	55.15			
		Closed	55.03		**60**	
HA5441	MOV	Open	54.89			
		Closed	55.05		**60**	
HA5442	MOV	Open	58.4			
		Closed	58.36		**60**	
HA5715A	AOV	Open				
		Closed			**70**	Fail position closed.

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range			Maximum Allowable Stroke Time	Comments
HA5715B	AOV	Open						
		Closed					**70**	Fail position closed.
HA5716A	AOV	Open						
		Closed					**70**	Fail position closed.
HA5716B	AOV	Open						
		Closed					**70**	Fail position closed.
HP2A	MOV	Open	8.53	6.4	-	10.66	**12.79**	
		Closed	8.7	6.53	-	10.87	**13.05**	
HP2B	MOV	Open	9.06	6.8	-	11.32	**13.45**	
		Closed	9.12	6.84	-	11.4	**13.68**	
HP2C	MOV	Open	8.87	6.66	-	11.08	**13.3**	
		Closed	8.97	6.73	-	11.21	**13.45**	
HP2D	MOV	Open	8.82	6.62	-	11.02	**13.23**	
		Closed	8.34	6.26	-	10.42	**12.51**	
HP31	MOV	Open	28.94					
		Closed	27.59	23.46	-	31.72	**41.38**	
HP32	MOV	Open	28.55					
		Closed	28.45	24.19	-	32.71	**42.67**	
IA2011	AOV	Open	2.58					
		Closed	2.42	1.21	-	3.63	**10**	Fail position closed.
ICS11A	AOV	Open	8	4	-	12	**24**	
		Closed	4.94	2.47	-	7.41	**14.82**	Fail position closed.
ICS11B	AOV	Open	8.75	4.38	-	13.12	**26.25**	
		Closed	5.72	2.86	-	8.58	**17.16**	Fail position closed.
MS100	AOV	Open	0					Values valid in Mode 4
		Closed	4.3	2.15	-	5	**5**	only. Fail position closed.
MS100-1	AOV	Open	4.58					
		Closed	19.18	14.39	-	23.97	**38.36**	Fail position closed.
MS101	AOV	Open	0					Values valid in Mode 4
		Closed	4.4	2.2	-	5	**5**	only. Fail position closed.
MS101-1	AOV	Open	4.24					
		Closed	19.95	14.97	-	24.93	**39.9**	Fail position closed.
MS106	MOV	Open	17.956	15.27	-	20.64	**26.93**	
		Closed	18.03	15.33	-	20.73	**27.04**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range	Maximum Allowable Stroke Time	Comments
MS106A	MOV	Open	29.286	24.9 - 33.67	**40**	
		Closed	29.469	25.05 - 33.88	**40**	
MS107	MOV	Open	28.183	23.96 - 32.41	**40**	
		Closed	28.377	24.13 - 32.63	**40**	
MS107A	MOV	Open	26.76	22.75 - 30.77	**40**	
		Closed	26.912	22.88 - 30.94	**40**	
MS375	AOV	Open	4.66			
		Closed	7.6	3.8 - 11.4	**22.8**	Fail position closed.
MS394	AOV	Open	6			
		Closed	7.48	3.74 - 11.22	**22.44**	Fail position closed.
MS603	MOV	Open	61.24			
		Closed	61.55	52.32 - 70.78	**92.32**	
MS611	MOV	Open	60.19			
		Closed	60.52	51.45 - 69.59	**90.78**	
MS5889A	AOV	Open	34.23	25.68 - 42	**42**	Fail position open.
		Closed	6.54			
MS5889B	AOV	Open	36.56	27.42 - 45.7	**46**	Fail position open.
		Closed	5.46			
MU1A	MOV	Open	9.26			
		Closed	9.59	7.2 - 11.98	**14.38**	
MU1B	MOV	Open	9.21			
		Closed	9.3	6.98 - 11.62	**13.95**	
MU2A	MOV	Open	9.76			
		Closed	9.86	7.4 - 12.32	**14.52**	
MU2B	MOV	Open	9.63			
		Closed	9.79	7.35 - 12.23	**14.68**	
MU3	AOV	Open	4.12			
		Closed	4.88	2.44 - 7.32	**10**	Fail position closed.
MU38	AOV	Open	1.16			
		Closed	0.7		**2**	Fail position closed.
MU59A	MOV	Open	15.81			
		Closed	15.96	13.57 - 18.35	**23.94**	
MU59B	MOV	Open	15.18			
		Closed	15.25	12.97 - 17.53	**22.87**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range			Maximum Allowable Stroke Time	Comments
MU59C	MOV	Open	14.13					
		Closed	14.24	12.11	-	16.37	**21.36**	
MU59D	MOV	Open	15.77					
		Closed	15.9	13.52	-	18.28	**23.85**	
MU66A	AOV	Open	2.84					
		Closed	1.67	0.84	-	2.5	**10**	Fail position closed.
MU66B	AOV	Open	4.15					
		Closed	2.95	1.48	-	4.42	**10**	Fail position closed.
MU66C	AOV	Open	3.46					
		Closed	2.67	1.34	-	4	**10**	Fail position closed.
MU66D	AOV	Open	4.01					
		Closed	2.94	1.47	-	4.41	**10**	Fail position closed.
MU3971	MOV	Open	15.97					
		Closed	16.09	13.68	-	18.5	**24.13**	
MU6405	MOV	Open	15.54					
		Closed	15.56	13.23	-	17.89	**23.34**	
MU6421	MOV	Open	14.05					
		Closed	13.65	11.61	-	15.69	**20.47**	
MU6422	MOV	Open	13.17					
		Closed	13.25	11.27	-	15.23	**19.87**	
NN236	AOV	Open	3.87					
		Closed	2.49	1.25	-	3.73	**10**	Fail position closed.
RC2A	PORV	Open	0.48				**2**	
		Closed	0.38				**2**	Fail position closed.
RC10	MOV	Open	11.29					
		Closed	11.37	9.67	-	13.07	**17.05**	
RC11	MOV	Open	17.27	14.68	-	19.86	**25.9**	
		Closed	17.4	14.79	-	20.01	**26.1**	
RC200	MOV	Open	10.95	9.31	-	12.59	**16.42**	
		Closed	10.87	9.24	-	12.5	**16.3**	
RC229A	AOV	Open	10					
		Closed	2.74	1.37	-	4.11	**10**	Fail position closed.
RC229B	AOV	Open	7.21					
		Closed	1.56	0.78	-	2.34	**10**	Fail position closed.

