Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

June 7, 2012

10 CFR 50.34(b)

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

Watts Bar Nuclear Plant Unit 2
Docket No. 50-391

Subject: **Watts Bar Nuclear Plant (WBN) Unit 2 – NUREG-0847 Supplemental Safety Evaluation Report (SSER) Related to the Operation of Watts Bar Nuclear Plant, Unit 2, Appendix HH Open Item 30 - Power System Degraded Voltage**

References:
1. TVA letter to NRC dated August 12, 2011, "Watts Bar Nuclear Plant (WBN) Unit 2 - Safety Evaluation Report Supplement 22 (SSER22) - Response to NRC Required Action Item"
2. NRC Regulatory Issue Summary (RIS) 2011-12, Revision 1, "Adequacy of Station Electrical Distribution System Voltages"

The purpose of this letter is to update the information provided in Reference 1 related to the offsite and onsite power system degraded voltage studies for safety-related electrical equipment. The enclosed information provides a study that shows the impact of using a methodology that meets the intent of the guidance provided in Reference 2. The information provided in the enclosure and associated attachments demonstrates that the plant design conforms to the applicable regulatory requirements.

There are no new regulatory commitments contained in this letter. If you have any questions, please contact Gordon Arent at (423) 365-2004.

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NRL

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 7th day of June, 2012.

Respectfully,

R. A. Hruby, Jr.

Raymond A. Hruby, Jr.
General Manager, Technical Services
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Enclosure: WBN Unit 2 Degraded Voltage Study

cc (Enclosure):

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ENCLOSURE
WBN Unit 2 Degraded Voltage Study

SER Open Item 30

TVA should confirm that all safety-related equipment (in addition to the Class 1E motors) will have adequate starting and running voltage at the most limiting safety-related components (such as motor-operated valves (MOVs), contactors, solenoid valves or relays) at the DVR setpoint dropout setting. TVA should also confirm that (1) the motor-starting transient studies are based on the dropout voltage value of DVR and time delay, (2) the steady-state voltage drop studies are carried out by maximizing running loads on the Class 1E distribution system (bounding combination of safety systems loads), with the voltage at 6.9-kV Class 1E buses (monitored by the DVRs) at or just above the DVR dropout setting, and (3) the DVR settings do not credit any equipment operation (such as LTC transformers) upstream of the 6.9-kV Class 1E buses. TVA should also confirm that the final technical specifications (TSs) are properly derived from these analytical values for the degraded voltage settings. This is Open Item 30.

TVA response:

TVA has performed an auxiliary power system study to update our response to this open item. A copy of the study and two appendices and one attachment to the study are provided in Attachment 1 below. This study was performed as a sensitivity analysis to determine if there is any impact on the Degraded Voltage Relay (DVR) setpoint and/or plant response if the current methodology is changed. This study did not credit any equipment operation (such as Load Tap Change [LTC] transformers) upstream of the 6.9 kV Class 1E buses. The methodology used in this study was developed to meet the intent of Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electrical Distribution System Voltages". The RIS states that the protective function of the DVR setpoint is to ensure adequate starting voltage to all Class 1E equipment for all operating and accident conditions. Additionally, the RIS states that the DVR setpoint must be based on the starting voltage requirement at the terminal of the most limiting component and must account for the effect of all components which could affect voltage; this includes offsite power circuits, the plant distribution system, as well as all Class 1E and non-Class 1E loads. However, the RIS does not prescribe a specific methodology to be used for the motor starting analysis, and there is no industry consensus as to how to best address DVR protection for motor starting scenarios. In actuality, the ability to start motors **cannot** be determined by monitoring voltage alone. The ability to start motors can only be determined by power system ***capacity***, which is the ability to maintain voltage while providing the required starting current. Therefore, the premise of using a voltage relay to protect motor starting ability requires an assumption of the power source capacity, which seems inconsistent with the stated purpose of the DVR protective function.

Considering these constraints, TVA used an analytical approach to determine if the DVR setpoint provides the minimum required voltages at the terminals of the Class 1E loads during motor starting (automatic starting during a design basis event or individually) while still connected to the preferred offsite power source. The following Class 1E motor starting scenarios were evaluated:

1. Dynamic Motor Starting – Safety Injection Signal Phase A (SIA)
2. Dynamic Motor Starting – Safety Injection Signal Phase B (SIB)
3. Static Motor Starting (starting individual motors). This analysis is performed with SIA since Safety Injection Signal Phase A provides the worst case voltages on the 480 V system. For this analysis, a motor starting study case is generated to individually start each Class 1E motor.

To perform the above analysis, the 6.9 kV shutdown boards were disconnected from all offsite power source(s) and a dedicated fixed voltage source was added to each 6.9 kV shutdown board (6.9 kV shutdown board was used as a swing bus). The source voltage was set to the DVR analytical dropout limit of 6555 V.

This study concludes:

1. That adequate starting voltage is available to each Class 1E load when the 6.9 kV Shutdown Boards are at the DVR dropout setpoint (analytical limit) for the following cases:

    - During a design basis event (DBE): all Class 1E loads that are automatically actuated for a safety injection signal (SI-Phase A or SI-Phase B).
    - When individually starting a motor (single motor start): all Class 1E loads, even if not SI-actuated.

2. The study shows that for a sustained degraded voltage condition, overcurrent protective devices associated with Class 1E loads will not trip during SI-actuated motor starting and subsequent start on the emergency diesel generator.

3. The bounding voltage recovery analysis demonstrates that any possible voltage transient caused by DBE motor starting, including drop to the loss of voltage (LOV) setpoint, will also result in successful recovery above DVR reset within 4 seconds.

With respect to the contactors, relays and solenoid valves, adequacy of pickup voltage for these control components was performed as part of the Control Circuit Voltage Drop (CCVD) analysis. This analysis was performed considering a steady state minimum voltage of 432 V at the motor control center (MCC) bus. All the components were determined to have adequate pickup voltage upon implementation of issued design changes as identified in the CCVD calculation. Implementation of these design changes is scheduled to be completed prior to Unit 2 fuel load.

The MCC transient bus voltage under degraded voltage conditions (at DVR dropout voltage of 6555 V) drops below 432 V due to starting of large motors on the 480 V switchgear. This voltage recovers to a value of >432 V within 4 seconds. Since the startup of the safety-related equipment may not have adequate starting voltage due to transient voltage conditions, Westinghouse evaluated the impact of an additional 5 second delay for the startup of the safety injection pumps and feedwater isolation valves with offsite power available, and concluded the following: "This safety evaluation concludes that an additional five second delay for the startup of the safety injection pumps and an additional five second delay in the closure of the feedwater isolation valve does not impact the conclusions of the safety analysis that form the Watts Bar licensing basis (SECL-92-029; RIMS No. T33930330990)."

Based on the above, TVA considers that the analysis performed to verify adequacy of available voltage for the contactors, solenoid valves, and relays is adequate and no further analysis under the transient voltage conditions needs to be performed.

In conclusion, TVA confirms that safety-related equipment will have adequate starting and running voltage and that the Technical Specifications for degraded voltage settings are properly derived and appropriate.

Attachment

Excerpts from Sensitivity Study of Degraded Voltage Relay(DVR) Protection During Motor Starting STUDY-EEB-WBN-12-001, Rev. 1

1) Write up for Sensitivity Study
2) Appendix A for Evaluation of Class 1E Motor Starting Voltages
3) Appendix B for Degraded Voltage Relay LOV Voltage Recovery Analysis
4) Attachment 2 for Degraded Voltage Relay Settings

1.0 Purpose

The purpose of this study is to address the issues concerning degraded voltage relay (DVR) protection at WBN as documented in:

1. WBN NCV 05000390/2010005-003 "Failure to Use Worst Case 6900 VAC Bus Voltage in Design Calculations"
2. Watts Bar (WBN) Unit 2 NUREG-0847, Supplement 22, RAI Item 30
3. Recent regulatory developments in the industry with respect to DVR protection and analysis including NRC Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electrical Distribution System Voltages"

These issues can be summarized as the need to determine if the DVR setpoint provides the minimum required voltages at the terminals of the Class 1E loads during motor starting (automatic starting during a design basis event or individually) while still connected to the preferred offsite power source.

Currently, the DVR analytical limit is determined by the Degraded Voltage Analysis calculation (Ref. 2.1), using methodology consistent with industry standard IEEE Std. 741-1997 and station licensing basis. The DVR setpoint methodology has not previously considered motor starting voltage as a basis of the relay setpoint. This study is being performed as a sensitivity study to see the impact to the setpoint and/or plant response if the current methodology is changed.

1.1 Scope

This study determines if adequate starting voltage is available to each Class 1E load when the 6.9kV Shutdown Boards are at the DVR dropout setpoint (analytical limit) for the following cases:

- During a design basis event (DBE): all Class 1E loads that are automatically actuated for a safety injection signal (SI-Phase A or SI-Phase B).
- When individually starting a motor (single motor start): all Class 1E loads, even if not SI-actuated.

This study will also show that for a degraded voltage condition[1], overcurrent protective devices associated with Class 1E loads will not trip during SI-actuated motor starting and subsequent start on the emergency diesel generator.

This analysis is performed for both Unit 1 and Unit 2.

2.0 References

2.1 Calculation WBNEEBMSTI060029, Revision 33 "Degraded Voltage Analysis"

2.2 Calculation EDQ00099920070002, R22, "AC Auxiliary Power System Analysis (dual unit operation)"

2.3 Calculation WBNEEBEDQ1999010001, R75, "AC Auxiliary Power System Analysis"

2.4 NRC Regulatory Issue Summary (RIS) 2011-12, Revision 1, "Adequacy of Station Electrical Distribution System Voltages"

2.5 Watts Bar (WBN) Unit 1 NCV 05000390/2010005-03, "Failure to Use Worst Case 6900 VAC Bus Voltage in Design Calculations"

2.6 Watts Bar (WBN) Unit 2 NUREG-0847, Supplement 22, "Safety Evaluation Report Related to the operation of Watts Bar Nuclear Plant, Unit 2", RAI Item 30

2.7 Calculation WBNEEBMSTI060010, R76, "Auxiliary Power System Analysis on 1E Buses" (Historical Reference)

[1] A degraded voltage condition is when the 6.9kV Shutdown Board voltage drops below the DVR setpoint, but not below the loss of voltage (LOV) setpoint, and does not recover.

2.8 Calculation WBPE2119202001, R8, "6.9kV Shutdown Logic Boards Undervoltage Relays Requirements/Demonstrated Accuracy Calculation"

2.9 Limitorque Maintenance Update 92-2 (RIMS L33930113 803) - Extract from Design Guide DG-E2.4.6

2.10 TVA General Engineering Specification DS-E9.4.1, R1, Selection and Specifications of Motors

2.11 NEMA MG-1-1998, Motors and Generators

2.12 PER 298321

3.0 Bases/Assumptions

3.1 The DVR dropout analytical limit (6555V) as determined in the Degraded Voltage Analysis calculation (Ref. 2.1) will be used to determine the available starting voltage.

3.2 The ETAP model used to perform offsite power analysis for dual unit operation (Ref. 2.2) is used to perform the motor starting analysis.

3.3 All process controlled loads (random loads) are conservatively considered to start at zero seconds in a DBE.

3.4 The Phase A Start Sequence evaluates a Safety Injection Initiation without receipt of a Phase B Containment Isolation (High Containment Pressure). The Phase B Start Sequence evaluates a Safety Injection Initiation with receipt of a Phase B Containment Isolation.

The short term steady state loading at the 480V level is higher during a Phase A start sequence than during a Phase B and results in a lower voltage at the 480V busses. However, piping breaks associated with a Phase A Start Sequence are small and will result in ECCS equipment being removed from service within a short period after the event (less than an hour). This will result in a much lower overall long term loading for a Phase A event when compared to a Phase B.

This study uses short term Phase A loading for the single motor start analysis since it is the most conservative loading. If, however the starting voltage (480V) is not acceptable using the Phase A loading, then Phase B loading is used provided:

- The load is only required for a Phase B event, or
- The load is required to be manually started at a time that is at least 2 hours after the initiation of a Phase A event.

This assumption is conservative since the long term 480V loading for a Phase B event is higher than for a Phase A event.

3.5 The 89-10 MOVs for WBN2 utilize motor actuators which have 'hammer-blow' feature, which allows the motor to start turning prior to engaging the mechanical load of the operator (i.e. start unloaded). The actual motor current draw is typically 50% of the full locked-rotor current (Ref. 2.9). Initially all MOVs are evaluated using full locked-rotor current but if the available voltage does not meet the required voltage criteria, the available voltage is re-calculated taking credit for the 'hammer-blow' feature. These MOVs are identified in Appendix A.

4.0 Methodology/Approach

The methodology used in this study was developed to meet the intent of Regulatory Issue Summary (RIS) 2011-12, "Adequacy of Station Electrical Distribution System Voltages". The RIS states the protective function of the DVR setpoint is to ensure adequate starting voltage to all Class 1E equipment for all operating and accident conditions. Additionally, the RIS states that the DVR setpoint must be based on the starting voltage requirement at the terminal of the most limiting component and must account for the effect of all components which could affect voltage, this includes offsite power circuits, the plant distribution system, as well as all Class 1E and non-Class 1E loads.

However, the RIS does not prescribe the specific methodology to be used for the motor starting analysis, and there is no industry consensus on how to best address DVR protection for motor starting scenarios.[2] In actuality, the ability to start motors cannot be determined by monitoring voltage alone. The ability to start motors can only be determined by power system capacity, which is the ability to maintain voltage while providing the required starting current. Therefore, the very premise of using a voltage relay to protect motor starting ability requires an assumption of the power source capacity, which seems to violate the stated purpose of the DVR protective function.

An analytical approach is used in this study to determine the acceptability of the voltage during any Class 1E motor starting scenario that bounds any value of upstream capacity. This approach is based on the fact that for any Class 1E motor starting event (single motor or group of motors), the voltage at the DVR monitored bus can only respond in one of three ways:

1. The voltage decreases to the DVR setpoint, or above (i.e. DVR does not actuate)
2. The voltage decreases below the DVR setpoint and does not recover (i.e. DVR actuates and transfers loads to the DGs after the specified time)
3. The voltage decreases below the DVR setpoint and does recover (i.e. DVR actuates but does not initiate transfer since voltage remains above the LOV setpoint and recovers above the DVR reset value prior to timeout)

Analyses are performed for each of these situations as follows:

1. A starting voltage analysis is performed using a technique known as the "independent source" method. The voltage at the DVR monitored bus (i.e. 6.9kV Shutdown Board) is set at the DVR setpoint (dropout analytical limit) using an independent fixed voltage source. Since the initial DVR bus voltage prior to the event can be ignored, this simple technique produces correct voltages for downstream loads immediately after the initiation of the event. The analysis is performed for DBE motor starting (SI-actuated loads) as well as individual motor starts.
2. A protective device analysis is performed using a technique known as the "start-start" method. Since this is truly a degraded voltage situation, there is no need for a starting voltage analysis. However, an analysis should be performed to demonstrate that the Class 1E loads will be successfully transferred to the DG and started prior to their protective devices tripping. This "start-start" analysis was previously performed in the Degraded Voltage Analysis calculation (reference 2.1) and the results are reprinted in this study.
3. For DBE motor starting events, a bounding analysis is performed to demonstrate that any possible voltage transient caused by DBE motor starting, including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 5 seconds (without crediting automatic load tap changers). For individual motor starting events, this situation is bounded by the starting voltage analysis from item 1 since the analysis at DVR dropout is more conservative than analysis at the DVR reset value.

These analyses bound any possible voltage outcome at the DVR monitored bus when starting any Class 1E motor required for any scenario.

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[2] IEEE Power &Energy Society, Nuclear Power Engineering Committee (NPEC), Working Group 4.7 (Protection of Class 1E Power Systems and Equipment) meeting minutes of January 24, 2012, San Antonio, TX.

5.0 Design Input Data

5.1 For individual minimum motor starting voltage requirements, see Appendix A.

5.2 The degraded voltage relay setpoints are as follows (Ref. 2.1, 2.8 & Att. 2 of this study):

	Dropout (V)	Reset (V)
Nominal Setpoint	6600	6642
Allowable Value	6570	6672
Analytical Limit	6555	N/A
Operational Limit	N/A	6681

6.0 Computations and Analysis

The motor starting analysis is performed using ETAP V7.0.0N and the existing ETAP model used to perform offsite power system analysis for two unit operation (Ref. 2.2).

6.1 Starting Voltage Analysis

The 6.9kV shutdown boards were disconnected from all offsite power source(s) and a dedicated fixed voltage source was added to each 6.9kV shutdown board. The source voltage was set to the DVR dropout setting of 6555V (Section 5.2).

Using the load configuration in the existing Unit 1& 2 ETAP model, the following analyses were performed:

- Dynamic Motor Starting – Safety Injection Signal Phase A (SIA)
- Dynamic Motor Starting – Safety Injection Signal Phase B (SIB)
- Static Motor Starting (starting individual motor): This analysis is performed with SIA since this provides the worst case voltages on the 480V system. For this analysis, motor starting study case is generated to individually start each Class 1E motor. Resolutions to loads requiring additional review are annotated in Appendix A. If the starting voltage using Phase A is not acceptable, analysis is performed using Phase B loading

DBE Motor Starting:
Each study case is run for a total simulation time of 15 seconds. Since it is considered that by this time all motors have been accelerated and the APS system has come to a steady state condition. ETAP reports provide terminal voltage and current for every motor which starts at 0+ second up to 15 seconds in steps of 0.1 second.

