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919.362.2000

10 CFR 50.90

Serial: HNP-14-043
June 19, 2014

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

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400

Subject: License Amendment Request to Revise Technical Specification Table 3.3-4 Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

Ladies and Gentlemen:

Pursuant to 10 CFR 50.90, Duke Energy Progress, Inc. (Duke Energy) hereby requests a revision to the Technical Specifications (TS) for Shearon Harris Nuclear Power Plant, Unit 1. The proposed license amendment revises TS 3.3.2, "Engineered Safety Features Actuation System (ESFAS) Instrumentation," Table 3.3-4 "Engineered Safety Features Actuation System Instrumentation Trip Setpoints." Specifically, the Functional Unit 9.a, Loss-of-Offsite Power 6.9 kV Emergency Bus Undervoltage – Primary, instrument trip setpoint and associated allowable value are being revised to correct a non-conservative TS.

This license amendment request was discussed with the NRC staff in a public meeting teleconference on July 9, 2013. Comments from the staff in that meeting have been incorporated into this request.

The proposed changes have been evaluated in accordance with 10 CFR 50.91(a)(1) using criteria in 10 CFR 50.92(c), and it has been determined that the proposed changes involve no significant hazards consideration. The bases for these determinations are included in the enclosure. Duke Energy is providing the state of North Carolina with a copy of this submittal in accordance with 10 CFR 50.91(b).

Approval of the proposed license amendment is requested by June 19, 2015. Once approved, the amendment shall be implemented within 120 days.

This document contains no new Regulatory Commitments.

Please refer any questions regarding this submittal to John Caves at (919) 362-2406.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on [19 JUNE 2014].

Sincerely,

Ernest J. Kapopoulos, Jr.

Enclosure: Evaluation of the Proposed Change

cc: Mr. J. D. Austin, NRC Sr. Resident Inspector, HNP (email)
Mr. W. L. Cox, III, Section Chief N.C. DENR (email)
Ms. M. Barillas, NRC Project Manager, HNP (email)
Mr. V. M. McCree, NRC Regional Administrator, Region II (EIE)

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HNP-14-043

Enclosure

Shearon Harris Nuclear Power Plant / Unit 1
Docket No. 50-400

Evaluation of the Proposed Change

License Amendment Request to Revise
Technical Specification Table 3.3-4
Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

Attachment 1
Revised Technical Specification Mark-ups

Attachment 2
Revised Technical Specification Retyped Pages

Attachment 3
Revised Technical Specification Bases Mark-ups

Attachment 4
Supporting Information Regarding Loss-of-Offsite Power
Instrumentation Setpoint Revision

Evaluation of the Proposed Change
License Amendment Request to Revise Technical Specification Table 3.3-4
Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

1. Summary Description

This license amendment request (LAR) proposes changes to the Renewed Facility Operating License No. NPF-63 for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) including Appendix A, Technical Specifications (TS), to correct a non-conservative TS requirement by revising the trip setpoint and allowable values specified in Table 3.3-4, "Engineered Safety Feature Actuation System Instrumentation Trip Setpoints," for Functional Unit 9.a, Loss-of-Offsite Power, 6.9 kV Emergency Bus Undervoltage – Primary.

Attachment 1 provides the TS change mark-ups. Attachment 2 provides the retyped TS pages. Attachment 3 provides the TS Bases mark-ups for information only. Attachment 4 provides additional information supporting the technical evaluation for the proposed changes.

2. Detailed Description

Duke Energy Progress, Inc. (Duke Energy), proposes to revise Renewed Facility Operating License No. NPF-63 pursuant to 10 CFR 50.90, as follows:

1. Functional Unit 9.a, Loss-of-Offsite Power, 6.9 kV Emergency Bus Undervoltage – Primary, trip setpoint specified in Table 3.3-4 is revised from "≥ 4830 volts with a ≤ 1.0 second time delay" to "≥ 5454 volts with a ≤ 1.46 second time delay. See NOTES 1, 2."