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range	Maximum Allowable Stroke Time	Comments
RC232	AOV	Open	8.86			
		Closed	4.83	2.42 - 7.24	**10**	Fail position closed.
RC239A	MOV	Open	12.94	11 - 14.88	**19.41**	
		Closed	13.03	11.08 - 14.98	**19.54**	
RC240A	MOV	Open	12.08		**18.12**	
		Closed	12	10.2 - 13.8	**18**	
RC240B	MOV	Open	12.01			
		Closed	11.93	10.15 - 13.71	**17.89**	
RC1719A	AOV	Open	4.45			
		Closed	2.87	1.44 - 4.3	**10**	Fail position closed.
RC1719B	AOV	Open	6.41			
		Closed	4.15	2.08 - 6.22	**10**	Fail position closed.
RC1773A	AOV	Open	3.12			
		Closed	1.67	0.84 - 2.5	**10**	Fail position closed.
RC1773B	AOV	Open	3.3			
		Closed	2	1 - 3	**10**	Fail position closed.
RC4608A	SOV	Open	0.94		**2**	
		Closed	0.61		**2**	Fail position closed.
RC4608B	SOV	Open	0.54		**2**	
		Closed	0.33		**2**	Fail position closed.
RC4610A	SOV	Open	0.47		**2**	
		Closed	0.35		**2**	Fail position closed.
RC4610B	SOV	Open	0.24		**2**	
		Closed	0.24		**2**	Fail position closed.
SA2010	AOV	Open	2.98			
		Closed	4.44	2.22 - 6.66	**10**	Fail position closed.
SP6A	AOV	Open	0			
		Closed	5.96		**7**	Fail position closed.
SP6B	AOV	Open	0			
		Closed	6		**7**	Fail position closed.
SP7A	AOV	Open	0			
		Closed	3.96		**12**	Fail position closed.
SP7B	AOV	Open	0			
		Closed	3		**12**	Fail position closed.

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range	Maximum Allowable Stroke Time	Comments
SS235A	AOV	Open	2.47			
		Closed	2.87	1.44 - 4.3	**10**	Fail position closed.
SS235B	AOV	Open	1.18			
		Closed	0.63		**2**	Fail position closed.
SS598	AOV	Open	2.12			
		Closed	4.24	2.12 - 6.36	**10**	Fail position closed.
SS607	AOV	Open	2.96			
		Closed	2.97	1.49 - 4.45	**10**	Fail position closed.
SW1356	AOV	Open	5.29	2.65 - 7.93	**10**	Fail position open.
		Closed	6.99	3.5 - 10.48	**20.97**	
SW1357	AOV	Open	3.87	1.94 - 5.8	**10**	Fail position open.
		Closed	8.107	4.06 - 12.16	**24.32**	
SW1358	AOV	Open	4	2 - 6	**10**	Fail position open.
		Closed	6.26	3.13 - 9.39	**18.78**	
SW1366	MOV	Open	20.1	17.09 - 23.11	**30.15**	
		Closed	20.1	17.09 - 23.11	**30.15**	
SW1367	MOV	Open	19.24	16.36 - 22.12	**28.86**	
		Closed	19.26	16.38 - 22.14	**28.89**	
SW1368	MOV	Open	19.43	16.52 - 22.34	**29.14**	
		Closed	19.41	16.5 - 22.32	**29.11**	
SW1379	MOV	Open	29.84	25.37 - 34.31	**44.76**	
		Closed	29.96	25.47 - 34.45	**44.94**	
SW1380	MOV	Open	27.89	23.71 - 32.07	**41.83**	
		Closed	28.05	23.85 - 32.25	**42.07**	
SW1381	MOV	Open	30.09	25.58 - 34.6	**45.13**	
		Closed	30.2	25.67 - 34.73	**45.3**	
SW1382	MOV	Open	10.38	8.83 - 11.93	**13**	
		Closed	10.45			
SW1383	MOV	Open	10.22	8.69 - 11.75	**13**	
		Closed	10.26			
SW1395	MOV	Open	30.68			
		Closed	31.08	26.42 - 34.15	**34.15**	

STROKE TIME LIMITS AND ACCEPTANCE CRITERIA

Valve	Type	Reference Times		Expected Stroke Time Range			Maximum Allowable Stroke Time	Comments
SW1399	MOV	Open	30.71					
		Closed	30.88	26.25	-	34	**34**	
SW1424	AOV	Open	4.78	2.39	-	7.17	**14.34**	Fail position open.
		Closed	26.23					
SW1429	AOV	Open	5.12	2.56	-	7.68	**15.36**	Fail position open.
		Closed	23.6					
SW1434	AOV	Open	4.79	2.4	-	7.18	**14.37**	Fail position open.
		Closed	25.49					
SW2927	MOV	Open	18.98	16.14	-	21.82	**28.47**	
		Closed	18.46					
SW2928	MOV	Open	18.27	15.53	-	21.01	**27.4**	
		Closed	17.26					
SW2929	MOV	Open	59.35	50.45	-	68.25	**89.02**	
		Closed	59.55	50.62	-	68.48	**89.32**	
SW2930	MOV	Open	50.44	42.88	-	58	**75.66**	
		Closed	50.68	43.08	-	58.28	**76.02**	
SW2931	MOV	Open	56.33					
		Closed	56.58	48.1	-	65.06	**84.87**	
SW2932	MOV	Open	51.41					
		Closed	51.49	43.77	-	59.21	**77.23**	
SW5067	MOV	Open	10.86	9.24	-	12.48	**16.29**	
		Closed	9.8					
SW5068	MOV	Open	19.34	16.44	-	22.24	**29.01**	
		Closed	18.78					

Attachment H

Operability Limits for EDG Voltage and Frequency During Transient Loading

(21 pages follow)

Abbreviations and acronyms used in the evaluation provided in Attachment H are identified in the attachment or presented below.

AC	alternating current	rpm	revolutions per minute
ANSI	American National Standards Institute	s	seconds
ASME	American Society of Mechanical Engineers	Sec.	second
DG	diesel generator	Seq.	sequence
FENOC	FirstEnergy Nuclear Operating Company	Sh.	sheet
HPI	high pressure injection	T	time
Hz	hertz	USAR	Updated Safety Analysis Report
IEEE	Institute of Electrical and Electronics Engineers	V	volt
Int.	interval	Vrms	Voltage root-mean-square
Min. Volt.	minimum voltage	e.g.	for example
kV	kilo-volt	i.e.	that is
kVA	kilo-volt-ampere	=	equals
kVAR	kilo-volt-ampere reactive	%	percent
kW	kilo-watt	+	plus
LOCA	loss of coolant accident	+/-	plus or minus
LOOP	loss of offsite power	ΔV	voltage change
QA	Quality Assurance		

MPR

MPR Associates, Inc.
320 King Street
Alexandria, VA 22314

CALCULATION TITLE PAGE

Client: Davis-Besse (FENOC)	Page 1 of 20 (Attachment A - 1 Page)
Project: Davis-Besse EDG LAR Engineering Support	Task No. 0200-1302-0151
Title: Operability Limits for EDG Voltage and Frequency During Transient Loading	Calculation No. CALC-0200-0151-0001

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QUALITY ASSURANCE DOCUMENT

This document has been prepared, checked, and reviewed/approved in accordance with the QA requirements of 10CFR50 Appendix B and/or ASME NQA-1, as specified in the MPR Nuclear Quality Assurance Program.

MPR Associates, Inc.
320 King Street
Alexandria, VA 22314

RECORD OF REVISIONS

Calculation No.	Prepared By	Checked By	Page: 2
CALC-0200-0151-0001	[signature]	[signature]	

Revision	Affected Pages	Description
0	All	Initial Issue
1	Pages 8 and 9	Corrected typographical errors on pages 8 and 9.