The output reports are saved as U1 sdbds at DVDO-Complete (Study Case U1-DV-SIBms, Config. DV-LOCA-U1), U2 sdbds at DVDO-Complete (Study Case U2SIB-DV(N), Config. DV-LOCA-U2) and U12 sdbds at DVDO-Complete (Study Case U1/2SIA, Config. Deg Volt SU) in folder J:\wbnp\DVR Analysis (Static) WBN\ETAP Reports - Dynamic Motor Analysis.

Single Motor Starting:
Each study case is run using 'Study Case ID U1/2SIA and Config. Deg Volt SU'.

The output reports, in pdf format, are saved in folders J:\wbnp\DVR Analysis (Static) WBN\ETAP Reports - Shutdown Boards 1A and 1B and J:\wbnp\DVR Analysis (Static) WBN\ETAP Reports Shutdown Boards 2A and 2B\New Reports. Due to the large number of output reports, the output report names are not listed.
These analyses did not credit any non-Class 1E equipment upstream of the 6.9-kV Class 1E buses (such as LTC transformers or administratively controlled grid capacity). The available starting voltage for each motor is then documented and compared to the required starting voltage.

6.2 Protective Device Analysis (Start-Start scenario):

The scenario evaluated for the short time delay is an SI concurrent with the degraded voltage condition such that a block start attempt is made. A determination is made of the time permitted to allow voltage to return above the degraded voltage relay setpoint reset limit under block start transient conditions and still assure a subsequent start on the diesel if the voltage fails to recover, thus, making this a start-start evaluation. To evaluate the effect of the starting currents during the start-start scenario, the effect on overcurrent protective devices are considered. The board voltages at the onset of the event are, considered normal (i.e. no preheat). The degraded voltage condition presumes that the voltage does not recover but remains below the degraded voltage relay setpoint subjecting the SI initiated motors to starting currents for the time delay selected and then sequence onto the emergency diesel generators. The design calculated worst-case transient voltage dip during the accident loading sequence is used. This is conservative, because a lower voltage would produce less starting current for the motors.

The above evaluation is performed for the safety related loads required for Units 1 and 2 which would be actuated for an SI as follows:

- Motor loads fed from 6.9kV and 480V Switchgear & MCCs, MOVs & Static loads fed from the MCCs are evaluated to determine the effect of the start-start heating of the overcurrent protective devices (breakers/TOLs), such that starting on the diesel without tripping can be assured.
- Protective devices are also evaluated for the 6.6kV and 460V safety-related motors that operate during non-accident conditions. The evaluation considers that the safety bus voltage is equivalent to operation at the lower boundary of the degraded voltage relay dropout The protective devices are evaluated to ensure that operation of the safety-related loads can be sustained indefinitely at this voltage without protective device trip.
- SI actuated medium voltage (6.6kV) motor loads are evaluated to ensure that their thermal damage limits are not exceeded during the start-start event.
- 120VAC control power transformer (CPT) fuse time characteristics are evaluated to determine if the fuse could blow when carrying rated inrush current of the starter and any other normally energized devices for the safety analysis time of 11.5 seconds (upper boundary of the degraded voltage relay time delay, Attachment 2) or 12 seconds in the start-start scenario.
- MCC 120VAC distribution panel fuse time characteristics are evaluated to determine if the fuses melt during the start attempts. It is considered that circuit components required to pick-up during starting will be at inrush conditions.

6.3 Voltage Recovery Analysis:

See Appendix B for voltage recovery analysis for DBE for detailed purpose, approach, bases and assumptions and computations.

7.0 Summary of Results

7.1 Starting Voltage Analysis

See Appendix A for summary of the results. Based on a review of the results, all safety related loads have adequate starting voltage during DVR conditions and the existing setpoints for the degraded voltage relay are considered acceptable.

Note: ERCW Screen Wash Pumps are not assured to have adequate voltage as analyzed. However per N3-67-4002 this load is not required to be manually placed into service until 12 hours into a design basis event. This provides sufficient time to take corrective actions such as correcting the grid condition, adjusting the tap changers on the CSSTs or transferring the shutdown board(s) to the diesel generators.

Control Circuit Voltage Drop (CCVD) Analysis

With respect to the contactors, relays and solenoid valves, adequacy of pickup voltage for these control components (contactors, solenoid valves, relays) were performed as part of the Control Circuit Voltage Drop (CCVD) analysis. This analysis was performed considering a steady state minimum voltage of 432V at the MCC bus. All the components were determined to have adequate pickup voltage upon implementation of the issued design changes as identified in the CCVD calculation prior to Unit 2 fuel load.

The MCC transient bus voltage under degraded voltage conditions (at DVR dropout voltage of 6555V) drops below 432V due to starting of large motors on the 480V switchgear. This voltage, however, recovers to a value of >432V within 4 seconds. Since the startup of the safety related equipment may not have adequate starting voltage due to transient voltage conditions, Westinghouse evaluated the impact of additional 5 second delay for the startup of the safety injection pumps and feedwater isolation valves with offsite power available, and concluded the following: "This safety evaluation concludes that an additional five second delay for the startup of the safety injection pumps and an additional five second delay in the closure of the feedwater isolation valve does not impact the conclusions of the safety analysis that form the Watts Bar licensing basis (SECL-92-029; RIMS No. T33930330990)".

Based on the above, the analysis performed to verify adequacy of available voltage for the contactors, solenoid valves, relays is considered to be adequate and, therefore, no further analysis under the transient voltage conditions has been performed.

7.2 Protective Device Analysis

Motors Actuated by SI Signal:
As discussed in Attachment 7, there is no adverse effect of the start-start heating on the overcurrent devices on the safety related motors which would be actuated by safety injection signal and powered from safety related 6.9kV and 480V switchgears and 480V MCCs while operating at the lower boundary of the degraded voltage relay setting (6555V).

Non-Accident Safety Related Motors:
Based on the analysis, operation of safety-related loads with the 6.9kV Shutdown Board voltage operating at the lower boundary of the degraded voltage relay 6555V, will not cause tripping of protective devices. Static loads (constant impedance) are not considered, since operation at lower voltage results in less current. Therefore, operation at the lower boundary of the degraded voltage relay dropout setting would not trip the motors.

TOL Evaluation:
The generic evaluation of TOL's, in Attachment 7, showed that only motors having locked rotor current in excess of 850% are required to be evaluated further. A review of the WBN ETAP database, showed that four motors have a locked rotor current greater than 850% and start for an accident. An evaluation of those four loads shows that their TOL's are set at 115%. Therefore they would not be an issue, because it would increase their tolerance for tripping by an additional 15%.

8.0 Conclusions

8.1 This study determines that adequate starting voltage is available to each Class 1E load when the 6.9kV Shutdown Boards are at the DVR dropout setpoint (analytical limit) for the following cases:

- During a design basis event (DBE): all Class 1E loads that are automatically actuated for a safety injection signal (SI-Phase A or SI-Phase B).
- When individually starting a motor (single motor start): all Class 1E loads, even if not SI-actuated.

8.2 This study shows that for a degraded voltage condition, overcurrent protective devices associated with Class 1E loads will not trip during SI-actuated motor starting and subsequent start on the emergency diesel generator.

8.3 The bounding voltage recovery analysis demonstrates that any possible voltage transient caused by DBE motor starting, including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 4 seconds.

Therefore, using motor starting voltage as a basis for the relay setpoint shows no impact to the DVR setpoint and/or the plant response.

8.0 Conclusions

8.1 This study determines that adequate starting voltage is available to each Class 1E load when the 6.9kV Shutdown Boards are at the DVR dropout setpoint (analytical limit) for the following cases:

- During a design basis event (DBE): all Class 1E loads that are automatically actuated for a safety injection signal (SI-Phase A or SI-Phase B).
- When individually starting a motor (single motor start): all Class 1E loads, even if not SI-actuated.

8.2 This study shows that for a degraded voltage condition, overcurrent protective devices associated with Class 1E loads will not trip during SI-actuated motor starting and subsequent start on the emergency diesel generator.

8.3 The bounding voltage recovery analysis demonstrates that any possible voltage transient caused by DBE motor starting, including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 4 seconds.

Therefore, using motor starting voltage as a basis for the relay setpoint shows no impact to the DVR setpoint and/or the plant response.

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Appendix A

Introduction

This appendix is a summary tabulation of the results for the various motor starting scenarios described in Section 6.0. The analyses in Appendix A were developed using the methodology and applicable inputs from References 2.2, and 2.3. Voltage values were obtained from the applicable ETAP files and output reports in this study. The key information and results are determined as follows:

A. Minimum Motor Starting Voltage

Minimum motor starting voltages are based on Attachments 1, 3 and 6 of this study. The minimum motor starting voltages used are:

6600 Volt Motors - 5280 Volts (80%)***

460 Volt Motors - 391 Volts (85%)**

460 Volt Air Compressors - 368 Volts (80%)**

89-10 MOVs - Valve thrust and torque design margin calculations/evaluations based on motor terminal voltage as documented in Attachments 4 and 5 of this study.

Non 89-10 MOVs - 368 Volts (80%)**

** Percentages are based on 460 Volt rated motor voltage. For motors rated other than 480V, the same percentages are applicable. The minimum starting voltage may be different from the above voltage if it is based on manufacturer's data or test report as documented in Attachments 3 and 6 of this study.

*** 80% for all motors except for the ERCW Pump motor which requires 90% and the Auxiliary Feedwater Pump motor which requires 85%

B. Motor Starting Evaluation Results

Individual motor starting evaluation results are tabulated for all class 1E safety-related motors and motor operated valves. As summarized in Section 6.1 of this study the following steps were performed:

1. Motor terminal voltage with Phase A loading is compared against the minimum motor starting requirements above. If acceptable voltage is obtained, no further action is required.
2. Motor terminal voltage with Phase B loading is compared against the minimum motor starting requirements above. If acceptable voltage is obtained, no further action is required.
3. Single motor start terminal voltage with Phase A loading or with Phase B loading provided the Phase B criteria in section 3.4 of this study applies is compared against the minimum motor starting requirements above. If acceptable voltage is obtained, no further action is required.

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4. Individual circuit operating evaluations are performed based on when the motor is in service such as the ERCW Screen Wash Pump.
5. For 89-10 MOVs, See Section C below.

C. 89-10 Motor Operated Valve Evaluation Results

For Unit 1 and Unit 2 89-10 MOVs that did not meet the required valve motor starting voltage criteria, as a first step the calculated starting voltages for these MOVs were provided to Mechanical discipline (valve group) to evaluate if the revised voltages were acceptable. Based on the new thrust and torque calculations and calculated new design margins by mechanical valve group, the new available starting voltage for some MOVs was determined to be acceptable. However, some of the MOVs still did not meet either the required voltage or the minimum design margin criteria. Available voltage for these MOVs were re-evaluated further using the hammer-blow (HB) feature (see Section 3.5) which resulted in improved starting voltage available at the motor terminals. The available voltage with HB feature was again evaluated by the mechanical valve group and determined to be acceptable.

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base
6.9KV Shutdown Board 1A-A							
12-10 AFW	Aux Feedwater PMP 1A-A 1-MTR-3-118-A (600 HP)	99.09	Starts	99.09	Starts	99.07	85
12-13 CSP	CNTMT SPRAY PMP 1A-A 1-MTR-72-27-A (700 HP)	N/A	Not Running	98.81	Start	98.80	80
12-14 RHR	RHR PUMP 1A-A 1-MTR-74-10-A (400 HP)	98.97	Starts	98.97	Starts	98.96	80
12-15 SI	SAFETY INJ PMP 1A-A 1-MTR-63-10-A (400 HP)	98.94	Starts	98.94	Starts	98.94	80
12-18 CCP	CNTFGL CHRG PMP 1A-A 1-MTR-62-108-A (600 HP)	98.91	Starts	98.91	Starts	98.90	80
12-8 ERCW	ERCW PMP A-A 0-MTR-67-28-A (800 HP)	N/A	Starts (A-A or B-A start, but not both, other is not running)	N/A	Starts (A-A or B-A start, but not both, other is not running)	96.45	90
12-9 ERCW	ERCW PMP B-A 0-MTR-67-32-A (800 HP)	93.25	Starts (A-A or B-A start, but not both, other is not running)	93.25	Starts (A-A or B-A start, but not both, other is not running)	93.12	90
480V Shutdown Board 1A1-A							
125-3B	Comp Cooling Sys Pump 1A-A 1-MTR-70-46-A (350hp)	83.59	Starts	84.18	Starts	83.61	70
126-10C	Containment Air Rtn Fan 1A-A 1-MTR-30-38-A (100hp)	N/A	Not Running Starts @ 9 Min)	N/A	Not Running Starts @ 9 Min)	80.82 (SIB)	80
126-7C	Reac Lwr Compt Clr Fan 1A-A 1-MTR-30-74-A (60hp)	N/A	Running	N/A	Trips	82.32	80
126-9C	Elec Bd Rm AHU A-A 0-MTR-31-30B-A (50hp)	N/A	Running	N/A	Running	84.46	80
126-7A	Spent Fuel Pit Pump C-S 0-MTR-78-35-S (100hp)	N/A	Running	N/A	Running	82.06 (SIB)	80
480V Shutdown Board 1A2-A							
127-2C	Control Rm A/C A-A Compressor 0-MTR-31-80/2-A (250hp)	N/A	Running	N/A	Running	90.44	85

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base
127-3B	Comp Cooling Sys Pump C-S 0-MTR-70-51-S (350hp)	81.68	Running	82.15	Running	81.05	70
128-7D	Reac Lwr Compt Clr Fan 1C-A 1-MTR-30-77-A (60hp)	N/A	Running	N/A	Trips	83.29	80
128-9D	480V SD Bd Rm AHU A-A 0-MTR-31-45-A (75hp)	N/A	Running	N/A	Running	89.60	85
480V C&A Vent Board 1A1-A							
203-12B	Cont Bldg Emerg Press Fan A-A 0-MTR-31-6-A (1hp)	87.37 (2S)	Start	85.95	Start	88.21	85
203-13D	ERCW Scrn Wash Pump 1A-A 1-MTR-67-431-A (40hp)	N/A	N/A	N/A	N/A	74.85	75
203-2A	Cont Bldg Emerg Air CU Fan A-A 0-MTR-31-8-A (10hp)	85.2	Start	86.44	Start	89.13	85
203-3C	Cntmt Spray Pump 1A-A Clr Fan 1-MTR-30-177-A (7.5hp)	N/A	Running	82.61	Starts	83.17	80
203-4D	Emerg Gas Trtmt Sys Fan A-A 0-MTR-65-23-A (20hp)	86.03	Start	87.3	Start	91.05	75
203-6B	ERCW Str 1A-A 1-MTR-67-9-A (3hp)	N/A	Running	N/A	Running	76.71	75
203-10A	Cntfg Chrg Pmp 1A-A Rm Clr Fan, 1-MTR-30-183-A, (5 HP)	83.95	Start	85.18	Start	87.97	80
203-10B	PEN RM EL 713 CLR FAN 1A-A, 1-MTR-30-196-A, (3HP)	85.48	Start	86.73	Start	90.91	80
203-10C	Pipe Chase Clr Fan 1A-A, 1-MTR-30-201-A, (3 HP)	84.25	Start	85.48	Start	89.17	80
203-11A	480V BD RM 1B PR SUP FAN 1B1-A 1-MTR-31-478-A, (3HP)	N/A	N/A	N/A	N/A	92.83	85
203-11C	480V Bd Rm 1A A/C Ahu 1A-A 1-MTR-31-461-A (15 HP)	N/A	N/A	N/A	N/A	90.71	85
203-11D	Cont Rm Ahu A-A 0-MTR-31-12-A (60 HP)	N/A	N/A	N/A	N/A	88.84	85
203-12A	125V Vtl Bat Rm II ExFan 1B1-A 1-MTR-31-285-A (0.33 HP)	N/A	N/A	N/A	N/A	91.80	85
203-12C	480V Bd Rm 1A A/C Cond 1A-A 1-MTR-31-290-A, (15 HP)	N/A	N/A	N/A	N/A	91.40	85