Note: *The revision number found on each individual page of the calculation carries the revision level of the calculation in effect at the time that page was last revised.*

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1.0 INTRODUCTION

1.1 Purpose

The Davis-Besse plant Technical Specifications include periodic Surveillance Requirements (SRs) for the Emergency Diesel Generators (EDGs). Surveillance Requirements SR 3.8.1.2, SR 3.8.1.8 a., SR 3.8.1.8 b., SR 3.8.1.11, SR 3.8.1.14 a., SR 3.8.1.14 b., and SR 3.8.1.15 define performance limits for the EDG voltage and frequency. This calculation documents an EDG transient loading analysis that is based on equipment Operability limits. These limits are not directly tied to the Technical Specification limits or the more stringent design basis limits.

The scope of this calculation does not include evaluating individual component response times with respect to Safety Features Actuation System response time requirements. Steady-state EDG loading is documented in Davis-Besse calculation C-EE-015.03-008, "AC Power System Analysis" (Reference 1).

1.2 Background

In May 2012, FirstEnergy Nuclear Operating Company (FENOC) submitted a License Amendment Request (LAR) to the NRC for the Davis-Besse Nuclear Power Station. The purpose of the proposed LAR was to address a non-conservative plant Technical Specification related to the emergency diesel generator (EDG) output breaker closure voltage permissive. Specifically, the LAR proposed to revise plant Technical Specifications 3.8.1 by changing the minimum voltage acceptance criterion for EDG surveillance testing in Surveillance Requirements 3.8.1.8 and 3.8.1.14 from greater than or equal to 4031 V to greater than or equal to 4070 V.

The NRC staff notified FENOC via email on June 21, 2012 that additional information would be necessary to assess the acceptability of FENOC's LAR. Some of the requested information went beyond the scope of the FENOC LAR and was related to topics addressed in the Westinghouse WCAP-17308-NP, Revision 0, "Treatment of Diesel Generator (DG) Technical Specification Frequency and Voltage Tolerances." Consequently, FENOC withdrew the LAR on July 16, 2012.

MPR previously developed a design basis analysis to address the transient frequency and voltage response of the EDGs to design basis LOOP/LOCA, LOOP Only, and Appendix R load sequencing. The analysis is documented in Davis-Besse calculation C-EE-024.01-011 (Reference 2). The purpose of the calculation was to document an analysis of the voltage and frequency response of the Davis-Besse Emergency Diesel Generators (EDGs) during design basis load transients. The load transients addressed by the evaluation include:

- design basis LOOP/LOCA load sequencing,
- design basis LOOP Only load sequencing,
- individual motor starting transients required for Appendix R fire scenarios, and
- design basis LOOP/LOCA load sequencing using a voltage setpoint of 4088 V and frequency setpoints of 59.5 and 60.5 Hz.

As indicated in the limitations section of C-EE-024.01-011, the analysis results are based on a minimum voltage setpoint of 4200 V, which is the lowest voltage setpoint allowed by the EDG operating procedure. Reference 2 also performs an analysis at voltage setpoint of 4088 V to provide the minimum voltage setpoint required to meet the Safety Guide 9 requirements. To provide the additional information requested by the NRC and support a revised LAR, additional analyses are required. Specifically, the following conditions are not analyzed in the calculation C-EE-024.01-011:

- LOOP/LOCA load sequence below 4088 V and 61.2 Hz frequency. Specifically, Technical Specification requirement stating minimum steady state voltage of 3744 V needs to be validated.
- Load reject at 4400 V and 58.8 Hz frequency. The maximum voltage during the transient shall be less than the overvoltage relay setpoint.

1.3 Approach

This calculation uses the MATLAB/Simulink model developed in Reference 2. This calculation does not revise the overall model, input parameters, or validation results. The model was used to perform the LOOP/LOCA studies to determine the voltage and frequency limits required to ensure equipment operability

The EDG transient analysis model was developed in Reference 2 using the MATLAB and Simulink computer programs. MATLAB is a computer program that provides an integrated computing environment that combines numeric computation, advanced graphics and visualization, and a high-level programming language. Simulink is a software program developed using the MATLAB programming language that works within the MATLAB program environment. Simulink provides an interactive, graphical environment for modeling, simulating, and proto-typing dynamic systems.

The following approach was used in Reference 2 to develop the model and perform the analyses and is provided here for reference only:

- Develop the Model Form. MPR developed a library of MATLAB/Simulink component models for modeling EDG response to large motor loads. The library was used to develop a system model that adequately represents the equipment installed at Davis-Besse. The model components consist of the diesel engine, governor, generator, excitation system (including voltage regulator) and the essential bus loads. The major motor loads (i.e. the 4kV motor loads) were modeled in detail and the smaller 480V loads were modeled as a combination of lumped static (i.e., constant impedance) and constant KVA loads.

- Develop the Model Input Parameters. Each component model requires a number of input parameters. The input parameters were determined based on equipment design information, including available factory acceptance test data. There were some parameters that are field adjustable (e.g. governor gain and reset) and some that have significant uncertainty (e.g. the inertia for most of the motor loads). Some of these input parameters were adjusted, or "tuned," based on EDG response data collected by Davis-Besse during surveillance testing of the EDGs.

- Verification of Model Results. The computer model and associated software used for this analysis is classified under the MPR Quality Assurance (QA) Manual as "working-level" software. As such, the requirements for use of this software consist of (a) verification that the program inputs are correct, (b) verification that the program is applicable for the task, (c) verification that the program correctly performs the operations that affects the results, and (d) documentation of the analysis, verification, and results.

  Verification that the program inputs are correct was performed during the check and review process of the associated calculations. Verification that the program is applicable for the task was performed as part of the review of the associated calculations.

  Verification that the EDG system model (i.e. generator, diesel engine, fuel rack, governor and load models) correctly performs the operations that affect the results was performed by comparing model results to a known test case. The known test case was measured data from EDG surveillance tests. The model was used to predict the frequency and voltage response to the surveillance test load steps for EDG1-1 and EDG1-2 and the model results were compared to the actual measured test results.

  Documentation of the verification results are discussed in Reference 2.

2.0 INPUTS

The EDG MATLAB/Simulink model was developed in Reference 2 and is directly used here. The inputs for the MATLAB/Simulink model were verified in Reference 2. No new design inputs were required for this calculation.

3.0 ACCEPTANCE CRITERIA

The acceptance criteria for this calculation are listed in Table 1 below. Sections 3.1 through 3.4 provide detailed discussion of these acceptance criteria.

Table 1. Summary of Acceptance Criteria

Description		Value (Note 1)	Section No.
Minimum Allowable Essential 4160 V Bus Voltage	Starting	67.31 %	Section 3.1
	Steady State	86.54 %	
Worst Case Minimum Allowable Essential 480 V MCC Voltage	Starting	68.69 %	Section 3.1
	Steady State	90.60 %	
Maximum Steady State 4160 V Bus Voltage		105.76%	Section 3.2
Maximum Steady State 480 V Bus and MCC Voltage		105.41%	Section 3.2
EDG Maximum Voltage During Transients (For Largest Load Reject Case)		109.4%	Section 3.2
EDG Maximum Voltage During Transients (For Full Load Reject Case)		224.0%	Section 3.2
EDG Minimum Allowable Frequency (Based on Safety Guide 9)	Steady State	58.8 Hz	Section 3.3
	Transient	57 Hz	
	Transient Recovery Time (sec.)	40 % of Load Seq. Time Int.	
EDG Maximum Allowable Frequency (Based on Overspeed Trip Setpoint)		66.75 Hz	Section 3.4

Note 1: The percent voltage values are based on bus rating of 4160 V and 480 V.

3.1 Minimum Voltage

The minimum bus voltage acceptance criteria is based on the following:

1. Minimum 4160 V essential bus voltage for motor starting and steady state condition.
2. Minimum 480 V essential MCC voltage for motor starting and steady state condition. This also includes minimum voltage required to pickup motor starters.

The minimum 4160 V and 480 V bus voltages during motor starting and steady state conditions are established in the Davis-Besse AC systems analysis calculation C-EE-015.03-008 (Reference 1). Attachment 3 of C-EE-015.03-008 provides these voltages. The minimum steady state and motor starting bus voltages are based on motor rated steady state and starting voltage, 480 V motor starter contactor holding and dropout voltages, and minimum voltages for other 480 V components such as regulated rectifier, radiation monitor, hydra motors, etc.

For the 4160 V essential buses, the minimum steady state and transient voltages are based on minimum continuous motor running and motor starting voltages.

For the 480 V buses and MCCs, the minimum steady state voltage is based on several factors and will depend on the MCC/bus:

a. 480 V bus and MCC minimum continuous motor running voltage
b. Motor starter contactor pickup voltage
c. Battery charger minimum steady state voltage
d. Minimum steady state voltage requirement for constant voltage transformers (CVTs)
e. Minimum steady state voltage requirement for regulated rectifier
f. Minimum steady state voltage requirement for hydra motors

Based on Attachment 3 of Reference 1, the most limiting 480 V MCC minimum bus voltage requirement is 90% (of 480 V) based on the regulated rectifier voltage requirement on MCCs E12A and F12A. For motor starting conditions, the minimum 480 V bus and MCC voltages are based on minimum motor starting voltage and motor starter contactor holding voltage. The minimum voltage for 480 V buses and MCCs during motor starting conditions is 68.69% (of 480 V) (See Table 2).

The EDG MATLAB/Simulink transient calculation (Reference 2) models the Davis-Besse essential 480 V MCCs as a single lumped load. Therefore, the voltage drop for each MCC is not known from the simulation results. Further, the Simulink model also assumes no voltage drop from the 480 V buses to the 480 V MCCs. A voltage drop from the 480 V buses to the MCCs was determined in Section 5.0 (Assumption and Limitations) and was added to the 480 V MCC acceptance criteria.

Table 2 below summarizes the minimum bus voltage acceptance criteria for this calculation:

Table 2. Minimum Bus Voltage Acceptance Criteria

Bus Level	Motor Starting (% Voltage)	Steady State (% Voltage)
4160 V Essential Buses	67.31	86.54
480 V Essential Buses and MCCs (Note 1)	68.69	90.60

Notes:

1. The MCC bus voltage acceptance criteria assumes additional voltage drop as documented in Section 5.0.

The voltage acceptance criteria listed in Table 2 are less than the minimum required bus voltage to provide EDG output breaker closure permissive (3990 V +/- 2%). These criteria bound the EDG breaker closure permissive voltage. The EDG output breaker will receive a permissive to close for bus voltage of 3990 V +/-2% (Reference 7). Technical Specification Surveillance Requirement require a minimum bus voltage of 4070 V to close the breaker. This voltage is based on 3990 V + 2% (95.91% + 2%) tolerance from Reference 7.

3.2 Maximum Voltage

The maximum established steady state 4160 V bus voltage is 105.76% and the maximum steady state 480 V bus and MCC voltage is 105.41% (Reference 1, Attachment 3). The steady state voltage for the essential buses shall be less than the limits specified above.

The overvoltage relay setpoint for the EDG output breaker is 4550 V (Reference 4). The overvoltage relay provides alarm in the control room during EDG output overvoltage conditions. Therefore, transient voltage during load rejection shall be less than the EDG output breaker overvoltage alarm setting. Furthermore, per ANSI C37.06 and IEEE C37.20.2 (References 11 and 12, respectively), the maximum rated voltage for 4.16 kV circuit breakers and metal clad switchgears, respectively, is 4.76 kV. Therefore, the maximum voltage acceptance criteria of 4550 V bounds the breaker and bus maximum voltage ratings.

For a full load rejection, the EDG is considered disconnected from the 4160 V essential bus. Therefore, for full load rejection, the maximum allowable EDG voltage rating is considered. Per EDG test report M-180-93-3 (Reference 13), the Davis-Besse EDG was tested at 9320 V for 1 minute. The testing voltage was established per the requirements of ANSI C50.10 (Reference 14) which requires the test voltage to be "1000 V plus twice the rated voltage of the machine." Therefore, the transient voltage during a full load reject shall be less than 9320 V and recover to the voltage setpoint in less than 1 minute.

3.3 Minimum Frequency

This calculation does not explicitly evaluate the response time of individual components. Consequently, for minimum allowable frequency, the acceptance criteria established by Safety Guide 9 are used. Safety Guide 9 requirement states that the frequency shall not fall below 57 Hz (95% of nominal) and should be restored above 58.8 Hz (within 2% of nominal) in less than 40 percent of each load sequence time interval.

3.4 Maximum Frequency

For maximum allowable frequency, the acceptance criteria established by Safety Guide 9 for maximum allowable frequency during load transient is used. The Safety Guide 9 requirement for the maximum allowable frequency is stated below:

> "During recovery from transients caused by step load increases or resulting from disconnection of the largest single load, the speed of the diesel generator set should not exceed 75 percent of the difference between nominal speed and the overspeed trip setpoint or 115 percent of nominal, whichever is lower."

The Davis-Besse EDG output breaker overfrequency trip is set at 115% of nominal (60 Hz) (=69 Hz). Therefore, the EDG frequency shall not exceed 75% of the difference between the nominal frequency (60 Hz) and the overspeed setpoint (69 Hz). This frequency is 66.75 Hz.

4.0 SUMMARY OF RESULTS

The EDG transient analysis results from Section 7.0 are summarized below:

1. **Minimum Voltage:** The minimum EDG terminal voltage required to maintain adequate motor starting and steady state voltage is 3850 V.

2. **Maximum Voltage:** The maximum EDG steady state voltage required to maintain adequate bus voltage during load loss transients is 4400 V. Operating the EDG at a maximum steady state voltage of 4400 V in conjunction with a largest load rejection transient results in transient voltages less than 4550 V (109.4% of 4160 V), i.e., EDG overvoltage alarm setpoint.

   Furthermore, during full load rejection, the EDG terminal voltage does not exceed the EDG maximum test voltage of 9320 V and recovers to the EDG setpoint of 4400 V within 60 seconds.

3. **Minimum Frequency:** The minimum EDG frequency setpoint required to meet the Safety Guide 9 requirements is 59.17 Hz (887.5 rpm). At this frequency, the EDG frequency recovers to 98% of nominal (58.8 Hz) within 40% of the each load sequence time interval. The frequency does not drop below 95% of nominal. The most limiting

time interval is between the first and the second load step which is 2.5 seconds. Safety Guide 9 recovery time for this load step is 1 second.