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base
203-12F1	Cntmt Purge Air Radn Exh Mon 1-RE-90-130-A, (0.75 HP)	N/A	N/A	N/A	N/A	93.37	85
203-2C	PEN RM EL 692 CLR FAN 1A-A 1-MTR-30-186-A, (3HP)	84.94	Start	86.18	Start	90.37	80
203-4A	Btry Rm El 692 Exh Fan A-A 0-MTR-31-28-A (1.5HP)	N/A	N/A	N/A	N/A	88.45	85
203-4B	STH VITL BATT.RM.EX. FAN 1B1-A 0-MTR-31-493B-A (0.25 HP)	N/A	N/A	N/A	N/A	94.40	85
203-5A	SFP Pmp A-A&TB Bst Pm SpClrFan 0-MTR-30-192-A (7.5HP)	87.48 (2S)	Start	86.06	Start	89.85	85
203-5E	CCS & AFW PMPS SP CLR FAN A-A 1-MTR-30-190-A (20HP)	86.11	Start	87.36	Start	91.01	80
203-6A	Shutdown Bd Rm A Press Fan A-A 0-MTR-31-64-A (3HP)	N/A	N/A	N/A	N/A	93.03	85
203-6C	Traveling Scrn 1A-A 1-MTR-67-434-A (5HP)	N/A	N/A	N/A	N/A	80.66	80
203-6F1	Cntmt Bldg Lwr Compt Air Mon 1-RE-90-106-A (3HP)	N/A	N/A	N/A	N/A	93.46	85
203-7B	125V Vtl Bat Rm I ExhFan 1A1-A 1-MTR-31-287-A (0.33HP)	N/A	N/A	N/A	N/A	91.74	85
203-8A	Safety Inj Pmp 1A-A Rm Clr Fan 1-MTR-30-180-A (5HP)	82.19	Start	83.39	Start	85.53	80
203-8B	Pen Rm El 737 Clr Fan 1A-A 1-MTR-30-194-A (3HP)	86.83	Start	88.1	Start	92.69	80
203-8C	480V Xfmr Rm 1A Exh Fan 1A2-A 1-MTR-30-244G-A (3HP)	N/A	N/A	N/A	N/A	89.97	80
203-8D	480V Xfmr Rm 1A Exh Fan 1A3-A 1-MTR-30-244H-A (3HP)	N/A	N/A	N/A	N/A	91.75	80
203-8F1	CONT RM A/C A-A CONTROL/O.PMP 0-MTR-31-80/3-A (3.11 HP)	N/A	N/A	N/A	N/A	93.28	85
203-9A	RHR Pmp 1A-A Rm Clr Fan 1-MTR-30-175-A (5HP)	82.27	Start	83.47	Start	85.63	80
203-9B	Cont Rm A/C Circ Pmp A-A 0-MTR-31-80/1-A (15HP)	N/A	N/A	N/A	N/A	89.52	85
203-9C	480V Bd Rm 1A Pr Sup Fan 1A1-A 1-MTR-31-462-A (3HP)	N/A	N/A	N/A	N/A	93.45	85
203-9D	480V Xfmr Rm 1A Exh Fan 1A1-A 1-MTR-30-244F-A (3HP)	N/A	N/A	N/A	N/A	90.00	85
203-9F1	Cont Rm Intake Mon 0-RE-90-205-A (0.75HP)	N/A	N/A	N/A	N/A	93.75	85
203-4E	ERCW Str 1A-A Backwash Viv 1-FCV-67-9A-A (0.33HP)	N/A	N/A	N/A	N/A	81.88	Pass
203-6E	ERCW Str 1A-A Flush Viv 1-FCV-67-98-A (0.33HP)	N/A	N/A	N/A	N/A	82.56	Pass
203-7D	RHR PMP 1A-A INLET FCV 1-FCV-74-3-A (5.2HP)	N/A	N/A	N/A	N/A	91.16	Pass
203-7E	RWST TO SPRAY HDR 1A FCV 1-FCV-72-22-A (3.2HP)	N/A	N/A	N/A	N/A	86.12	Pass

1A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV /460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV/460V Base
480V C&A Vent Board 1A2-A							
None							
480V Diesel Aux Board 1A1-A							
217-2B	DG 1A-A Rm Exh Fan 1-A 1-MTR-30-447-A (15hp)	90.72	Starts	91.33	Start	92.82	85
217-3D	DG 1A-A Day Tk FO XFR PMP 1 1-MTR-18-55/1-A (1hp)	90.73	Random	91.34	Random	94.88	85
217-4B	DG 1A-A AUX LUBEOIL CIRC PMP A 1-MTR-82-AOPA1A (0.75hp)	91.05	Random	91.66	Random	94.71	85
217-4D	Dg Rm 1A-A Pnl Vent Fan 1-MTR-30-491-A (15HP)	N/A	N/A	N/A	N/A	92.27	85
217-4E	Dg 1A-A 480V Elec Bd Rm Ex Fan 1-MTR-30-459-A (2HP)	90.91	N/A	91.5	N/A	94.43	85
217-3A	EM DG HX 1A1 & 1A2 SPLY VLV 1-FCV-67-66-A (0.13HP)	81.56	N/A	82.1	N/A	85.68	80
217-6A	DG 1A-A Muffler Rm Exh Fan 1-MTR-30-463 (0.5hp)	90.83	Starts	91.44	Running	95.19	85
480V Diesel Aux Board 1A2-A							
218-2B	DG 1A-A Rm Exh Fan 2-A 1-MTR-30-451-A (15hp)	92.41	Starts	92.88	Running/ Start	93.22	85
218-3D	DG 1A-A DAY TNK FO XFR PMP 2 1-MTR-18-54/1-A (1hp)	91.64	Random	92.1	Random	94.22	85
218-2A	DG 1A-A AUX LUBEOIL CIRC PMP B 1-MTR-82-AOPB1A (0.75HP)	N/A	N/A	N/A	N/A	93.80	85
218-2D	Dg 1A-A Lube Oil Circ Pmp 2 1-MTR-82-A2-A (1HP)	N/A	N/A	N/A	N/A	93.75	85
218-5F1	Dg Bldg Co2 Refrigeration Unit 0-PKG-39-37 (2HP)	N/A	N/A	N/A	N/A	94.86	85
480V RMOV Board 1A1-A							
235-5C	Lower CNTMT 1B CLRS ISLN VLV 1-FCV-67-97-A (0.13hp)	N/A	Not Running	80.6	Starts	85.01	Pass
235-7A	Seal Flow Ret Isln Vlv 1-FCV-62-63-A (1.9hp)	77.96	Closes on Ph A (Starts)	79.06	Closes on Ph A (Starts)	83.32	Pass
235-7B	CHARGING FLOW ISLN VLV 1-FCV-62-90-A (1.9hp)	77.05	Closes on SI (Starts)	78.15	Closes on SI (Starts)	82.36	Pass
235-8B	Vol Cont Tank Outlet Isln Vlv 1-LCV-62-132-A (1.9hp)	79.54	Closes on SI (Starts)	80.68	Closes on SI (Starts)	85.02	Pass
235-9A	RWST To Charging Pmp Vlv Cont 1-LCV-62-135-A (1.9hp)	82.76	Opens on SI (Starts)	83.94	Opens on SI (Starts)	88.45	Pass
235-9D	RCP Oil Lir Cntmt Iso Vlv 1-FCV-70-100 (0.13hp)	N/A	Not Running	80.49	Closes (Starts)	84.90	Pass
235-11A	SIS Pmp Inlet to CVCS Chrg Pmp 1-FCV-63-7 (1.9hp)	N/A	Not Running	N/A	Not Running	88.21*	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base
235-11D	SIS Boron Inj Tank Shutoff Vlv 1-FCV-63-26 (1.9hp)	83.54*	Opens on SI (Starts)	80.29	Opens on SI (Starts)	84.61	Pass
235-12B	Cntmt Sump To RHR Pmp A-A 1-FCV-63-72-A (13hp)	81.75	Operate about 20 minutes after SI	82.9	Opperate about 20 minutes after SI	86.95	Pass
235-13E	Cntmt Spray Hdr 1A Isln Vlv 1-FCV-72-39-A (3.2hp)	N/A	Not Running	92.54* (5s)	Opens on Ph B (Starts)	91.80*	Pass
235-14D	RHR Pmp 1A-A Min Flow Vlv 1-FCV-74-12-A (0.13hp)	79.62	Random	80.74	Random	85.17	Pass
235-15D	LWR CNTMT 1D CLRS ISLN VLV 1-FCV-67-89-A (0.13hp)	N/A	Not Running	80.71	Closes (Starts)	85.13	Pass
235-17B	Cntmt Standpipe Isln Vlv 1-FCV-26-240-A (0.67hp)	81.4	Close (Start)	82.55	Close (Start)	87.05	Pass
235-18E	RCP Spray Isln Vlv 1-FCV-26-243-A (0.67hp)	82.65	Close (Start)	83.82	Close (Start)	88.39	Pass
235-2E1	RWST To RHR Pmp Flow Cont Vlv 1-FCV-63-1-A (5.2HP)	N/A	N/A	N/A	N/A	92.09*	Pass
235-5B	RHR Sys Isln Vlv 1-FCV-74-1-A (2.6HP)	N/A	N/A	N/A	N/A	90.74*	Pass
235-6D	RCS Press Relief FCV 1-FCV-68-333-A (1.9HP)	N/A	N/A	N/A	N/A	89.2*	Pass
235-10B	SIS Pmp Recirc To RWST 1-FCV-63-3-A (0.7HP)	N/A	N/A	N/A	N/A	90.70*	Pass
235-10F	Cont Spray Pmp 1A-A Recirc FCV 1-FCV-72-34-A (0.13HP)	N/A	N/A	N/A	N/A	89.39*	Pass
235-11B	RHR Hx A To CVCS Chrgr Pmp 1-FCV-63-8-A (1.9HP)	N/A	N/A	N/A	N/A	87.48	Pass
235-12A	SIS Pmp 1A-A Inlet Vlv 1-FCV-63-47-A (1.9HP)	N/A	N/A	N/A	N/A	88.18*	Pass
235-12D	SIS To RCS Loops 2&3 FCV 1-FCV-63-93-A (1.6 HP)	N/A	N/A	N/A	N/A	90.65	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base
235-12E	SIS Pmp 1A-A Outlet FCV 1-FCV-63-152-A (1.9HP)	N/A	N/A	N/A	N/A	88.48*	Pass
235-13A	SIS Pmp Out RCS Lp 1&3 Hot Leg 1-FCV-63-156-A (1.9HP)	N/A	N/A	N/A	N/A	89.28*	Pass
235-13B	Cntmt Sump To Spray Hdr 1A FCV 1-FCV-72-44-A (3.2HP)	N/A	N/A	N/A	N/A	90.33*	Pass
235-14A	RHR Spray Hdr 1A Isln Vlv 1-FCV-72-40-A (1.9HP)	N/A	N/A	N/A	N/A	87.66	Pass
235-14E	RHR Hx 1A Bypass Vlv 1-FCV-74-33-A (2HP)	N/A	N/A	N/A	N/A	85.27	Pass
235-4E	AFW Pmp A-A Lube Oil Pmp A-A 1-MTR-3-118D-A (0.25HP)	N/A	Manual	N/A	Manual	89.72	85
480V RMOV Board 1A2-A							
236-17E	480V Bd Rm 1A A/C Compressor 1A-1 1-MTR-31-465-A (50hp)	N/A	Running	N/A	Running	92.10	85
236-2A	ERCW Hdr A Isln Vlv 1-FCV-3-116 (0.25hp)	N/A	Random	N/A	Random	83.47	Pass
236-3A	ERCW Hdr A Isln Vlv 1-FCV-3-136 (0.33hp)	N/A	Random	N/A	Random	84.05	Pass
236-3D	St Gen No 1 FW Isln Vlv 1-FCV-3-33-A (39.4hp).	81.91	Use 89-10 start	82.72	Use 89-10 start	83.23	Pass
236-4D	St Gen No 3 FW Isln Vlv 1-FCV-3-87 (39.4hp)	79.1	Use 89-10 start	79.87	Use 89-10 start	80.53	Pass
236-7D	Lwr Cntmt Clr 1A Disch Iso Vlv 1-FCV-67-87-A (0.13hp)	N/A	Not Running	84.68	Closes (Starts)	86.96	Pass
236-7F	Upr Cntm Vt Clr 1A Sup Iso Vlv 1-FCV-67-130-A (0.13hp)	N/A	Not Running	82.31	Closes (Starts)	84.53	Pass
236-8B	Lwr Cntmt 1A Clr Sply Isln Vlv 1-FCV-67-107-A (0.33hp)	N/A	Not Running	85.33	Closes (Starts)	87.62	Pass
236-8D	Lwr Cntmt 1C Clr Disch Iso Vlv 1-FCV-67-95-A (0.13hp)	N/A	Not Running	84.43	Closes (Starts)	86.71	Pass
236-8F	Upr Cntm Vt Clr 1C Sup Iso Vlv 1-FCV-67-133-A (0.13hp)	N/A	Not Running	81.23	Closes (Starts)	83.44	Pass
236-9A	Lwr Cntmt 1C Clr Sply Isln Vlv 1-FCV-67-99-A (0.33hp)	N/A	Not Running	85	Closes (Starts)	87.30	Pass
236-9B	Lwr CNTMT 1B CLR DISCH ISO VLV 1-FCV-67-104-A (0.33hp)	N/A	Not Running	85.36	Closes (Starts)	87.65	Pass
236-9D	Up Cntmt VT Clr 1A Disc Iso Vlv 1-FCV-69-295 (0.13hp)	N/A	Not Running	79.83	Closes (Starts)	81.98	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base
236-9F	Upr Cntm Vt Clr 1B Sup Iso Vlv 1-FCV-67-139-A (0.13hp)	N/A	Not Running	81.23	Closes (Starts)	83.44	Pass
236-10A	Lwr Cntmt 1D Clr Disch Iso Vlv 1-FCV-67-112-A (0.33hp)	N/A	Not Running	85.41	Closes (Starts)	87.70	Pass
236-10D	UP CNTM VT CLR 1C DISH ISO VLV 1-FCV-67-296-A (0.13hp)	N/A	Not Running	81.28	Closes (Starts)	83.47	Pass
236-10F	UP CNTM VT CLR 1D DISH ISO VLV 1-FCV-67-142-A (0.13hp)	N/A	Not Running	82.31	Closes (Starts)	84.53	Pass
236-11D	RCP Thrm Barr Rtn Cntm Iso Vlv 1-FCV-70-90-A (0.7hp)	N/A	Not Running	85.99	Closes (Starts)	88.28	Pass
236-11E	RCP Thrm Barr Cntmt Isln Vlv 1-FCV-70-133-A (0.13hp)	N/A	Not Running	83.79	Closes (Starts)	86.06	Pass
236-12D	RCP Oil Clr Rtn Cntmt Isln Vlv 1-FCV-70-92-A (0.13hp)	N/A	Not Running	85.07	Closes (Starts)	87.37	Pass
236-16D	Excs Ltdn Hx Cont Inlt Iso Vlv 1-FCV-70-143-A (0.33hp)	83.8	Closes on Phase A	84.63	Closes on Phase A	86.91	Pass
236-2B	ERCW Hdr A Isln Vlv 1-FCV-3-116B-A (0.25HP)	N/A	N/A	N/A	N/A	83.47	Pass
236-2D	AFWP Turb Stm Sup Fm Stm Gen 1 1-FCV-1-15-A (1HP)	N/A	N/A	N/A	N/A	92.47*	Pass
236-2E	St Flow To AFWP Turb Isln Vlv 1-FCV-1-17-A (1HP)	N/A	N/A	N/A	N/A	88.75	Pass
236-3B	ERCW Hdr A Isln Vlv 1-FCV-3-136B-A (0.33HP)	N/A	N/A	N/A	N/A	84.05	Pass
236-3D	St Gen No 1 FW Isln Vlv 1-FCV-3-33-A (39.4HP)	81.91		82.72		83.23	Pass
236-5A	Sample Hx Isln Vlv 1-FCV-70-215-A (0.13HP)	N/A	N/A	N/A	N/A	86.04	Pass
236-5E	Cntmt Spray Hx 1A Sup Cont Vlv 1-FCV-67-125-A (0.33HP)	N/A	N/A	N/A	N/A	92.51*	Pass
236-5F	Cntmt Spray Hx 1A Disch Vlv 1-FCV-67-126-A (0.33HP)	N/A	N/A	N/A	N/A	92.19*	Pass
236-6A	AFWP Turb St Sply Frm St gen 4 1-FCV-1-16-A (1HP)	N/A	N/A	N/A	N/A	92.52*	Pass

1A Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV /460V Base	6.6kV/460V Base
236-6D	RHR Sys Isln Bypass Vlv 1-FCV-74-8-A (1.6HP)	N/A	N/A	N/A	N/A	90.99*	Pass
236-11A	Cmpnt Clg Hx A Disch Cont Vlv 1-FCV-67-146-A (0.3HP)	N/A	N/A	N/A	N/A	87.97	Pass
236-12B	SS&Con AirCpsr Sup Hdr A Iso V 0-FCV-67-205-A (0.33HP)	N/A	N/A	N/A	N/A	87.76	Pass
236-15A	CCS HX A ERCW BYPASS FCV 1-FCV-67-143-A (0.13HP)	N/A	N/A	N/A	N/A	84.52	Pass
236-16E	RHR Hx A-A Outlet Vlv 1-FCV-70-156-A (0.33HP)	N/A	N/A	N/A	N/A	88.75	Pass
236-17A	Sample Hx Hdr Outlet Vlv 1-FCV-70-183-A (0.13HP)	N/A	N/A	N/A	N/A	85.99	Pass
236-17B	SFPCS Hx Sply Hdr Isln Vlv 0-FCV-70-197-A (0.3HP)	N/A	N/A	N/A	N/A	89.63	Pass
480V Reac Vent Board 1A-A							
None							

* This MOV terminal voltage is calculated taking credit for the hammer blow feature.

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
6.9kV Shutdown Board 1B-B							
13-10 AFW	Aux Feedwater PMP 1B-B 1-MTR-3-128-B (600 HP)	99.02	Starts	99.02	Starts	98.97	85
13-13 CSP	CNTMT SPRAY PMP 1B-B 1-MTR-72-10-B (700 HP)	N/A	Not Running	98.7	Start	98.69	80
13-14 RHR	RHR PUMP 1B-B 1-MTR-74-20-B (400 HP)	99.12	Starts	99.12	Starts	99.12	80
13-15 SI	SAFETY INJ PMP 1B-B 1-MTR-63-15-B (400 HP)	98.85	Starts	98.85	Starts	98.85	80
13-18 CCP	CNTFGL CHRG PMP 1B-B 1-MTR-62-104-B (600 HP)	98.77	Starts	98.77	Starts	98.77	80
13-8 ERCW	ERCW PMP F-B 0-MTR-67-51-B (800 HP)	N/A	Starts (F-B or E-B start, but not both, other is not running)	N/A	Starts (F-B or E-B start, but not both, other is not running)	96.20	90
13-9 ERCW	ERCW PMP E-B 0-MTR-67-47-B (800 HP)	95.11	Starts (E-B or F-Bstart, but not both, other is not running)	95.11	Starts (E-B or F-Bstart, but not both, other is not running)	95.01	90
480V Shutdown Board 1B1-B							
129-3C	Comp Cooling Sys Pump 1B-B 1-MTR-70-38-B (350hp)	80.88	Starts	81.52	Starts	80.78	70
130-7A	Elec Bd Rm AHU C-B 0-MTR-31-31B-B (50hp)	N/A	Running	N/A	Running	90.49	80
130-7D	Reac Lwr Compt Clr Fan 1B-B 1-MTR-30-75-B (60hp)	N/A	Running	N/A	Trips	82.53	80
480V Shutdown Board 1B2-B							
131-2B	Control Rm A/C B-B Compressor 0-MTR-31-96/2-B (250hp)	N/A	Running	N/A	Running	83.24	80
131-3C	SHDN BD RM CHLR PKG B-B Compressor 0-MTR-31-49/2-B (240hp)	N/A	Running	N/A	Running	87.99	85
132-7D	Reac Lwr Compt Clr Fan 1D-B 1-MTR-30-78-B (60hp)	N/A	Running	N/A	Trips	83.00	80
132-9A	Spent Fuel Pit Pmp B-B 0-MTR-78-9-B (100hp)	N/A	Running	N/A	Running	84.80	80
132-9C	Cntmt Air Rtn Fan 1B-B 1-MTR-30-39-B (100hp)	N/A	Not Running Starts @ 9 Min)	N/A	Not Running Starts @ 9 Min)	81.61 (SIB)	80
132-9D	480V SD Bd Rm AHU C-B 0-MTR-31-55-B (75hp)	N/A	Running	N/A	Running	88.01	85
480V C&A Vent Board 1B1-B							
205-11A	Cont Bldg Emerg Press Fan B-B, 0-MTR-31-5-B (1hp)	87.9	Start	89.19	Start	92.26	85

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
205-13D	ERCW Scrn Wash Pump 1B-B 1-MTR-67-440-B (40hp)	N/A	N/A	N/A	N/A	73.64 (SIB)	75
205-2A	Cont Bldg Em Air Clnup Fan B-B 0-MTR-31-7-B (10hp)	86.62	Start	87.89	Start	89.94	85
205-3C	Cntmt Spray Pump 1B-B Rm Clr Fan 1-MTR-30-178-B (7.5hp)	N/A	Random	88.51	Starts	89.81	80
205-4D	Emerg Gas Trtmt Sys Fan B-B 0-MTR-65-42-B (20hp)	85.41	Start	86.66	Start	89.23	80
205-6B	ERCW Str 1B-B 1-MTR-67-10-B (3hp)	N/A	Running	N/A	Running	77.45	75
205-7E	RWST to Spray Hdr 1A Vlv 1-FCV-72-22 (3.2hp)	N/A	Stopped (No auto Start)	N/A	Stopped (No auto Start)	88.06 (SIB)	Pass
205-4E	ERCW Str 1B-B Backwash Vlv 1-FCV-67-10A-B (0.33HP)	N/A	N/A	N/A	N/A	82.38	80
205-6E	ERCW Str 1B-B Flush Vlv 1-FCV-67-10B-B (0.33HP)	N/A	N/A	N/A	N/A	82.39	80
205-7D	RHR PMP 1B-B INLET FCV 1-FCV-74-21-B (5.2HP)	N/A	N/A	N/A	N/A	91.00	Pass
205-2C	Pen Rm El 713 Clr Fan 1B-B 1-MTR-30-197-B (3HP)	86.49	Start	87.77	Start	91.08	80
205-3A	Shdn Bd Rm Chlr CW Clr Pmp B-B 0-MTR-31-49/1-B (25HP)	N/A	N/A	N/A	N/A	90.81	85
205-3B	Pipe Chase Clr Fan 1B-B 1-MTR-30-202-B (3HP)	85.35	Start	86.6	Start	89.47	80
205-3F1	Cntmt Bldg Upper Compt Air Mon 1-RE-90-112-B (3HP)	N/A	N/A	N/A	N/A	90.10	85
205-4A	Battery Rm El 692 Exh Fan B-B 0-MTR-31-29-B (1.5HP)	N/A	N/A	N/A	N/A	88.13	85
205-4F1	CNTMT PURGE AIR EXH MON 1-RE-90-131-B (0.75HP)	N/A	N/A	N/A	N/A	93.34	85
205-5A	SFP PmpB-B&TB Bst Pmp SpClrFan 0-MTR-30-193-B (7.5HP)	85.14	Start	86.39	Start	89.28	80
205-5E	CCS & AFW Pumps Sp Clr Fan B-B 1-MTR-30-191-B (20HP)	85.45	Start	86.71	Start	89.06	80
205-6A	SHUTDOWN BD RM A PRESS FAN C-B 0-MTR-31-67-B (3HP)	N/A	N/A	N/A	N/A	92.26	85
205-6C	Traveling Scrn 1B-B 1-MTR-67-445-B (5HP)	N/A	N/A	N/A	N/A	80.73 (SIB)	80
205-7B	125V Vtl Bat Rm I Ex Fan 1A2-B 1-MTR-31-288-B (0.33HP)	N/A	N/A	N/A	N/A	91.84	85
205-7C	High Press Fire Pmp Str B-B 0-MTR-26-14-B (0.75HP)	N/A	N/A	N/A	N/A	87.47	85
205-8A	Safety Inj Pmp 1B-B Rm Clr Fan 1-MTR-30-179-B (5HP)	N/A	N/A	N/A	N/A	86.70	80

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
205-8B	Pen Rm El 692 Clr Fan 1B-B 1-MTR-30-187-B (3HP)	N/A	N/A	N/A	N/A	90.19	80
205-8C	Shtdn Xfmr Rm 1B Exh Fan 1B2-B 1-MTR-30-248F-B (3HP)	N/A	N/A	N/A	N/A	90.62	80
205-8D	Shtdn Xfmr Rm 1B Exh Fan 1B3- 1-MTR-30-248G-B (3HP)	N/A	N/A	N/A	N/A	90.57	80
205-8E	Cont Rm A/C Clr Pmp B-B 0-MTR-31-96/1-B (15HP)	N/A	N/A	N/A	N/A	86.05	85
205-8F1	CONT RM A/C B-B CONTROL/O.PMP 0-MTR-31-96/3-B (3HP)	N/A	N/A	N/A	N/A	92.45	85
205-9A	RHR Pmp 1B-B Rm Clr Fan 1-MTR-30-176-B (5HP)	82.05	Start	83.25	Start	84.16	80
205-9B	5th Vitl Batt Rm Exh Fan 1B2-B 0-MTR-31-495B-B (0.25HP)	N/A	N/A	N/A	N/A	94.51	85
205-9C	480V Bd Rm 1A Pr Sup Fan 1A2-B 1-MTR-31-463-B (3HP)	N/A	N/A	N/A	N/A	93.17	85
205-9D	Shtdn Xfmr Rm 1B Exh Fan 1B1-B 1-MTR-30-248E-B (3HP)	N/A	N/A	N/A	N/A	83.36	80
205-9E	Pen Rm El 737 Clr Fan 1B-B 1-MTR-30-195-B (3HP)	86.32	Start	87.58	Start	90.44	80
205-10A	Cntlg Chrg Pmp 1B-B Rm Clr Fan 1-MTR-30-182-B (5HP)	83.54	Start	84.77	Start	86.23	80
205-10B	480V Bd Rm 1B Pr Sup Fan 1B2-B 1-MTR-31-477-B (3HP)	N/A	N/A	N/A	N/A	93.09	85
205-10C	125V VTL BAT RM II EXFAN 1B2-B 1-MTR-31-286-B (0.33HP)	N/A	N/A	N/A	N/A	91.87	85
205-10F1	Cont Rm Intake Mon 0-RE-90-206-B (0.75HP)	N/A	N/A	N/A	N/A	90.47	85
205-11B	480V Bd Rm 1B A/C Ahu 1B-B 1-MTR-31-475-B (20HP)	N/A	N/A	N/A	N/A	90.26	85
205-11C	480V Bd Rm 1B A/C Cond 1B-B 1-MTR-31-289-B (20HP)	N/A	N/A	N/A	N/A	92.28	85
205-11D	Cont Rm Ahu B-B 0-MTR-31-11-B (60HP)	N/A	N/A	N/A	N/A	88.49	85
480V C&A Vent Board 1B2-B							
None							
480V Diesel Aux Board 1B1-B							
219-2B	DG 1B-B RM EXH FAN 1-B 1-MTR-30-449-B (15hp)	89.74	Starts	90.34	Start	91.72	85
219-3D	DG 1B-B DAY TNK FO XFR PMP 1 1-MTR-18-55/2-B (1hp)	89.78	Random	90.4	Random	94.00	85
219-4B	Dg 1B-B Aux LubeOil Circ Pmp A 1-MTR-82-AOPA2B (0.75hp)	90.42	Start	91.03	Start	94.24	85
219-6A	DG 1B-B Muffler Rm Exh Fan 1-MTR-30-465 (0.5hp)	90.2	Starts	90.81	Starts	94.71	85
219-2D	Dg 1B-B Lube Oil Circ Pmp 1 1-MTR-82-B1-B (1HP)	N/A	N/A	N/A	N/A	94.04	85
219-4E	DG 1B-B 480V ELEC BD RM EX FAN 1-MTR-30-461-B (2HP)	N/A	N/A	N/A	N/A	93.87	85

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
480V Diesel Aux Board 1B2-B							
220-2B	DG 1B-B Rm Exh Fan 2-B 1-MTR-30-453-B (15hp)	91.34	Starts	91.81	Start	92.66	85
220-3D	DG 1B-B DAY TNK FO XFR PMP 2 1-MTR-18-54/2-B (1HP)	91.15	Start	91.62	Start	94.87	85
220-2A	Dg 1B-B Aux LubeOil Circ Pmp B 1-MTR-82-AOPB2B (0.75HP)	N/A	N/A	N/A	N/A	94.39	85
220-2D	Dg 1B-B Lube Oil Circ Pmp 2 1-MTR-82-B2-B (1HP)	N/A	N/A	N/A	N/A	94.77	85
480V RMOV Board 1B1-B							
237-3F2	SIS ACCUM TANK FLOW ISOL VLV 1-FCV-63-98-B (6.6hp)	90.26	Opens on SI (Starts)	91.57	Opens on SI (Starts)	95.10	Pass
237-6D	Seal Flow Ret Isln Vlv 1-FCV-62-61-B (1.9hp)	80.78	Closes on Ph A (Starts)	81.93	Closes on Ph A (Starts)	85.36	Pass
237-7A	CHRG FLOW ISLN VLV 1-FCV-62-91-B (1.9hp)	83.3	Closes on SI (Starts)	84.49	Closes on SI (Starts)	88.02	Pass
237-8A	Vol Cont Tank Outlet Isln Vlv 1-LCV-62-133-B (1.9hp)	80.92	Closes on SI (Starts)	82.08	Closes on SI (Starts)	85.50	Pass
237-8B	RWST To Charging Pmp Vlv Cont 1-LCV-62-136-B (1.9hp)	78.63	Opens on SI (Starts)	79.76	Opens on SI (Starts)	83.09	Pass
237-10A	SIS 1A-A DSH TO RWST SHTFF VLV 1-FCV-63-4-B (0.7hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	84.57	Pass
237-10B	RWST To SIS Pump Flow Cont Vlv 1-FCV-63-5-B (1.9hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	88.02*	Pass
237-11A	SIS PMP INLT TO CVCS CHRG PMP 1-FCV-63-6-B (1.9hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	88.21*	Pass
237-11E	SIS Boron Inj Tank Shutoff Vlv 1-FCV-63-25-B (1.9hp)	82.06	Opens on SI (Starts)	83.24	Opens on SI (Starts)	86.70	Pass
237-12B	SIS Pmp 1B-B Inlet Vlv 1-FCV-63-48-B (1.9hp)	N/A	Not Running or Starting	N/A	Not Running or Starting	90.23*	Pass
237-12D	CNTMT SUMP TO RHR PMP B-B 1-FCV-63-73-B (13hp)		Opens at approx. 20 min		Opens at approx. 20 min	88.03	Pass
237-14A	Cntmt Spray Hdr 1B Isln Vlv 1-FCV-72-2-B (3.2hp)	N/A	Closed, Not Running	92.89* (5s)	Opens, Starting.	92.86*	Pass
237-15B	RHR Pmp 1B-B Min Flow Vlv 1-FCV-74-24-B (0.13hp)	78.73	Random	79.87	Random	83.27	Pass
237-17D	AFW Pmp B-B Lube Oil Pmp B-B 1-MTR-3-128D-B (0.25HP)	N/A	N/A	N/A	N/A	89.84	85

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
237-5E	RCS Press Relief Flow Cont Vlv 1-FCV-68-332-B (1.9HP)	N/A	N/A	N/A	N/A	88.06*	Pass
237-9B	RHR To RCS H.L. 1&3 Flow Iso V 1-FCV-63-172-B (2.6HP)	N/A	N/A	N/A	N/A	85.99	Pass
237-9F	Cont Spray Pmp 1B-B Recirc FCV 1-FCV-72-13-B (0.13HP)	N/A	N/A	N/A	N/A	90.08*	Pass
237-11B	RHR Hx B To SIS Pmp 1-FCV-63-11-B (2HP)	N/A	N/A	N/A	N/A	85.71	Pass
237-12E	SIS To RCS Loops 1&4 FCV 1-FCV-63-94-B (1.6HP)	N/A	N/A	N/A	N/A	90.63	Pass
237-13A	SIS Pmp 1B-B Outlet FCV 1-FCV-63-153-B (1.9HP)	N/A	N/A	N/A	N/A	88.75*	Pass
237-13B	SIS PMP OUT RCS LP 2&4 H. LEG 1-FCV-63-157-B (1.9HP)	N/A	N/A	N/A	N/A	91.36*	Pass
237-13D	SIS 1B-B Dsh To RWST Shtff Vlv 1-FCV-63-175-B (0.7HP)	N/A	N/A	N/A	N/A	84.70	Pass
237-14D	RHR Spray Hdr 1B Isln Vlv 1-FCV-72-41-B (1.9HP)	N/A	N/A	N/A	N/A	85.82	Pass
237-14E	Cntmt Sump To Spray Hdr 1B FCV 1-FCV-72-45-B (3.2HP)	N/A	N/A	N/A	N/A	89.68*	Pass
237-15D	RHR Hx 1B Bypass Vlv 1-FCV-74-35-B (1.9HP)	N/A	N/A	N/A	N/A	83.01	Pass
480V RMOV Board 1B2-B							
238-2A	ERCW Hdr B Isln Vlv 1-FCV-3-126A-B (0.25hp)	N/A	Random	N/A	Random	82.91	Pass
238-3A	ERCW Hdr B Isln Vlv 1-FCV-3-179A-B (0.33hp)	N/A	Random	N/A	Random	83.46	Pass
238-3D	ST GEN NO 2 FW ISLN VLV 1-FCV-3-47-B (39.4hp)	80.6	start	81.37	start	82.84	Pass
238-4D	St Gen No 4 FW Isln Vlv 1-FCV-3-100-B (39.4hp)	80.6	Use 89-10 start	81.38	Use 89-10 start	82.84	Pass
238-5C	LWR CNTMT 1A CLRS ISLN VLV 1-FCV-67-113-B (0.13hp)	N/A	Not Running	81.98	Closes (Starts)	85.37	Pass
238-6D	RCP Thrm Bar Rtn Cntmt Iso Vlv 1-FCV-70-87-B (0.7hp)	N/A	Not Running	84.13	Closes (Starts)	87.57	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
238-6E	RCP THRM BAR CNTMT ISO VLV 1-FCV-70-134-B (0.13hp)	N/A	Not Running	82.29	Closes (Starts)	85.70	Pass
238-7D	Lwr Cntmt 1B Clr Dish Iso Vlv 1-FCV-67-103-B (0.13hp)	N/A	Not Running	82.76	Closes (Starts)	86.18	Pass
238-7F	Up Cntm Vt Clr 1A Dish Iso Vlv 1-FCV-67-131-B (0.13hp)	N/A	Not Running	80.6	Closes (Starts)	83.94	Pass
238-8D	Lwr Cntmt 1D Clr Dish Iso Vlv 1-FCV-67-111-B (0.13hp)	N/A	Not Running	83.07	Closes (Starts)	86.50	Pass
238-8F	Up Cntm Vt Clr 1C Dish Iso Vlv 1-FCV-67-134-B (0.13hp)	N/A	Not Running	80.56	Closes (Starts)	83.90	Pass
238-9A	Lwr Cntmt 1A Clr Dish Iso Vlv 1-FCV-67-88-B (0.33hp)	N/A	Not Running	83.67	Closes (Starts)	87.12	Pass
238-9B	Lwr Cntmt 1C Clr Dish Iso Vlv 1-FCV-67-96-B (0.33hp)	N/A	Not Running	83.79	Closes (Starts)	87.25	Pass
238-9D	Up Cntm Vt Clr 1B Dish Iso Vlv 1-FCV-67-297-B (0.13hp)	N/A	Not Running	81.45	Closes (Starts)	84.82	Pass
238-9F	Up Cntm Vt Clr 1B Sup Iso Vlv 1-FCV-67-138-B (0.13hp)	N/A	Not Running	80.5	Closes (Starts)	83.84	Pass
238-10A	Lwr Cntmt 1B Clr Sply Isln Vlv 1-FCV-67-91-B (0.33hp)	N/A	Not Running	83.71	Closes (Starts)	87.16	Pass
238-10B	Lwr Cntmt 1D Clr Sply Isln Vlv 1-FCV-67-83-B (0.33hp)	N/A	Not Running	84.28	Closes (Starts)	87.77	Pass
238-10D	UP CNTM VT CLR 1D DIS ISO VLV 1-FCV-67-298-B (0.13hp)	N/A	Not Running	80.09	Closes (Starts)	83.41	Pass
238-10F	Up Cntm Vt Clr 1D Sup Iso Vlv 1-FCV-67-141-B (0.13hp)	N/A	Not Running	80.89	Closes (Starts)	84.23	Pass
238-11D	LWR CNTMT 1C CLRS ISLN VLV 1-FCV-67-105-B (0.13hp)	N/A	Not Running	81.73	Closes (Starts)	85.11	Pass
238-13D	RCP Oil Clr Rtn Cntnt Isln Vlv 1-FCV-70-89-B (0.13hp)	N/A	Not Running	83.41	Closes (Starts)	86.85	Pass
238-13F	RCP Oil Clr Hdr Cntmt Isln Vlv 1-FCV-70-140-B (0.33hp)	N/A	Not Running	83.59	Closes (Starts)	87.05	Pass
238-18D	480V Bd Rm 1B A/C Cprsr 1B-B 1-MTR-31-447-B (75HP)	N/A	N/A	N/A	N/A	89.25	85
238-2B	ERCW Hdr B Isln Vlv 1-FCV-3-126B-B (0.25HP)	N/A	N/A	N/A	N/A	88.81*	Pass
238-2E	St Flow To AFWP Turb Isln Vlv 1-FCV-1-18-B (1HP)	N/A	N/A	N/A	N/A	92.50*	Pass
238-3B	ERCW Hdr B Isln Vlv 1-FCV-3-179B-B (0.33HP)	N/A	N/A	N/A	N/A	83.47	Pass
238-5E	Cntmt Spray Hx 1B Sup Cont Vlv 1-FCV-67-123-B (0.33HP)	N/A	N/A	N/A	N/A	92.08*	Pass