4. **Maximum Frequency:** The maximum EDG frequency setpoint of 61.2 Hz satisfies the requirements of maximum allowable EDG frequency transient during large load and full load rejections.

5. **EDG Loading:** The maximum EDG steady state loading at the maximum voltage setpoint of 4400 V and frequency setpoint of 61.2 Hz is 2413 kW and 1610 kVAR, which is less than the EDG steady state loading limit of 2600 kW and 1950 kVAR.

5.0 ASSUMPTIONS AND LIMITATIONS

This calculation is not a design basis calculation. The purpose of this calculation is to provide bounding EDG terminal voltage and frequency to support an Operability evaluation.

For further assumptions and limitations, see EDG Transient Response Evaluation calculation C-EE-024.01-011 (Reference 2).

Assumptions associated with MCC voltage acceptance criteria are discussed below.

MCC Minimum Voltage Acceptance Criteria

The EDG MATLAB/Simulink transient calculation (Reference 2) models the Davis-Besse essential 480 V MCCs as a single lumped load. Therefore, the voltage drop for each MCC is not known from the simulation results. Further, the Simulink model also assumes no voltage drop from the 480 V buses to the 480 V MCCs.

The AC Systems Analysis calculation, C-EE.015-008 (Reference 1), provides the worst case voltage drop from the 480 V E1/F1 buses to the respective essential MCCs. Table 3 below provides the worst case voltage drop from the 480 V buses to the MCCs

Table 3. Minimum Bus Voltage Acceptance Criteria (Reference 1, Attachment 23A and 23B)

Condition	480 V Bus	Min. Volt.	Case	MCC	Min. Volt.	Case	ΔV
Steady State	E1	94.85%	LF4h	E12D	94.30%	LF4h	0.55%
	F1	95.39%	LF4h	F12D	94.91%	LF4h	0.48%
Motor Starting	E1	75.06%	ST1k2	E12F	74.00%	ST1k2	1.06%
	F1	76.94%	ST1k2	F11D	75.35%	ST1j	1.59%

Table 3 shows that the worst case voltage drop to the MCCs during motor starting and steady state conditions are 0.55% and 1.59%, respectively. Therefore, 0.6% and 1.6% have been added to the acceptance criteria for the MCC minimum steady state and starting voltages, respectively.

This is a conservative assumption because it assumes the same voltage drop at all MCCs. This assumption does not require verification.

6.0 ANALYSIS CASES AND METHODOLOGY

Case 2 of C-EE-024.01-011 simulates a design basis LOOP/LOCA with 480V MCCs and Component Cooling Water Pump (CCWP) starting at breaker closure and MUP starting at 2.5 seconds after breaker closure. Case 2 assumes a cold generator field. Loading sequence of Case 3 of Reference 2 is similar to Case 2 but assumes a hot generator field. For both cases the voltage and frequency setpoints were 4160 V and 900 rpm, respectively.

The voltage and frequency setpoints for these cases were modified to perform the analysis provided in this calculation. The description of the cases and the underlying methodology is provided in the following sections.

6.1 Minimum Voltage Case, Case 3A-V

The minimum voltage case was performed using loading conditions of Case 3 from Reference 2. The voltage setpoint of 3744 V was used and the value was raised until acceptance criterion 3.1 was met. A system frequency of 61.2 Hz (918 EDG rpm) was used. The motor load increases with increase in frequency. Therefore, using a higher frequency setpoint is more conservative for determining minimum EDG terminal voltage is conservative.

6.2 Minimum Frequency Case, Case 3A-F

The minimum frequency case was performed using the loading conditions and resultant voltage setpoint (3850 V) from Section 6.1 above. An initial frequency setpoint of 58.8 Hz was used (882 rpm). The frequency was increased until the requirements of acceptance criterion 3.3 was met.

6.3 Maximum Voltage and Frequency Case, Case 2A-LL and 2A-FL

The maximum voltage and frequency cases were performed using the loading conditions of Case 2 from Reference 2.

The voltage and frequency setpoints of 4400 V and 61.2 Hz (918 rpm) were used, respectively.

Two loading cases, Case 2A-LL and 2A-FL, were evaluated. Case 2A-LL was performed to simulate the tripping of the largest load (High Pressure Injection pump motor). Case 2A-FL was performed to simulate full load reject.

The voltage plots in Section 7.0 provide the voltage transient after the load rejection. The voltage transients during load addition are not shown.

7.0 RESULTS

Sections 7.1 to 7.3 document the predicted EDG voltage and frequency, and MCC bus voltage for the motor starting and load reject cases detailed in Section 6.0. Sections 7.1 to 7.3 include plots of EDG voltage, EDG frequency, and MCC voltage during the transient. Preceding the plots is a summary that compares the minimum and maximum voltage and frequency acceptance criteria established in Section 3.0.

7.1 Minimum Voltage Case, Case 3A-V

The minimum voltage setpoint to meet acceptance criterion 3.1 is 3850 V. Figure 1 and Figure 2 provide the EDG terminal frequency and voltage, and MCC voltage during the transient, respectively. As shown in the figures, the MCC voltage is the most limiting. At a 3850 V setpoint both EDG terminal voltage and the MCC voltage meet acceptance criterion 3.1.

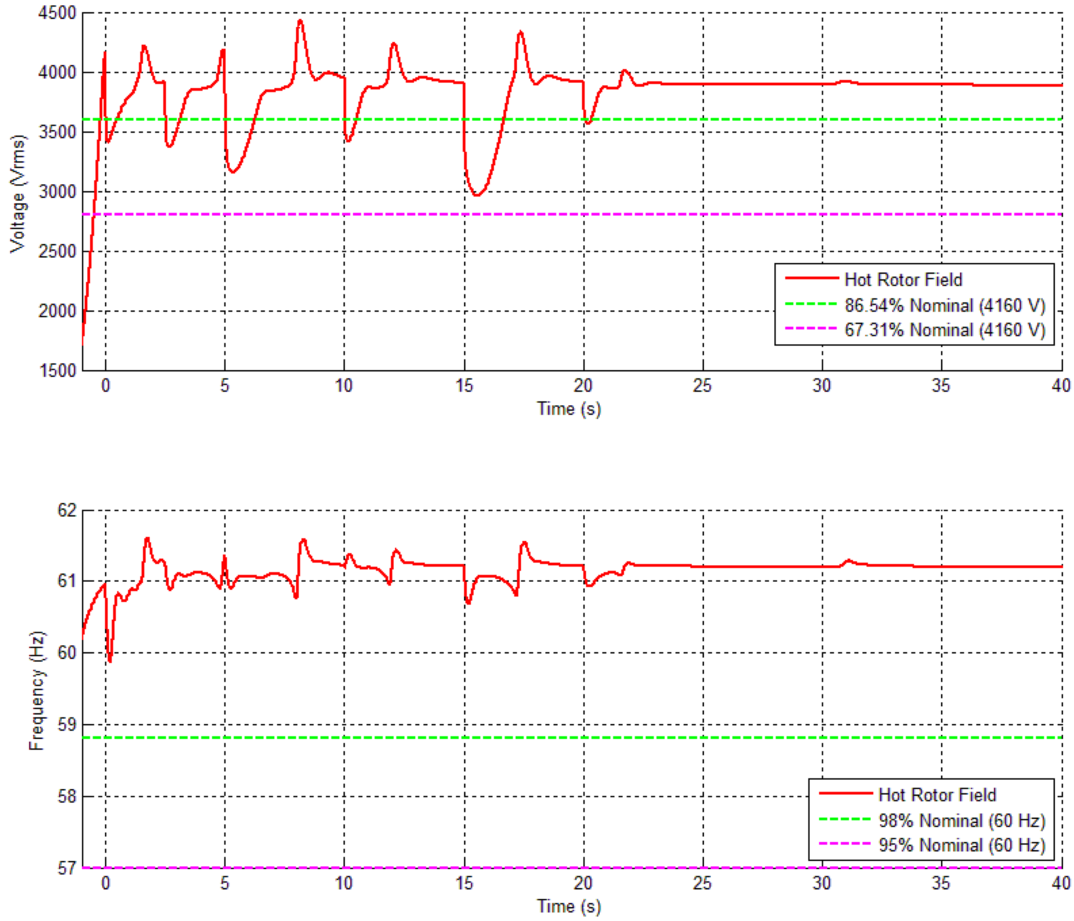


Figure 1. Minimum Voltage Analysis Case 3A-V - EDG Terminal Voltage and Frequency
Voltage Setpoint = 3850 V
Frequency Setpoint = 61.2 Hz (918 rpm)

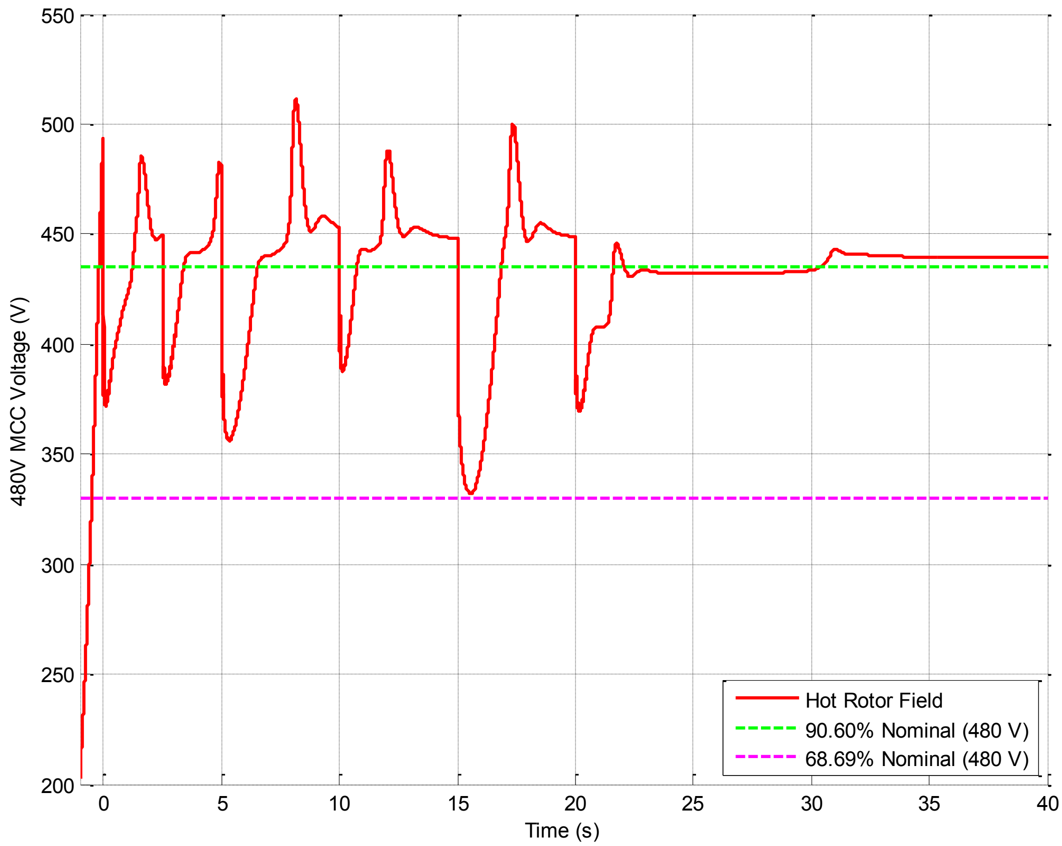


Figure 2. Minimum Voltage Analysis Case 3A-V - MCC Voltage

7.2 Minimum Frequency Case, Case 3A-F

The voltage setpoint was fixed at the 3850 V setpoint established in Section 7.1. The minimum frequency was varied to meet the acceptance criterion 3.3. The frequency response in Figure 3 provides the maximum time by which the frequency should recover above 98% of nominal. The acceptance requirement is shown by vertical bars on the figure. The minimum frequency required to meet the acceptance criterion 3.3 is 59.17 Hz (887.5 rpm).

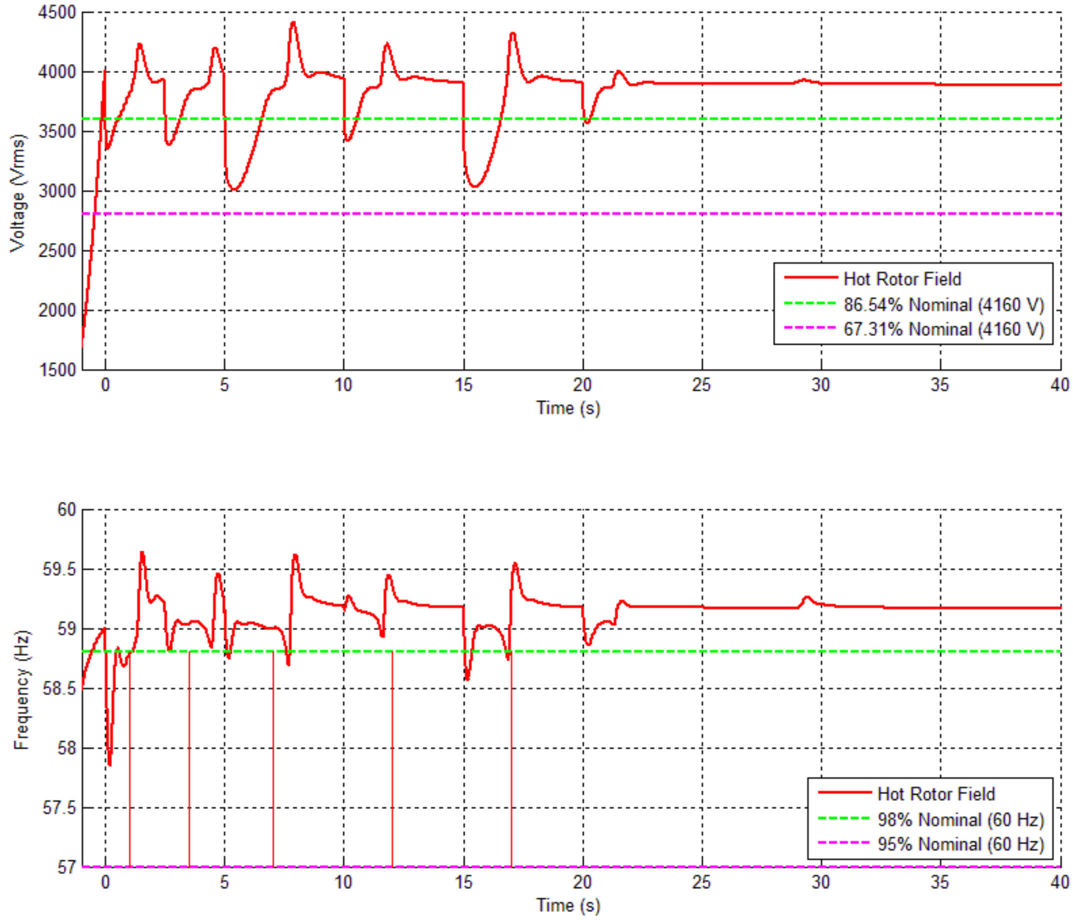


Figure 3. Minimum Frequency Analysis Case 3A-F - EDG Terminal Voltage and Frequency Response
Voltage Setpoint = 3850 V
Frequency Setpoint = 59.17 Hz (887.5 rpm)