1B Boards

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
238-5F	Cntmt Spray Hx 1B Disch Vlv 1-FCV-67-124-B (0.33HP)	N/A	N/A	N/A	N/A	91.73*	Pass
238-11B	STA S & C AC SUP HDR B ISO VLV 0-FCV-67-208-B (0.33HP)	N/A	N/A	N/A	N/A	91.28*	Pass
238-17D	CCS HX B ERCW BYPASS FCV 0-FCV-67-144-B (0.13HP)	N/A	N/A	N/A	N/A	84.29	Pass
480V Reac Vent Board 1B-B							
None							

* This MOV terminal voltage is calculated taking credit for the hammer blow feature.

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
6.9KV Shutdown Board 2A-A							
14-10 AFW	AUX FEEDWTR PMP 2A-A 2-MTR-3-118-A (600hp)	98.97	Starts	98.97	Starts	98.96	85
14-13 CSP	CNTMT SPRAY PMP 2A-A 2-MTR-72-27-A (700hp)	N/A	Not Running	98.62	Start	98.60	80
14-14 RHR	RHR PMP 2A-A 2-MTR-74-10-A (400hp)	99.08	Starts	99.08	Starts	98.84	80
14-15 SI	SAFETY INJ PMP 2A-A 2-MTR-63-10-A (400hp)	98.84	Starts	98.84	Starts	98.83	80
14-18 CCP	CNTFGL CHRG PMP 2A-A 2-MTR-62-108-A (600hp)	98.67	Starts	98.67	Starts	98.80	80
14-8 ERCW	ERCW PMP D-A 0-MTR-67-40-A (800hp)	N/A	Starts (D-A or C-A start, but not both, other is not running)	N/A	Starts (D-A or C-A start, but not both, other is not running)	96.59	90
14-9 ERCW	ERCW PMP C-A 0-MTR-67-36-A (800hp)	96.67	Starts (D-A or C-A start, but not both, other is not running)	96.67	Starts (D-A or C-A start, but not both, other is not running)	96.61	90
480V Shutdown Board 2A1-A							
133-3B	Cmpnt Clg Sys Pmp 2A-A 2-MTR-70-59-A (350hp)	81.46	Running	81.66	Running	81.05	70
134-10C	Cntmt Air Rtn Fan 2A-A 2-MTR-30-38-A (100hp)	N/A	Not Running Starts @ 9 Min)	N/A	Not Running Starts @ 9 Min)	83.19 (SIB)	85
134-7C	Reac Lwr Compt Clr Fan 2A-A 2-MTR-30-74-A (60hp)	N/A	Running	N/A	Trips	85.18	80
134-9C	Elec Bd Rm AHU B-A 0-MTR-31-30D-A (50hp)	N/A	Running	N/A	Running	83.35	80
480V Shutdown Board 2A2-A							
135-2C	Elec Bd Rm A/C A-A Cprsr 0MTR-31-128/2-A (250hp)	N/A	Running	N/A	Running	86.41	85
135-3C	SHDN BD RM CHLR PKG A-A CPRSR 0-MTR-31-36/2-A (240hp)	N/A	Running	N/A	Running	92.01	85
136-7D	REAC LWR COMPT CLR FAN 2C-A 2-MTR-30-77-A (60hp)	N/A	Running	N/A	Trips	82.60	80
136-8D	480V SHUTDOWN BD RM AHU B-A 0-MTR-31-44-A (75hp)	N/A	Running	N/A	Running	87.42	85
136-9D	Spent Fuel Pit Pmp A-A 0-MTR-78-12-A (100hp)	N/A	Running	N/A	Running	83.94 (SIB)	80
480V Reactor Vent Board 2A-A							
None							
480V C&A Vent Board 2A1-A							

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
207-10A	Cntfg Chrg Pmp 2A-A Rm Clr Fan 2-MTR-30-183-A (5HP)	83.11	Starts on SI	80.62	Starts on SI	83.43	80
207-10B	Pen Rm El 713 Clr Fan 2A-A 2-MTR-30-196-A (3HP)	86.84	Starts on SI	84.23	Starts on SI	90.72	80
207-10C	Pipe Chase Clr Fan 2A-A 2-MTR-30-201-A (3HP)	84.53	Starts on SI	82	Starts on SI	87.16	80
207-10D	ABGTS HUM HTR A-A 0-HTR-30-147-A (50.008kW)	N/A	Starts on ABI (from SI)	N/A	Starts on ABI (from SI)	N/A	Static Load
207-11A	480V Bd Rm 2B Pr Sup Fan 2B1-A 2-MTR-31-478-A (3HP)	N/A	Running	N/A	Running	92.42	85
207-11C	480V Bd Rm 2A A/C Ahu 2A-A 2-MTR-31-461-A (10HP)	N/A	Running	N/A	Running	88.58	85
207-12A	125V Vital Bat Rm III Ex Fan 2B1-A 2-MTR-31-285-A (0.33HP)	N/A	Running	N/A	Running	91.85	85
207-12C	480V Bd Rm 2A A/C Cond 2A-A 2-MTR-31-290-A (15HP)	N/A	Running	N/A	Running	91.03	85
207-12F1	Cntmt Purge Air Radn Exh Mon 2-RE-90-130-A (0.75HP)	N/A	Running	N/A	Running	94.19	85
207-13D	ERCW SCREEN WASH PUMP 2A-A 2-MTR-67-437-A (40HP)	N/A	Running	N/A	Running	77.36 (SIB)	75
207-2A	AUX CONTROL AIR COMPRESSOR A-A 0-MTR-32-60-A (20hp)	N/A	Not Running	N/A	Not Running	84.00	80
207-2C	Pen Rm El 692 Clr Fan 2A-A 2-MTR-30-186-A (3HP)	84.03	Starts on SI	81.51	Starts on SI	86.41	80
207-3A	Shdn Bd Rm Chlr CW Clr Pmp A-A 0-MTR-31-36/1-A (25HP)	N/A	Running	N/A	Running	86.13	85
207-3C	Cntm Spray Pmp 2A-A Rm Clr Fan 2-MTR-30-177-A (7.5HP)	N/A	Running	80.79	Starts on Phase B	86.61	80
207-3D	Aux BldG Gas Trtmt Sys Fan A-A 2-MTR-30-146-A (50hp)	83.58	Starts On ABI (from SI)	81.08	Starts On ABI	89.01	80
207-4A	EG Trtmt Sys A-A Rm Clr Fan 2-MTR-30-200-A (3HP)	85.94	Starts on ABI (from SI)	83.35	Starts on ABI (from SI)	90.81	80
207-4E	ERCW Str 2A-A Backwash Vlv 2-FCV-67-9A-A (0.33HP)	N/A	N/A	N/A	N/A	83.30	80
207-5E	AFW & BA XFR SPACE CLR FAN A-A 2-MTR-30-184-A (15HP)	86.9	Starts on ABI (from SI)	84.29	Starts on ABI (from SI)	90.70	80
207-6B	ERCW Str 2A-A 2-MTR-67-9-A (3HP)	N/A	Running	N/A	Running	82.30	75
207-6C	Traveling Scrn 2A-A 2-MTR-67-439-A (5HP)	N/A	N/A	N/A	N/A	81.27	80
207-7B	125V VIT BAT RM IV EXFAN 2A1-A 2-MTR-31-287-A (0.33HP)	N/A	Running	N/A	Running	91.86	85
207-8A	Safety Inj Pmp 2A-A Rm Clr Fan 2-MTR-30-180-A (5HP)	85.07 (2s)	Starts on Pump Start	82.96 (2s)	Starts on Pump Start	82.09	80
207-8B	Pen Rm El 737 Clr Fan 2A-A 2-MTR-30-194-A (3HP)	87.49	Starts on ABI (from SI)	84.86	Starts on ABI (from SI)	92.26	80

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
207-8C	480V Xfmr Rm 2A Exh Fan 2A2-A 2-MTR-30-250F-A (3HP)	N/A	Running	N/A	Running	91.75	80
207-8D	480V Xfmr Rm 2A Exh Fan 2A3-A 2-MTR-30-250G-A (3HP)	N/A	Running	N/A	Running	91.75	80
207-8F1	EL BD RM A/C A-A CONTROL/O.PMP 0-MTR-31-128/3-A (3.11HP)	N/A	Running	N/A	Running	90.94	85
207-9A	RHR Pmp 2A-A Rm Clr Fan 2-MTR-30-175-A (5HP)	85.43 (2s)	Starts on SI	82.57 (2s)	Starts on SI	81.91	80
207-9B	C.BIDG Ele BdRm AC Clr Pmp A-A 0-MTR-31-128/1-A (20HP)	N/A	Running	N/A	Running	87.98	85
207-9C	480V Bd Rm 2A Pr Sup Fan 2A1-A 2-MTR-31-462-A (3HP)	N/A	Running	N/A	Running	92.21	85
207-9D	480V Xfmr Rm 2A Exh Fan 2A1-A 2-MTR-30-250E-A (3HP)	N/A	Running	N/A	Running	91.39	85
207-9F1	Cont Rm Intake Mon 0-RE-90-125-A (0.75HP)	N/A	Running	N/A	Running	93.10	85
480V C&A Vent Board 2A2-A							
None							
480V Diesel Aux Board 2A1-A							
221-2B	DG 2A-A RM EXH FAN 1-A 2-MTR-30-448-A (15hp)	92.24	Starts	91.12	Start	93.75	85
221-2D	DG 2A-A Lube Oil Circ Pmp 1 2-MTR-82-A1-A (1hp)	N/A	Running	N/A	Running	94.57	85
221-3A	EM DG ENG HX 2A1 & 2A2 SUP VLV 2-FCV-67-66-A (0.13hp)	82.51	Starts	81.51	Starts	85.79	Pass
221-3D	DG 2A-A DAY TNK FO XFR PMP 1 2-MTR-18-55/3-A (1hp)	91.5	Random	90.39	Random	94.63	85
221-4B	DG 2A-A Aux LubeOil Circ Pmp A 2-MTR-82-AOPA1A (0.75hp)	N/A	Running	N/A	Running	94.82	85
221-6A	DG 2A-A Muffler Rm Exh Fan 2-MTR-30-464 (0.5hp)	91.94	Starts on Diesel Start from SI	90.81	Starts on Diesel Start from SI	94.77	85
221-4D	DG Rm 2A-A Pnl Vent Fan 2-MTR-30-492-A (15HP)	N/A	N/A	N/A	N/A	92.14	85
221-4E	2A-A 480V ELEC BD RM EX FAN 2-MTR-30-460-A (2HP)	N/A	N/A	N/A	N/A	95.01	85
480V Diesel Aux Board 2A2-A							
222-2A	DG 2A-A Aux LubeOil Circ Pmp B 2-MTR-82-AOPB1A (0.75hp)	N/A	Running	N/A	Running	94.86	85
222-2B	DG 2A-A RM EXH FAN 2-A 2-MTR-30-452-A (15hp)	92.65	Starts	92.94	Start	93.57	85
222-2D	DG 2A-A Lube Oil Circ Pmp 2 2-MTR-82-A2-A (1hp)	N/A	Running	N/A	Running	95.28	85
222-3D	DG 2A-A DAY TNK FO XFR PMP 2 2-MTR-18-54/3-A (1hp)	92.22	Random	92.5	Random	95.28	85
480V RMOV Board 2A1-A							
239-10F	Cntm Spray Pmp 2A-A Recirc FCV 2-FCV-72-34-A (0.13hp)	N/A	Not Running	81.21	Closes shortly after Phase B	83.80	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
239-11D	SIS Boron Inj Tank Shutoff Vlv 2-FCV-63-26-A (1.9hp)	84.83	Opens on SI (Starts)	82.23	Opens on SI (Starts)	84.04	Pass
239-12B	Cntmt Sump To RHR Pmp A-A 2-FCV-63-72-A (13hp)	N/A	Operate about 20 minutes after SI	N/A	Opperate about 20 minutes after SI	90.19	Pass
239-13E	Cntmt Spray Hdr 2A Isln Vlv 2-FCV-72-39-A (3.2hp)	N/A	Not Running	79.41	Opens on Ph B (Starts)	85.41	Pass
239-14D	RHR Pmp 2A-A Min Flow Vlv 2-FCV-74-12-A (0.13hp)	84.39	Random	81.8	Random	84.61	Pass
239-15D	LWR CNTMT 2A CLRS SUP ISLN VLV 2-FCV-67-89-A (0.33hp)	N/A	Not Running	84.22	Closes (Starts)	88.86	Pass
239-17B	Cntmt Standpipe Isln Vlv 2-FCV-26-240-A (0.67hp)	81.97	Close (Start)	79.45	Close (Start)	87.19	Pass
239-18E	RCP Spray Isln Vlv 2-FCV-26-243-A (0.67hp)	81.05	Close (Start)	78.55	Close (Start)	86.47	Pass
239-7A	Seal Flow Ret Isln Vlv 2-FCV-62-63-A (1.9hp)	77.73	Closes on Ph A (Starts)	75.34	Closes on Ph A (Starts)	81.71	Pass
239-7B	CHRG FLOW ISLN VLV 2-FCV-62-90-A (1.9hp)	85.01	Closes on SI	82.4	Closes on SI	88.88	Pass
239-8B	Vol Cont Tank Outlet Isln Vlv 2-LCV-62-132-A (1.9hp)	79.79	Closes on SI	77.34	Closes on SI	84.75	Pass
239-5C	LWR CNTMT 2C CLRS SUP ISLN VLV 2-FCV-67-97-A (0.33hp)	N/A	Not Running	84.01	Closes (Starts)	88.15	Pass
239-9A	RWST TO CHARGING PMPS CONT 2-LCV-62-135-A (1.9hp)	83.78	Opens on SI (Starts)	81.2	Opens on SI (Starts)	88.57	Pass
239-9D	2-FCV-70-100A (0.33hp)	N/A	Not Running	83.69	Closes on Phase B	94.38	Pass
239-10B	SIS PMPS RECIRC TO RWST 2-FCV-63-3-A (0.7HP)	N/A	N/A	N/A	N/A	86.31	Pass
239-2B	Boric Acid Transfer Pmp 2A-A 2-MTR-62-230-A (15HP)	N/A	N/A	N/A	N/A	89.58	80
239-11A	SIS Pmp Inlet To CVCS Chrg Pmp 2-FCV-63-7-A (1.9HP)	N/A	N/A	N/A	N/A	80.28	Pass
239-14E	RHR Hx 2A Bypass Vlv 2-FCV-74-33-A (1.9HP)	N/A	N/A	N/A	N/A	82.97	Pass
239-2C	THERM BAR SYS BSTR PMP 2A-A 2-MTR-70-131-A (10HP)	N/A	N/A	N/A	N/A	85.11	80
239-11B	RHR Hx A To CVCS Chrgr Pmp 2-FCV-63-8-A (1.9HP)	N/A	N/A	N/A	N/A	87.15	Pass
239-2E1	RWST To RHR Pmp Flow Cont Vlv 2-FCV-63-1-A (5.2HP)	N/A	N/A	N/A	N/A	90.81	Pass
239-9F	RWST To Spray Hdr 2A FCV 2-FCV-72-22-A (3.2HP)	N/A	N/A	N/A	N/A	88.02 (SIB)	Pass
239-3E	Cntfgl Chrg Pmp 2A-A AOP 2-MTR-62-AOP-A (2HP)	N/A	N/A	N/A	N/A	85.37	85

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
239-12A	SIS Pmp 2A-A Inlet Vlv 2-FCV-63-47-A (1.9HP)	N/A	N/A	N/A	N/A	78.09	Pass
239-4E	AFW Pmp A-A Lube Oil Pmp A-A 2-MTR-3-118D-A (0.25HP)	N/A	N/A	N/A	N/A	89.61	85
239-12D	SIS To RCS Loops 2&3 FCV 2-FCV-63-93-A (1.6HP)	N/A	N/A	N/A	N/A	91.22	Pass
239-12E	SIS Pmp 2A-A Outlet FCV 2-FCV-63-152-A (1.9HP)	N/A	N/A	N/A	N/A	89.49*	Pass
239-13A	SIS Pmp Out RCS Lp 1&3 Hot Leg 2-FCV-63-156-A (1.9HP)	N/A	N/A	N/A	N/A	83.86	Pass
239-6D	RCS Press Relief FCV 2-FCV-68-333-A (1.9HP)	N/A	N/A	N/A	N/A	89.95*	Pass
239-13B	Cntmt Sump To Spray Hdr 2A FCV 2-FCV-72-44-A (3.2HP)	N/A	N/A	N/A	N/A	82.00	Pass
239-14A	RHR Spray Hdr 2A Isln Vlv 2-FCV-72-40-A (1.9HP)	N/A	N/A	N/A	N/A	86.50	Pass
480V RMOV Board 2A2-A							
240-10A	Lwr Cntm 2D Clr Dish Iso Vlv 2-FCV-67-112-A (0.33hp)	N/A	Not Running	85.97	Closes (Starts)	88.00	Pass
240-10D	Up Cntm Vt Clr 2C Dish Iso Vlv 2-FCV-67-296-A (0.13hp)	N/A	Not Running	75.07	Closes (Starts)	86.16	Pass
240-10F	Up Cntm Vt Clr 2D Dish Iso Vlv 2-FCV-67-142-A (0.13hp)	N/A	Not Running	76.26	Closes (Starts)	86.51	Pass
240-11D	RCP Thrm Barr Rtn Cntm Iso Vlv 2-FCV-70-90-A (0.7hp)	N/A	Not Running	86.96	Closes (Starts)	88.28	Pass
240-11E	RCP Thrm Barr Cntmt Isln Vlv 2-FCV-70-133-A (0.13hp)	N/A	Not Running	75.18	Closes (Starts)	88.94	Pass
240-12D	RCP Oil Clr Rtn Cntmt Isln Vlv 2-FCV-70-92-A (0.13hp)	N/A	Not Running	85.07	Closes (Starts)	90.95	Pass
240-16D	Excs Ltdn Hx Cont Inlt Iso Vlv 2-FCV-70-143-A (0.33hp)	85.07	Closes on Phase A	85.53	Closes on Phase A	87.61	Pass
240-3D	St Gen No 1 FW Isln Vlv 2-FCV-3-33-A (39.4hp)	86.38	Use 89-10 start	86.85	Use 89-10 start	86.86	Pass
240-4D	St Gen No 3 FW Isln Vlv 2-FCV-3-87-A (39.4hp)	87.15	Use 89-10 start	87.63	Use 89-10 start	87.77	Pass
240-7D	Lwr Cntm 2A Clr Dish Iso Vlv 2-FCV-67-87-A (0.13hp)	N/A	Not Running	81.03	Closes (Starts)	87.34	Pass
240-7F	Up Cntm Vt Clr 2A Sup Iso Vlv 2-FCV-67-130-A (0.13hp)	N/A	Not Running	76.04	Closes (Starts)	86.47	Pass
240-8B	Lwr Cntmt 2A Clr Sply Isln Vlv 2-FCV-67-107-A (0.33hp)	N/A	Not Running	85.95	Closes (Starts)	88.27	Pass
240-8D	Lwr Cntm 2C Clr Dish Iso Vlv 2-FCV-67-95-A (0.13hp)	N/A	Not Running	80.8	Closes (Starts)	87.16	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
240-8F	Up Cntm Vt Clr 2C Sup Iso Vlv 2-FCV-67-133-A (0.13hp)	N/A	Not Running	76.32	Closes (Starts)	86.47	Pass
240-9A	Lwr Cntmt 2C Clr Sply Isln Vlv 2-FCV-67-99-A (0.33hp)	N/A	Not Running	85.67	Closes (Starts)	88.00	Pass
240-9B	Lwr Cntm 2B Clr Dish Iso Vlv 2-FCV-67-104-A (0.33hp)	N/A	Not Running	86.87	Closes (Starts)	89.38	Pass
240-9D	Up Cntm Vt Clr 2A Dish Iso Vlv 2-FCV-67-295-A (0.13hp)	N/A	Not Running	74.94	Closes (Starts)	85.86	Pass
240-9F	Up Cntm Vt Clr 2B Dish Iso Vlv 2-FCV-67-139-A (0.13hp)	N/A	Not Running	76.38	Closes (Starts)	86.47	Pass
240-11A	Cmpnt Clg Hx A Disch Cont Vlv 2-FCV-67-146-A (0.3HP)	N/A	N/A	N/A	N/A	89.16	80
240-15A	CCS HX B ERCW BYPASS FCV 2-FCV-67-143-A (0.13HP)	N/A	N/A	N/A	N/A	78.67	Pass
240-16E	RHR Hx A-A Outlet Vlv 2-FCV-70-156-A (0.33HP)	N/A	N/A	N/A	N/A	89.51	Pass
240-17A	Sample Hx Hdr Outlet Vlv 2-FCV-70-183-A (0.13HP)	N/A	N/A	N/A	N/A	86.06	Pass
240-17E	480V BD RM 2A A/C CPRSR 2A-A 2-MTR-31-465-A (50HP)	N/A	N/A	N/A	N/A	91.61	85
240-2A	ERCW Hdr A Isln Vlv 2-FCV-3-116A-A (0.25HP)	N/A	N/A	N/A	N/A	83.72	Pass
240-2B	ERCW Hdr A Isln Vlv 2-FCV-3-116B-A (0.25HP)	N/A	N/A	N/A	N/A	83.68	Pass
240-2D	AFWP Turb Stm Sup Fm Stm Gen 1 2-FCV-1-15-A (1HP)	N/A	N/A	N/A	N/A	91.15*	Pass
240-3A	ERCW Hdr A Isln Vlv 2-FCV-3-136A-A (0.33HP)	N/A	N/A	N/A	N/A	83.49	Pass
240-3B	ERCW Hdr A Isln Vlv 2-FCV-3-136B-A (0.33HP)	N/A	N/A	N/A	N/A	83.50	Pass
240-5A	Sample Hx Isln Vlv 2-FCV-70-215-A (0.13HP)	N/A	N/A	N/A	N/A	86.16	Pass
240-5E	Cntmt Spray Hx 2A Sup Cont Vlv 2-FCV-67-125-A (0.33HP)	N/A	N/A	N/A	N/A	89.40	Pass
240-5F	Cntmt Spray Hx 2A Disch Vlv 2-FCV-67-126-A (0.33HP)	N/A	N/A	N/A	N/A	88.91	Pass
240-6A	AFWP Turb Stm Sup Fm Stm Gen 4 2-FCV-1-16-A (1HP)	N/A	N/A	N/A	N/A	91.14*	Pass

* This MOV terminal voltage is calculated taking credit for the hammer blow feature.

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
6.9kV Shutdown Board 2B-B							
15-10 AFW	Aux Feedwater PMP 2B-B 2-MTR-3-128-B (600 HP)	99.11	Starts	99.11	Starts	99.09	85
15-13 CSP	CNTMT SPRAY PMP 2B-B 2-MTR-72-10-B (700 HP)	N/A	Not Running	98.93	Start	98.93	80
15-14 RHR	RHR PUMP 2B-B 2-MTR-74-20-B (400 HP)	99.04	Starts	99.04	Starts	99.06	80
15-15 SI	SAFETY INJ PMP 2B-B 2-MTR-63-15-B (400 HP)	99.06	Starts	99.06	Starts	99.06	80
15-18 CCP	CNTFGL CHRG PMP 2B-B 2-MTR-62-104-B (600 HP)	98.99	Starts	98.99	Starts	98.99	80
15-8 ERCW	ERCW PMP H-B 0-MTR-67-59-B (800 HP)	N/A	Starts (H-B or G-B start, but not both, other is not running)	N/A	Starts (H-B or G-B start, but not both, other is not running)	96.05	90
15-9 ERCW	ERCW PMP G-B 0-MTR-67-55-B (800 HP)	96.72	Starts (H-B or G-B start, but not both, other is not running)	96.72	Starts (H-B or G-B start, but not both, other is not running)	96.66	90
480V Shutdown Board 2B1-B							
137-3C	Cmpnt Clg Sys Pmp 2B-B 2-MTR-70-33-B (350 hp)	81.41	Starts	81.82	Starts	81.05	70
138-7A	Elec Bd Rm AHU D-B 0-MTR-31-31D-B (50 hp)	N/A	Running	N/A	Running	88.7	80
138-7B	Spent Fuel Pit Pmp C-S ALT FDR 0-MTR-78-35-S (100 hp)	N/A	Running	N/A	Running	85.43	80
138-7D	Reac Lwr Compt Clr Fan 2B-B 2-MTR-30-75-B (60 hp)	N/A	Running	N/A	Trips	82.99	80
480V Shutdown Board 2B2-A							
139-2B	Elect Bd rm A/C B-B Cprsr 0-MTR-31-129/2-B (250 hp)	N/A	Running	N/A	Running	86.94	85
139-2D	Cmpnt Clg Sys Pmp C-S 0-MTR-70-51-S (350 hp)	N/A	Running	N/A	Running	70.08 (SIB)	70
140-7D	Reac Lwr Compt Clr Fan 2D-B 2-MTR-30-78-B (60 hp)	N/A	Running	N/A	Trips	86.09	80
140-9C	Cntmt Air Rtn Fan 2B-B 2-MTR-30-39-B (100 hp)	N/A	Not Running Starts @ 9 Min	84.69	Not Running Starts @ 9 Min	86.54	80
140-9D	480V Shutdown Bd Rm AHU D-B 0-MTR-31-61-B (75 hp)	N/A	Running	N/A	Running	89.3	85
480V CA Vent Board 2B1-B							
209-2A	Aux Cont Air Cprsr B-B 0-MTR-32-86-B (20 hp)	N/A	Not Running	N/A	Not Running	84.06	80
209-2C	Pen Rm El713 Clr Fan 2B-B 2-MTR-30-197-B (3 hp)	85.22	Starts on ABI	86.03	Starts on ABI	91.23	80
209-3B	Pipe Chase Clr Fan 2B-B 2-MTR-30-202-B (3 hp)	84.86	Starts on ABI	85.66	Starts on ABI	89.65	80

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation Terminal Voltage (%)		SI Phase B DBE Actuation Terminal Voltage (%)		Individual Motor Start Terminal Voltage (%)	Minimum Required Voltage Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
209-3C	Cntm Spray Pmp 2B-B Rm Clr Fan 2-MTR-30-178-B (7.5 hp)	81.68	Random	82.46	Starts on Pump Start	85.59	80
209-3D	Aux Bldg Gas Trtmt Sys Fan B-B 2-MTR-30-157-B (50 hp)	81.1	Starts on ABI	81.87	Starts on ABI	88.34	80
209-4A	BATTERY RM EL 692 EXH FAN C-B 0-MTR-31-27-B (2 hp)	N/A	Running	N/A	Running	89.74	85
209-5E	AFWP&BA XFR PMP SP CLR FAN B-B 2-MTR-30-185-B (15 hp)	85.35	Starts on ABI	86.16	Starts on ABI	88.71	80
209-6B	ERCW Str 2B-B 2-MTR-67-10-B (3 hp)	N/A	Running	N/A	Running	77.35	75
209-6C	Traveling Scrn 2B-B 2-MTR-67-10-B (5 hp)	N/A	Running	N/A	Running	81.59	80
209-7B	125V Vit Bat Rm IV ExFan 2A2-B 2-MTR-31-288-B (0.33 hp)	N/A	Running	N/A	Running	92	85
209-8A	Safety Inj Pmp 2B-B Rm Clr Fan 2-MTR-30-179-B (5 hp)	83.21	Starts on Pump Start	84	Starts on Pump Start	87.86	80
209-8B	Pen Rm El 692 Clr Fan 2B-B 2-MTR-30-187-B (3 hp)	84.87	Starts on ABI	85.67	Starts on ABI	89.67	80
209-8C	Shtdn Xfmr Rm 2B Exh Fan 2B2-B 2-MTR-30-246G-B (3 hp)	N/A	Running	N/A	Running	91.81	80
209-8D	Shtdn Xfmr Rm 2B Exh Fan 2B3-B 2-MTR-30-246H-B (3 hp)	N/A	Running	N/A	Running	85.86	80
209-8E	C.Bldg Ele BdRm AC Clr Pmp B-B 0-MTR-31-129/1-B (20 hp)	N/A	Running	N/A	Running	88.41	85
209-8F1	EL BD RM A/C B-B CONTROL/O.PMP 0-MTR-31-129/3-B (3 hp)	N/A	Running	N/A	Running	92.24	85
209-9A	RHR Pmp 2B-B Rm Clr Fan 2-MTR-30-176-B (5 hp)	84.05 (2s)	Starts on Pump Start	84.98 (2s)	Starts on Pump Start	82.62	80
209-9C	480V Bd Rm 2A Pr Sup Fan 2A2-B 2-MTR-31-463-B (3 hp)	N/A	Running	N/A	Running	92.91	85
209-9D	Shtdn Xfrm Rm 2B Exh Fan 2B1-B 2-MTR-30-246F-B (3 hp)	N/A	Running	N/A	Running	92.51	80
209-9E	Pen Rm El 737 Clr Fan 2B-B 2-MTR-30-195-B (3 hp)	85.73	Starts on ABI	86.55	Starts on ABI	91.79	80
209-10A	Cntfg Chrg Pmp 2B-B Rm Clr Fan 2-MTR-30-182-B (5 hp)	84.1	Starts on Pump Start	84.9	Starts on Pump Start	89.11	80
209-10B	480V Bd Rm 2B Pr Sup Fan 2B2-B 2-MTR-31-477-B (3 hp)	N/A	Running	N/A	Running	93.3	85
209-10C	125V Vit BatRm III ExFan 2B2-B 2-MTR-31-286-B (0.33 hp)	N/A	Running	N/A	Running	92.03	85
209-10F1	Cont Rm Intake Mon 0-RE-90-126-B (0.75 hp)	N/A	Running	N/A	Running	93.29	85
209-11B	480V Bb Rm 2B A/C Ahu 2B-B 2-MTR-31-475-B (20 hp)	N/A	Running	N/A	Running	90.95	85
209-11C	480V Bd Rm 2B A/C cond 2B-B 2-MTR-31-289-B (20 hp)	N/A	Running	N/A	Running	90.38	85
209-12B	EG Trtmt Sys B-B Rm Clr Fan 2-MTR-30-207-B (3 hp)	85.5	Starts on ABI	86.32	Starts on ABI	91.86	80
209-13D	ERCW Scrn Wash Pmp 2B-B 2-MTR-67-447-B (40 hp)	N/A	N/A	N/A	N/A	76.04 (SIB)	75
209-7E	RWST To Spray Hdr 2B FCV 2-FCV-72-21-B (3.3 hp)	N/A	Not Running	N/A	Not Running	89.23	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base
209-6E	ERCW Str 2B-B Flush Vlv 2-FCV-67-108-B (0.33HP)	N/A	N/A	N/A	N/A	82.73	80
209-4E	ERCW Str 2B-B Backwash Vlv 2-FCV-67-10A-B (0.33HP)	N/A	N/A	N/A	N/A	82.99	80
480V CA Vent Board 2B2-B							
None							
480V Diesel Aux Board 2B1-B							
223-2B	DG 2B-B RM EXH FAN 1B 2-MTR-30-450-B (15 hp)	91.73	Starts	92.13	Start	93.06	85
223-2D	DG 2B-B Lube Oil Circ Pmp 1 2-MTR-82-B1-B (1 hp)	N/A	Running	N/A	Running	95.01	85
223-3A	EM DG ENG SUP VLV FROM HDR 1B 2-FCV-67-67-B (0.13hp)	82.62	Open on Diesel Start	82.98	Open on Diesel Start	86.11	Pass
223-3D	DG 2B-B DAY TNK FO XFR PMP 1 2-MTR-18-55/4-B (1 hp)	91.57	Random	91.96	Random	94.93	85
223-4D	DG Rm 2B-B Pnl Vent Fan 2-MTR-30-494-B (15 hp)	N/A	Running	N/A	Running	92.41	85
223-4E	DG 2B-B 480V Elec Bd Rm Ex Fan 2-MTR-30-462-B (2 hp)	N/A	Running	N/A	Running	94.53	85
223-6A	Dg 2B-B Muffler Rm Exh Fan 2-MTR-30-466 (0.5HP)	91.97	Starts	92.37	Starts	95.49	85
480V Diesel Aux Board 2B2-B							
224-2A	DG 2B-B Aux LubeOil Circ Pmp B 2-MTR-82-AOPB2B (0.75 hp)	N/A	Running	N/A	Running	94.78	85
224-2B	DG 2B-B RM EXH FAN 2-B 2-MTR-30-454-B (15 hp)	93.44	Starts	92.08	Start	93.5	85
224-2D	DG 2B-B Lube Oil circ Pmp 2 2-MTR-82-B2-B (1 hp)	N/A	Running	N/A	Running	95.21	85
224-3D	DG 2B-B DAY TNK FO XFR PMP 2 2-MTR-18-54/4-B (1 hp)	93.21	Random	91.85	Random	95.21	85
480V RMOV Board 2B1-B							
241-17D	AFW Pmp B-B Lube Oil Pmp B-B 2-MTR-3-128D-B (0.25 hp)	N/A	Running	N/A	Running	89.82	85
241-3F2	SIS Accum Tank Flow Isol Vlv 2-FCV-63-98-B (19.5 hp)	80.71	Not Running	81.43	Not Running	84.24	Pass
241-5A	HPFP Sys Low Level Intake Vlv 0-FCV-26-8-B (0.13 hp)	N/A	Running	N/A	Running	80.39	80
241-5E	RCS Press Relief FCV 2-FCV-68-332-B (2 hp)	N/A	Not Running	N/A	Not Running	88.80*	Pass
241-6D	Seal Flow Ret Isln Vlv 2-FCV-62-61-B (1.9 hp)	79.93	Closes on Ph A (Starts)	80.64	Not Running	86.3	Pass
241-7A	CHRG FLOW ISLN VLV 2-FCV-62-91-B (1.9 hp)	83.04	Closes on SI	83.77	Closes on SI	83.99	Pass
241-8A	Vol Cont Tank Outlet Isln Vlv 2-LCV-62-133-B (1.9 hp)	78.75	Closes on SI	79.45	Closes on SI	84.9	Pass
241-8B	RWST TO CHRG PMP VALVE CONT 2-LCV-62-136-B (1.9 hp)	77.7	Opens on SI	78.39	Opens on SI	83.76	Pass
241-9B	RHR To RCS H.L. 1&3 Flow Iso V 2-FCV-63-172-B (2.6 hp)	N/A	Not Running	N/A	Not Running	80.11	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