7.3 Maximum Voltage and Frequency

The maximum voltage and frequency cases were simulated for both large load and full load reject. The cases are discussed in the subsections below. For both cases, prior to the trip of the largest load or the full load, the EDG steady loading will be the same. The EDG steady state loading will be maximum at maximum voltage and frequency. This is because at maximum voltage, resistive loads draw maximum current and at maximum frequency motor loads draw maximum current. The EDG steady state load during this condition is 2413 kW and 1610 kVAR as shown in Figure 4 below.

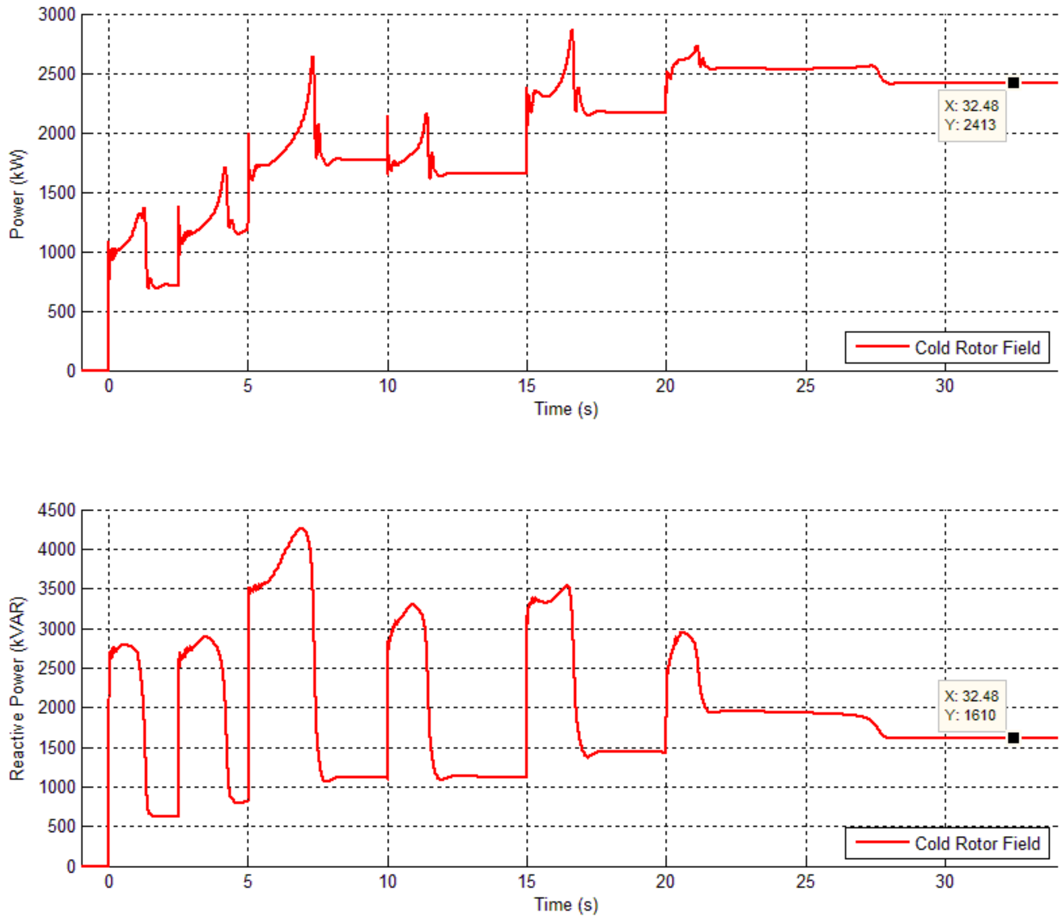


Figure 4. Maximum Voltage and Frequency Analysis - EDG Output Real and Reactive Power
Voltage Setpoint = 4400 V
Frequency Setpoint = 61.2 Hz (918 rpm)

7.3.1 Large Load Reject, Case 2A-LL

For the large load reject case, the largest essential load (the HPI pump motor) was tripped at T=30s in the simulation time step. The EDG terminal voltage and frequency response are provided in Figure 5. The voltage and frequency response meet the requirements of acceptance criteria 3.2 and 3.4.