ETAP Bus ID/ Compt No	Load Description	SI Phase A DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase A	SI Phase B DBE Actuation Terminal Voltage (%) 6.6kV / 460V Base	SI Phase B	Individual Motor Start Terminal Voltage (%) 6.6kV / 460V Base	Minimum Required Voltage Terminal Voltage V(%) 6.6kV / 460V Base
241-9F	Cntm spray Pmp 2B-B Recirc FCV 2-FCV-72-13-B (0.1 hp)	N/A	Not Running	79.89*	Starts slightly after Phase B	85.26	Pass
241-10A	SIS 2B-B Dsh To RWST Shtff Vlv 2-FCV-63-4-B (0.66 hp)	N/A	Not Running	N/A	Not Running	84.47	Pass
241-10B	RWST To SIS Pump FCV 2-FCV-63-5-B (2 hp)	N/A	Not Running	N/A	Not Running	81.8	Pass
241-10F	RWST To Spray Hdr 2B FCV 2-FCV-72-21-B (3.2 hp)	N/A	Not Running	N/A	Not Running	85.62	Pass
241-11A	SIS Pmp Inlet To CVCS Chrg Pmp 2-FCV-63-6-B (2 hp)	N/A	Not Running	N/A	Not Running	80.24	Pass
241-11B	RHR Hx B to SIS Pmp 2-FCV-63-11-B (2 hp)	N/A	Not Running	N/A	Not Running	86.86	Pass
241-11E	SIS Boron Inj Tank Shutoff Vlv 2-FCV-63-25-B (1.9 hp)	82.51	Closes on SI	83.24	Closes on SI	87.8	Pass
241-12B	SIS Pmp 2B-B Inlet Vlv 2-FCV-63-48-B (2 hp)	N/A	Not Running	N/A	Not Running	82.55	Pass
241-12D	Cntmt Sump To RHR Pmp B-B 2-FCV-63-73-B (13.2 hp)	N/A	Open at 20 Min after SI	N/A	Open at 20 Min after SI	90.37	Pass
241-12E	SIS To RCS Loops 1 & 4 FCV 2-FCV-63-94-B (1.6 hp)	N/A	Not Running	N/A	Not Running	91.33	Pass
241-13A	SIS Pmp 2B-B Outlet FCV 2-FCV-63-153-B (2 hp)	N/A	Not Running	N/A	Not Running	89.61*	Pass
241-13B	SIS pmp Out RCS Lp 2&4 Hot Leg 2-FCV-63-157-B (2 hp)	N/A	Not Running	N/A	Not Running	86.64	Pass
241-13D	SIS 2B-B Dsh to RWST Shtff Vlv 2-FCV-63-175-B (0.66 hp)	N/A	Not Running	N/A	Not Running	84.87	Pass
241-14A	Cntmt Spray Hdr 2B Isln Vlv 2-FCV-72-2-B (3.2 hp)	N/A	Not Running	83.75	Open on Phase B	85.35	Acceptable Margin
241-14D	RHR SPRAY HDR 2B ISOL VLV 2-FCV-72-41-B (2 hp)	N/A	Not Running	N/A	Not Running	90.92*	Pass
241-14E	Cntm Sump To Spray Hdr 2B FCV 2-FCV-72-45-B (3.3 hp)	N/A	Not Running	N/A	Not Running	89.25*	Pass
241-15A**	RHR Pmp 2B-B Inlet FCV 2-FCV-74-21-B (5.2 hp) * * Relocated to Bus 210-7D	N/A	Not Running	N/A	Not Running	94.27	Pass
241-15B	RHR Pmp 2B-B Min Flow Vlv 2-FCV-74-24-B (0.1 hp)	71.67	Start on RHR pump start on SI	72.3	Start on RHR pump start on SI	83.49	Pass
241-15D	RHR Hx 2B Bypass Vlv 2-FCV-74-35-B (2 hp)	N/A	Not Running	N/A	Not Running	78.21	Pass
480V RMOV Board 2B2-B							
242-18D	480V Bd Rm 2B A/C Cprsr 2B-B 2-MTR-31-447-B (75 hp)	N/A	Running	N/A	Running	91.1	85
242-2A	ERCW Hdr B Isln Vlv 2-FCV-3-126A-B (0.67 hp)	N/A	Not Running	N/A	Not Running	83.07	Pass
242-2B	ERCW Hdr B Isln Vlv 2-FCV-3-126B-B (0.67 hp)	N/A	Not Running	N/A	Not Running	83.06	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit)
Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage
Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts

		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
242-2E	St Flow To AFWP Turb Isln Vlv 2-FCV-1-18-B (1 hp)	N/A	Running	N/A	Running	90.84*	Pass
242-3A	ERCW Hdr B Isln Vlv 2-FCV-3-179A-B (0.33 hp)	N/A	Random	N/A	Random	83.66	Pass
242-3B	ERCW Hdr B Isln Vlv 2-FCV-3-179B-B (0.33 hp)	N/A	Random	N/A	Random	83.67	Pass
242-3D	St Gen No 2 FW Isln Vlv 2-FCV-3-47-B (39.4 hp)	86.1	Use 89-10 start	82.89	Use 89-10 start	86.23	Pass
242-4D	St Gen No 4 FW Isln Vlv 2-FCV-3-100-B (39.4 hp)	87.12	Use 89-10 start	83.86	Use 89-10 start	87.41	Pass
242-5C	LWR CNTMT 2A CLRS SUP ISLN VLV 2-FCV-67-113B (0.3 hp)	N/A	Not Running	82.26	Closes (Starts)	88.28	Pass
242-5E	Cntmt Spray Hx 2B Sup Cont Vlv 2-FCV-67-123-B (0.33 hp)	N/A	Not Running	N/A	Not Running	89.15	Pass
242-5F	Cntmt Spray Hx 2B Sup Disch Vlv 2-FCV-67-124-B (0.33 hp)	N/A	Not Running	N/A	Not Running	88.5	Pass
242-6D	RCP Thrm Barr Rtn Cntm Iso Vlv 2-FCV-70-87-B (0.7 hp)	N/A	Not Running	84.57	Closes (Starts)	90.2	Pass
242-6E	RCP Thrm Barr Cntmt Isln Vlv 2-FCV-70-134-B (0.1 hp)	N/A	Not Running	72.05	Closes (Starts)	85.83	Pass
242-7D	Lwr Cntmt 2B Clr Dish Isln Vlv 2-FCV-67-103-B (0.1 hp)	N/A	Not Running	76.56	Closes (Starts)	86.35	Pass
242-7F	Up Cntm Vt Clr 2A Dish Iso Vlv 2-FCV-67-131-B (0.1 hp)	N/A	Not Running	71.76	Closes (Starts)	85.63	Pass
242-8D	Lwr Cntm 2D Clr Dish Iso Vlv 2-FCV-67-111-B (0.1 hp)	N/A	Not Running	76.9	Closes (Starts)	86.73	Pass
242-8F	Up Cntm Vt Clr 2C dish Iso Vlv 2-FCV-67-134-B (0.1 hp)	N/A	Not Running	71.76	Closes (Starts)	85.63	Pass
242-9A	Lwr Cntm 2A Clr Dish Iso Vlv 2-FCV-67-88-B (0.3 hp)	N/A	Not Running	81.57	Closes (Starts)	86.35	Pass
242-9B	Lwr Cntm 2C Clr Dish Iso Vlv 2-FCV-67-96-B (0.3 hp)	N/A	Not Running	81.06	Closes (Starts)	86.45	Pass
242-9D	Up Cntm Vt Clr 2B Dish Iso Vlv 2-FCV-67-297-B (0.1 hp)	N/A	Not Running	71.38	Closes (Starts)	85.46	Pass
242-9F	Up Cntm Vt Clr 2B Sup Isln Vlv 2-FCV-67-138-B (0.1 hp)	N/A	Not Running	71.76	Closes (Starts)	85.63	Pass
242-10A	Lwr Cntmt 2B Clr Sply Isln Vlv 2-FCV-67-91-B (0.3 hp)	N/A	Not Running	81.06	Closes (Starts)	86.74	Pass
242-10B	Lwr Cntmt 2D Clr Sply Isln Vlv 2-FCV-67-83-B (0.3 hp)	N/A	Not Running	81.57	Closes (Starts)	87.34	Pass
242-10D	Up Cntm Vt Clr 2D Dish Iso Vlv 2-FCV-67-298-B (0.1 hp)	N/A	Not Running	71.85	Closes (Starts)	85.7	Pass
242-10F	Up Cntm Vt Clr 2D Sup Isln Vlv 2-FCV-67-141-B (0.1 hp)	N/A	Not Running	71.76	Closes (Starts)	85.69	Pass
242-11B	LWR CNTMT 2B CLRS SUP ISLN VLV 2-FCV-67-105-B (0.3 hp)	N/A	Not Running	81.82	Closes (Starts)	87.89	Pass
242-12B	CCS Hx C Disch Vlv To Hdr B 0-FCV-67-152-B (0.7 hp)	N/A	Running	N/A	Running	89.96	Pass
242-13D	RCP Oil CLR RTN CNTMT ISLN VLV 2-FCV-70-89-B (0.3 hp)	N/A	Not Running	72.25	Closes (Starts)	91.79	Pass
242-13F	RCP Oil Clr Hdr Cntmt Isln Vlv 2-FCV-70-140-B (0.3 hp)	N/A	Not Running	80.79	Closes (Starts)	86.42	Pass

EVALUATION of CLASS 1E MOTOR STARTING VOLTAGES at DVR DROPOUT (Analytical Limit) Comparison of Minimum Available Starting Voltage v/s Required Starting Voltage Results Shown for DBE Actuation (SI-A or SI-B) and Individual Motor Starts							
		SI Phase A DBE Actuation		SI Phase B DBE Actuation		Individual Motor Start	Minimum Required Voltage
		Terminal Voltage (%)		Terminal Voltage (%)		Terminal Voltage (%)	Terminal Voltage V(%)
ETAP Bus ID/ Compt No	Load Description	6.6kV / 460V Base	SI Phase A	6.6kV / 460V Base	SI Phase B	6.6kV / 460V Base	6.6kV / 460V Base
242-17A	SFPCS Hx Sply Hdr Isln Vlv 0-FCV-70-194-B (0.33 hp)	N/A	Not Running	N/A	Not Running	92.18*	Pass
480V Reactor Vent Board 2B-B							
None							

* This MOV terminal voltage is calculated taking credit for the hammer blow feature.

Voltage Recovery Analysis for DBE

Purpose

The purpose of the attachment is to demonstrate that any possible voltage transient caused by motor starting during a DBE (SI with Phase A or Phase B isolation), including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 5 seconds.

Approach

This transient voltage dip and recovery analysis is similar to that analyzed by the offsite power analysis (reference 2.2) which shows that the voltage recovers above the DVR reset within 5 seconds. However, the offsite power analysis credits the use of automatic load tap changers (LTC) for voltage recovery and also assumes minimum operable grid capacity. The offsite power analysis accounts for minimum operable grid capacity by using an extremely conservative technique of forcing the switchyard voltage to the minimum allowable post-event voltage. This technique ignores the voltage recovery that would occur once the larger motors accelerate.

In this analysis, the offsite power source has been modeled using a classical Thevenin equivalent impedance technique (fixed voltage source behind impedance). The impedance chosen is equivalent to that grid capacity that would result in the voltage at the 6.9kV Shutdown Boards dropping all the way to the loss of voltage (LOV) relay setpoint during initial DBE motor starting (block-start of ECCS loads).

Bases/Assumptions

- The offsite power LTCs (CSST C & D) are not allowed to correct the voltage during the motor starting event. However, they are allowed to adjust the voltage prior to the event. This is conservative because it will result in the worst-case voltage transient with no voltage recovery from the LTCs.
- The auxiliary power system is assumed to be in normal alignment prior to the event (Unit Boards and RCP Boards on USSTs, Common Boards on CSSTs A/B, Shutdown Boards on CSSTs C/D). This is conservative, because it puts the least amount of load on the offsite power source prior to the event and thereby results in a "stiffer" offsite power source impedance (i.e. less recovery).
- The 161kV Switchyard voltage is assumed to be at the minimum operable voltage prior to the event. This is conservative, because it will also result in a "stiffer" offsite power source impedance (i.e. less recovery).

Computations

Using the existing ETAP model used to perform offsite power analysis for two unit operation (Ref. 2.2), a dynamic motor starting analysis was performed for both SI-Phase A and SI-Phase B events on each unit. Using a trial and error technique, the switchyard source capacity (MVA_{sc}) was adjusted until the applicable 6.9kV Shutdown Board voltages just equaled the LOV setpoint (80% nominal) at t=0+ in the event being studied.

Each dynamic motor starting study case (SIA and SIB) was run for at least 5 seconds. The associated ETAP reports provide the voltage during the event in 0.1 second intervals for each 6.9kV Shutdown Board.

Results

A plot of the worst-case voltage recovery is shown for both U1 SIB and U2 SIB. The results show that in all cases the 6.9kV Shutdown Board voltage recovers above the DVR reset value (operational limit of 6681V) within 4 seconds.

Conclusions

This bounding analysis demonstrates that any possible voltage transient caused by DBE motor starting, including drop to the LOV setpoint, will also result in successful recovery above DVR reset within 5 seconds.

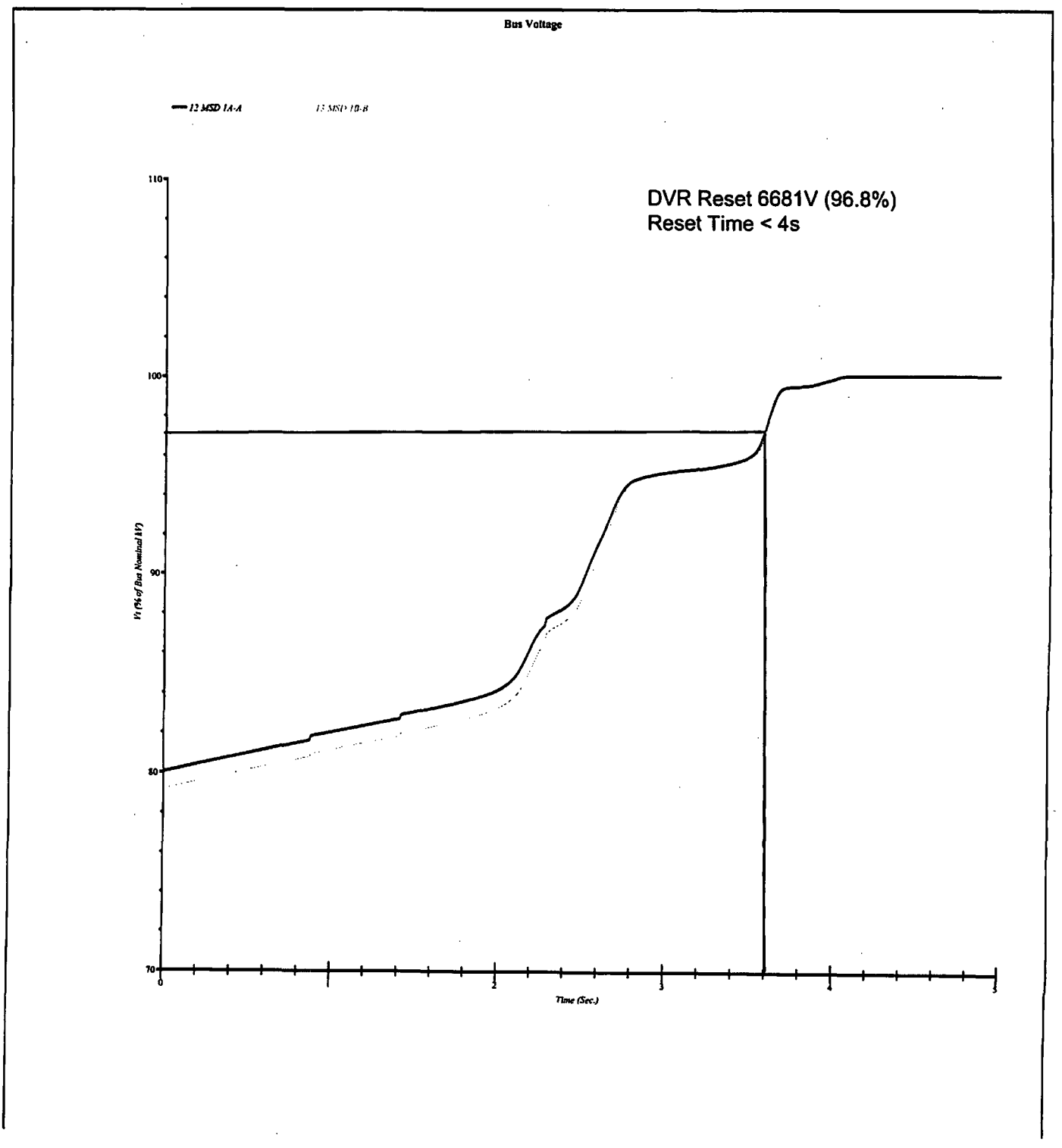
ETAP

Project:	Watts Bar Nuclear Plant	7.0.0N	Date: 03-21-2012
Location:	//chachaapp5/etaps/wbnp/		SN: 90TVA12DC2
Contract:			Revision: Unit 1&2
Engineer:		Study Case: U1 SIB-U2	Config.: N 4 CSST-U2

WBN-EEB-MS-TI06-0029
Unit 1 SI Phase B. Plant in normal alignment (4CSSTs) at lowest operable grid (161kV). No LTC during the event.

Project File: J:\wbnp\R0 EDQ00099920120004 (DVR Analysis)\DVR Analysis WBN\DVR LOV Recovery Analysis\WBNDATA
Output Report: U1SIB-152MVA

MOTOR STARTING ANALYSIS

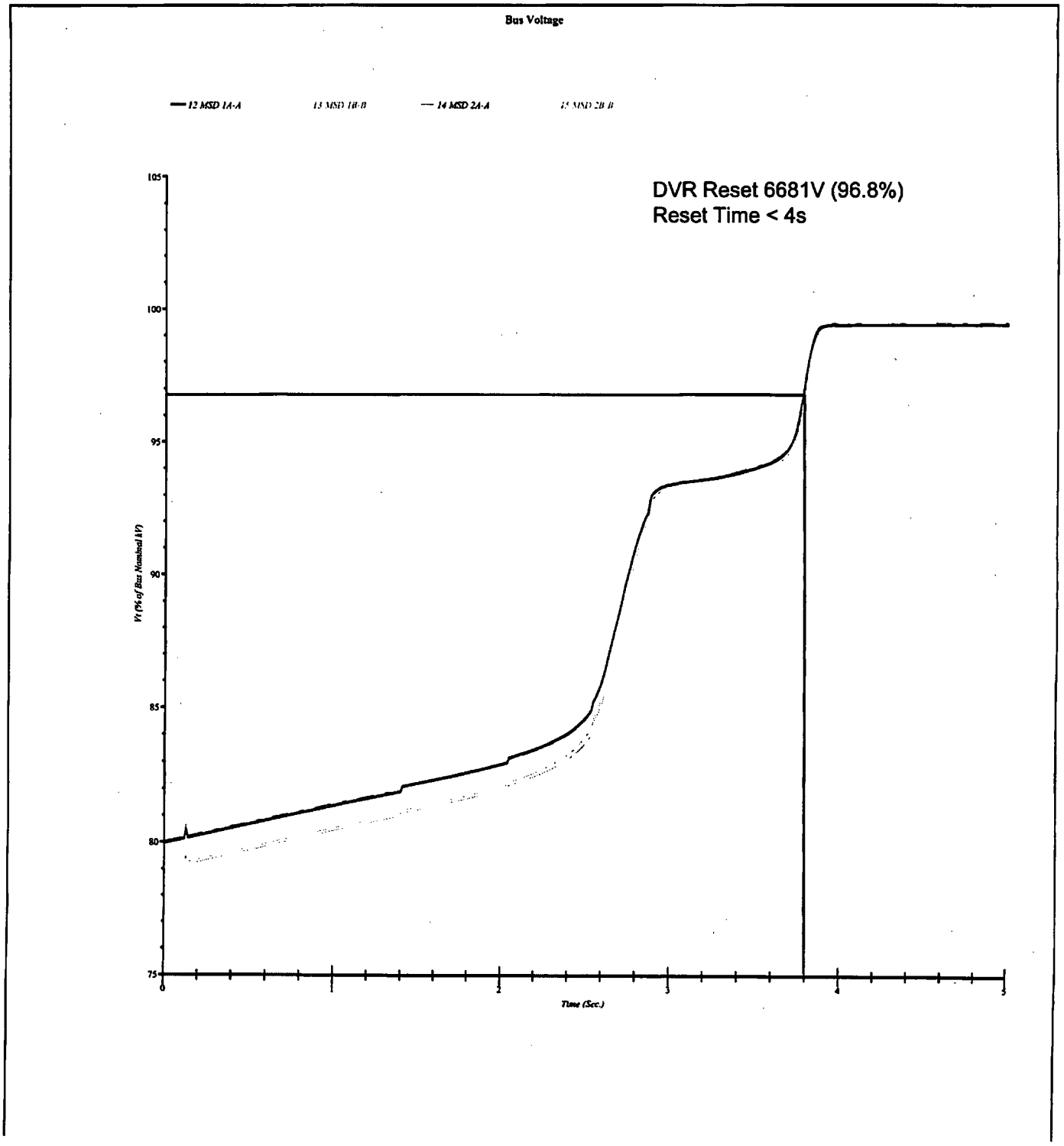


		ETAP			
Project:	Watts Bar Nuclear Plant	7.0.0N		Date:	03-21-2012
Location:	//chachaapp5/etaps/wbnp/			SN:	90TVA12DC2
Contract:				Revision:	Unit 1&2
Engineer:		Study Case: U1/2 SIA		Config.:	N 4 CSST-U2

WBN-EEB-MS-TI06-0029
Unit 1/2 SI Phase A. Plant in normal alignment (4CSSTs) at lowest operable grid (161kV). No LTC during the event.

Project File: J:\wbnp\R0 EDQ00099920120004 (DVR Analysis)\DVR Analysis WBN\DVR LOV Recovery Analysis\WBNDATA
Output Report: U12-SIA

MOTOR STARTING ANALYSIS



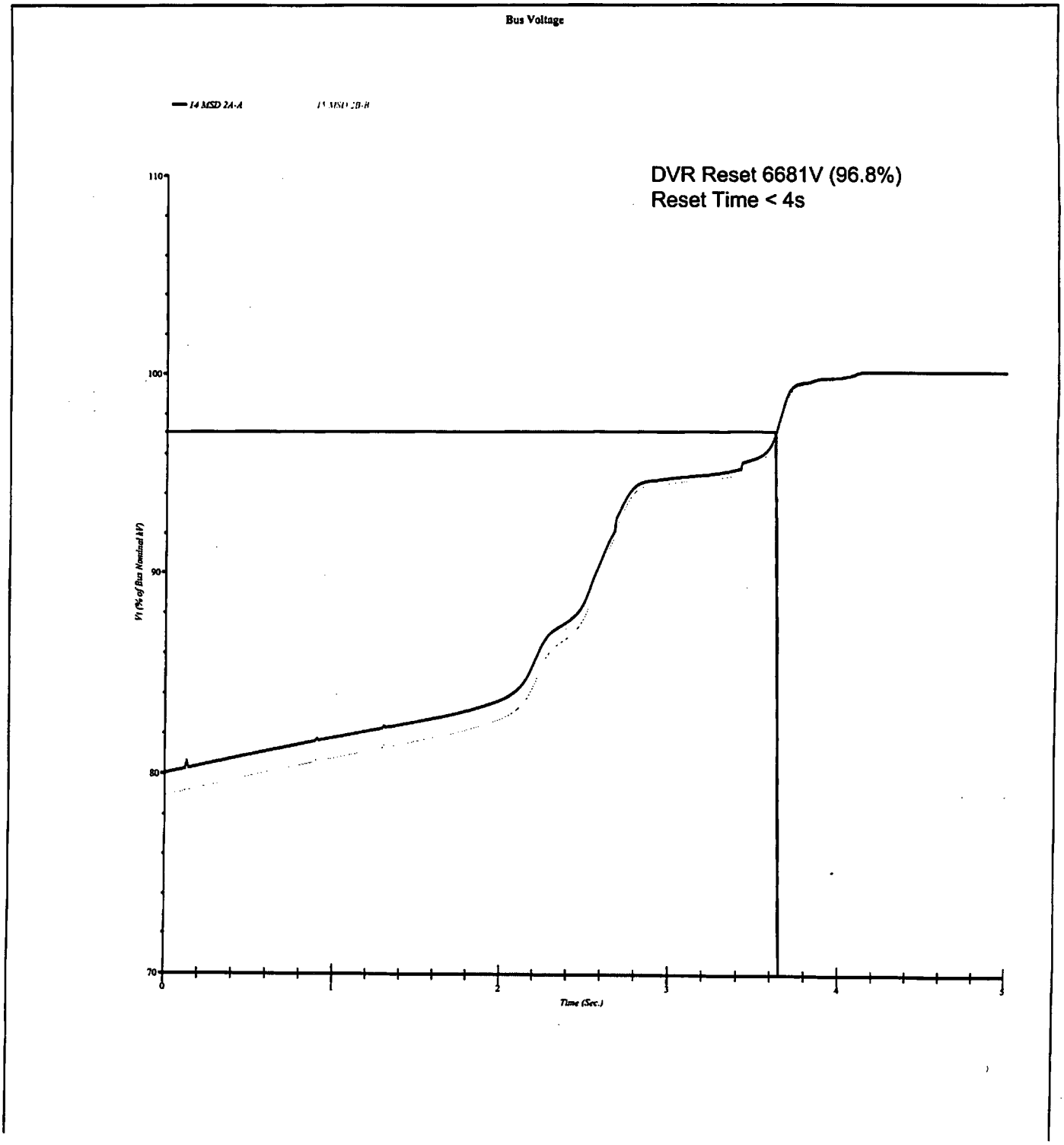
ETAP

Project:	Watts Bar Nuclear Plant	7.0.0N	Date: 03-21-2012
Location:	//chachaapp5/etaps/wbnp/		SN: 90TVA12DC2
Contract:			Revision: Unit 1&2
Engineer:		Study Case: U2 SIB-U2	Config.: N 4 CSST-U2

WBN-EEB-MS-TI06-0029
Unit 2 SI Phase B. Plant in normal alignment (4CSSTs) at lowest operable grid (161kV). No LTC during the event.

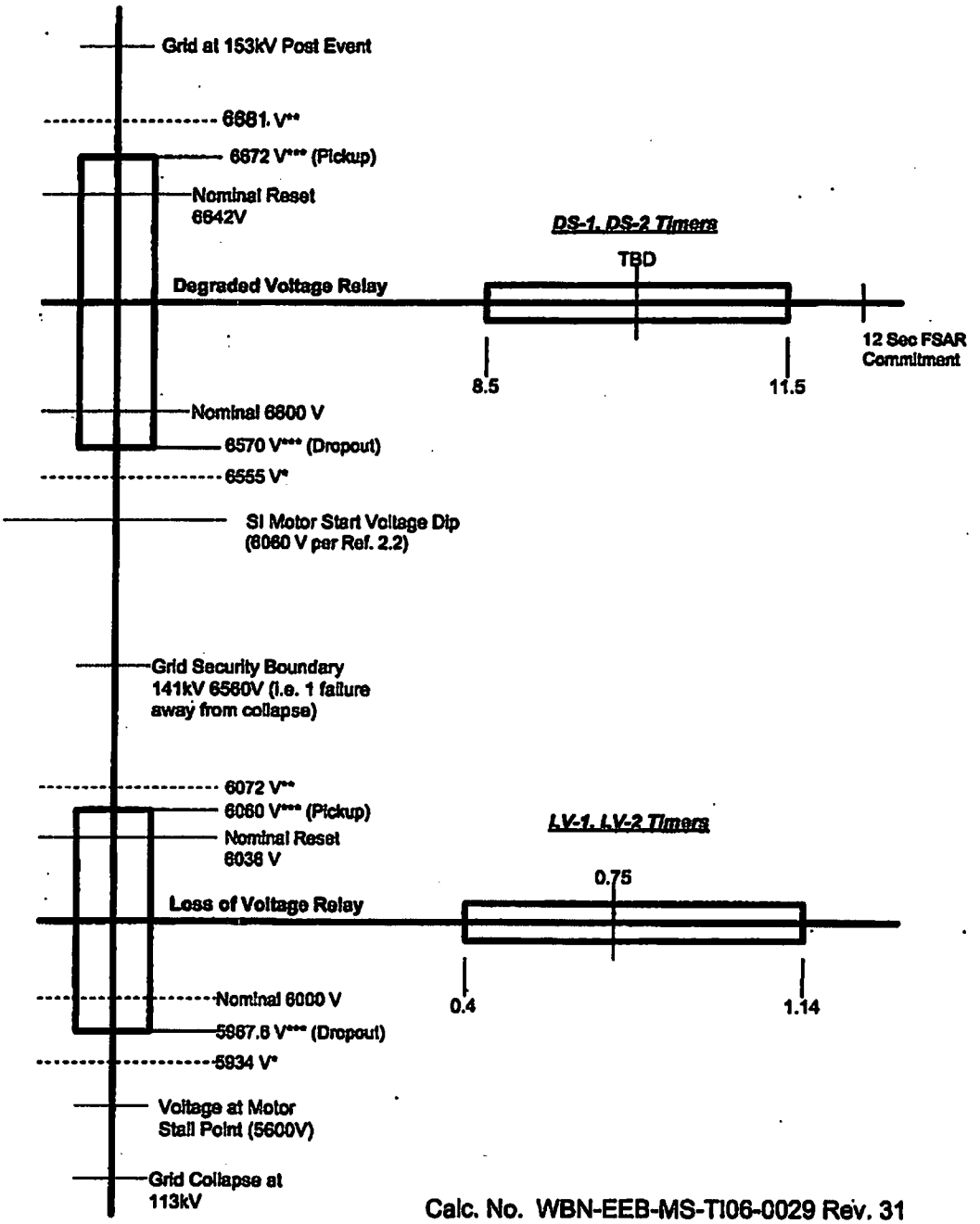
Project File: J:\wbnp\R0 EDQ00099920120004 (DVR Analysis)\DVR Analysis WBN\DVR LOV Recovery Analysis\WBNDATA
Output Report: U2SIB-152MVA

MOTOR STARTING ANALYSIS



~~WBN-EEB-TI06-0029~~

Figure 8.3



Calc. No. WBN-EEB-MS-TI06-0029 Rev. 31
This Sheet revised by Revision 31 .

Figure 8.3 - Degraded Voltage and Loss-of-Voltage Relay Setpoint

* Analytical Limit (Ref. 2.20)
** Operational Limit (Ref. 2.20)
*** Allowable Value (Excludes PT accuracy - Ref. 2.16)

This page replaced by R20