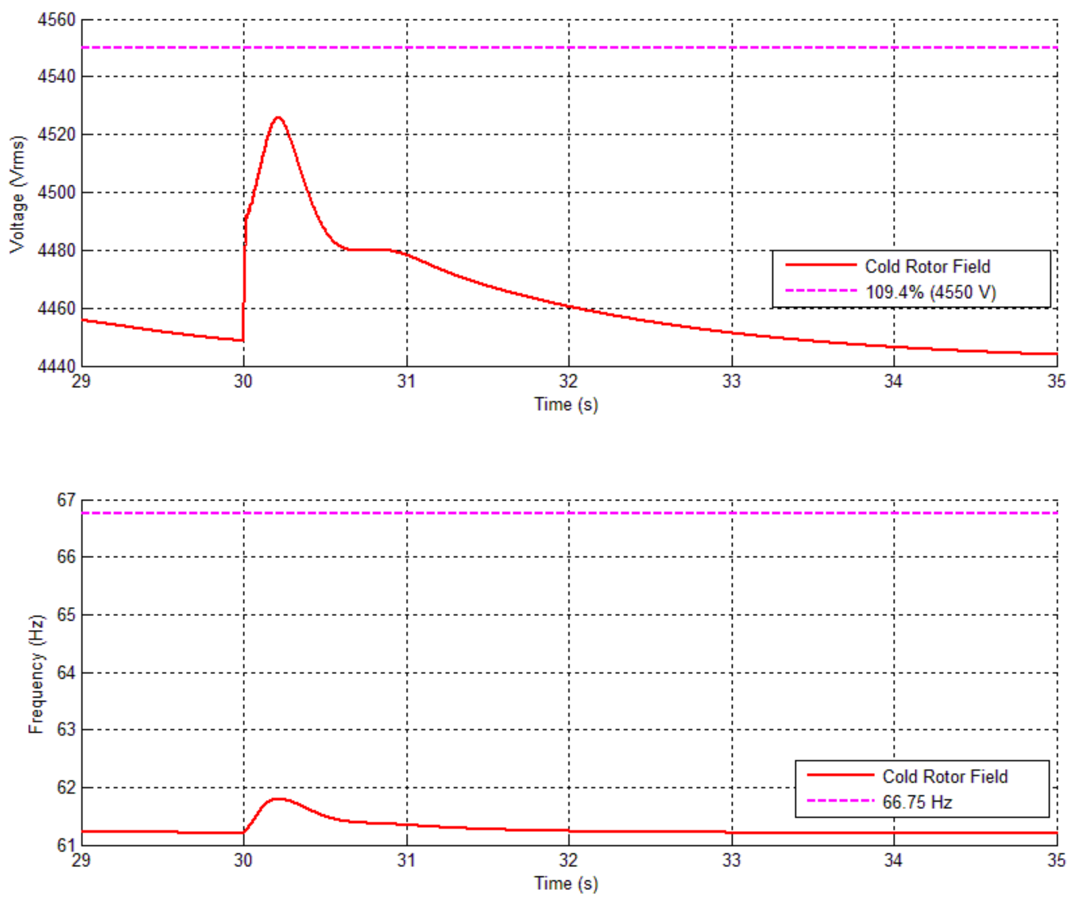
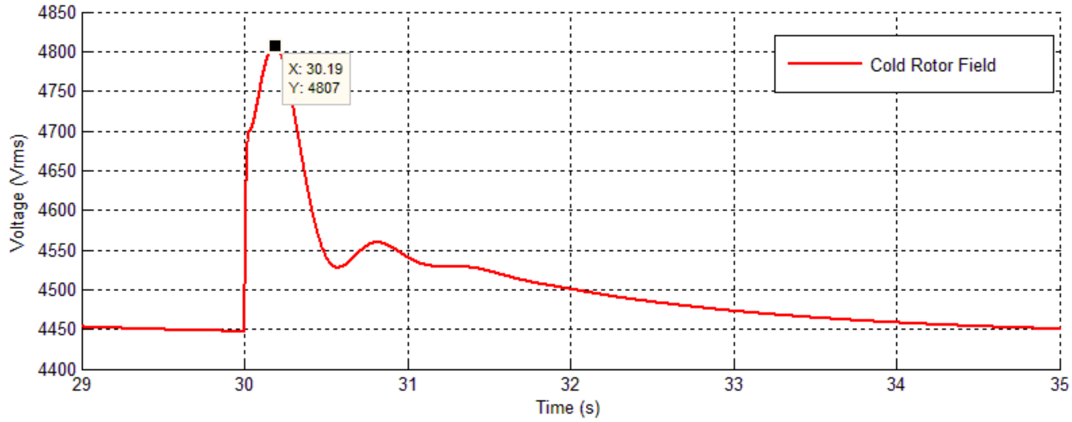


Figure 5. Large Load Reject Analysis Case 2A-LL - EDG Terminal Voltage and Frequency
Voltage Setpoint = 4400 V
Frequency Setpoint = 61.2 Hz (918 rpm)

7.3.2 Full Load Reject, Case 2A-FL

For the full load reject case, all loads were tripped at T=30s in the simulation time step. The EDG terminal voltage and frequency response are provided in Figure 6. The maximum voltage due to the full load reject transient is 4807 V. The voltage recovers to a steady state voltage of 4450 V within 5 seconds. The voltage response meets the requirements of maximum voltage acceptance criterion 3.2 for full load rejection. The frequency response meets the requirements of acceptance criterion 3.4.



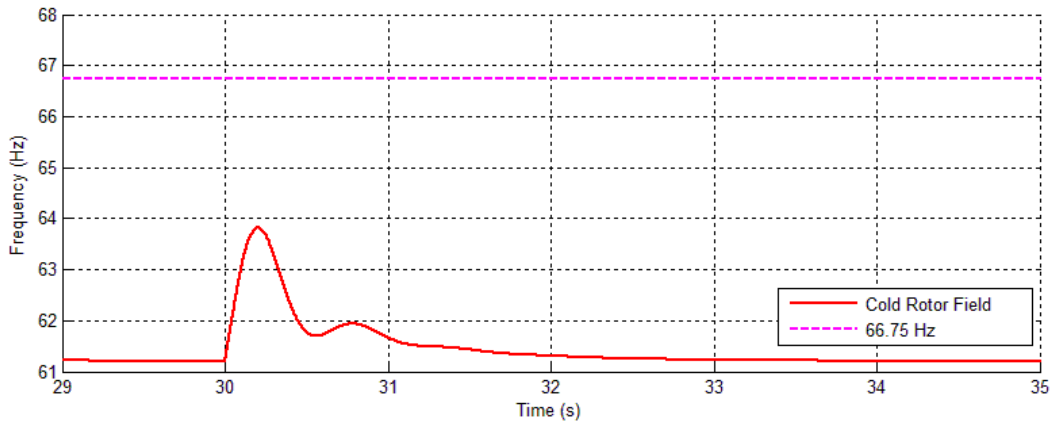


Figure 6. Full Load Reject Analysis Case 2A-FL - EDG Terminal Voltage and Frequency
Voltage Setpoint = 4400 V
Frequency Setpoint = 61.2 Hz (918 rpm)

Calculation No.	Prepared By	Checked By	Page: 20
CALC-0200-0151-0001	[signature]	[signature]	Revision: 0

8.0 REFERENCES

1. Davis-Besse Calculation C-EE-015.03-008, AC Power System Analysis, Revision 5.
2. Davis-Besse Calculation C-EE-024.01-011, Evaluation of Davis-Besse EDG Transient Response During Design Basis LOOP/LOCA, LOOP Only and Appendix R Loading, Revision 2.
3. Davis-Besse Drawing M-180Q-14, Schematic Diagram of Engine Control, Revision 13.
4. Davis-Besse Relay Setting Manual Volume 1 Tab 02 Sheet 024A, Emergency DG 1 Control and Relay Board, Revision 7.
5. Davis-Besse Drawing E-64B Sh. 1A, Emergency Diesel Generators, Diesel Generator 1-1 Breaker AC101 Control, Revision 13.
6. Davis-Besse Drawing M-180-31 Sh. 2, EDG Excitation System Interconnection Diagram, Revision 23.
7. Davis-Besse Drawing M-180-31 Sh. 3, EDG Excitation System Interconnection Diagram, Revision 23.
8. Davis-Besse USAR, Revision 26.
9. Davis-Besse Technical Specifications, Amendment 279.
10. Davis-Besse Systems Procedure DB-OP-06316, Diesel Generator Operating Procedure, Revision 48.
11. ANSI C37.06-2000, AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities.
12. IEEE Standard C37.20.2-1999, IEEE Standard for Metal Clad Switchgear.
13. Davis-Besse EDG Serial Number 172217211 Data Sheet (M-180-93-3).
14. ANSI C50.10-1977, General Requirements for Synchronous Machines.

A

Timestamps for Simulation Files

Table A-1. Timestamps for MATLAB/Simulink Files

Filename	Timestamp (EDT)	File Size (KB)
case_3A_F.m	8/27/2013 11:22	4
case_3A_V.m	8/27/2013 11:22	4
case_2A_FL.m	8/27/2013 11:24	4
case_2A_LL.m	8/27/2013 11:24	4
db_edg_rev6.mdl	11/1/2013 16:56	680
design_data_rev6.m	7/5/2011 17:41	16