2. Functional Unit 9.a, Loss-of-Offsite Power, 6.9 kV Emergency Bus Undervoltage – Primary, allowable value specified in Table 3.3-4 is revised from "≥ 4692 volts with a time delay ≤ 1.5 seconds" to "≥ 5329 volts with a ≤ 1.5 second time delay."

3. Two notes are added to Table 3.3-4. Note 1 states "If the as-found channel setpoint is outside its predefined as-found tolerance, the channel shall be evaluated to verify that it is functioning as required before returning the channel to service." Note 2 states "The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Trip Setpoint in Table 3.3-4 (Nominal Trip Setpoint (NTSP)) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the surveillance procedures (field setting) to confirm channel performance. The methodologies used to determine NTSPs and the as-found and the as-left tolerances are specified in EGR-NGGC-0153, "Engineering Instrument Setpoints." The as-found and as-left tolerances are specified in PLP-106 "Technical Specification Equipment List Program and Core Operating Limits Report."

3. Technical Evaluation

The 6.9 kV buses (designated 1A-SA and 1B-SB) supply power to safety-related loads, downstream power centers, motor control centers (MCCs), and panels. They are provided with two sets of undervoltage (UV) protection; one is called Degraded Voltage Relaying (i.e., DGVR or secondary UV protection), and the second is known as Loss of Voltage relaying (i.e., primary

UV protection). These UV relays monitor the voltage on these buses and separate them from offsite power if the bus voltage goes below the UV relay setpoint for a specific time delay. Each set of UV protection (i.e., DGVR and primary UV protection) gets input from three UV relays (i.e., three for DGVR and three for primary UV) with two-out-of-three trip logic.

The primary undervoltage protection scheme consists of Undervoltage Relays 27-1, 27-2 and 27-3 along with Time Delay Relay 2. Its function is to protect the emergency power system against loss of voltage utilizing a nominal setting (existing setting is 4830 V per TS Table 3.3-4) and time delay (the existing time delay is 1.0 second per TS Table 3.3-4). Upon actuation, the primary undervoltage protection logic automatically initiates separation of the emergency power system from the upstream balance-of-plant buses (i.e., the offsite source), load shedding and starting of the Emergency Diesel Generators (EDGs). When the EDGs attain adequate voltage and speed, the EDG supply breakers to the 6.9kV Emergency Buses close and safety-related loads are connected to the buses automatically by the emergency load sequencer. Once EDG loading begins, the primary undervoltage protection scheme logic is blocked. The dropout setting of the primary undervoltage protection scheme is such that bus voltage does not drop below the setpoint during “normal” transient conditions such as during motor starting. The 6.9 kV bus undervoltage protection is described in the HNP Final Safety Analysis Report (FSAR) Sections 8.3.1.1.2.8 and 8.3.1.1.2.11.

During a Component Design Basis Inspection performed from March 21, 2011, to April 21, 2011 (Reference a), the NRC inspection team identified a green non-cited violation with respect to the degraded voltage time delay setpoints. Specifically, the team determined that the trip setpoint and allowable value specified in the TS for the second time delay for the degraded voltage relays (i.e., the primary undervoltage protection) would allow motors to be subjected to voltage below 75% for up to one minute, which is in excess of the capability cited in the FSAR.

Branch Technical Position PSB-1 Position B.1 states that setpoints shall be determined from an analysis of the voltage requirements of the Class IE loads. HNP FSAR section 8.3.1.1.3 states that motors can operate at 75% voltage for one minute without damage. TS Table 3.3-4 establishes the setpoint for the secondary Loss-of-Offsite Power (degraded voltage) relay non-accident time delay and for the primary Loss-of-Offsite Power relay.

Duke Energy addressed the condition in the HNP Corrective Action Program and determined that the TS Table 3.3-4 Functional Unit 9.a (Loss-of-Offsite Power, 6.9 kV Emergency Bus Undervoltage – Primary) trip setpoint and allowable value minimum voltage limits, as well as the associated setpoint in the field, should be increased to ensure that the trip of the safety-related AC bus will occur at a voltage at or above the minimum voltage necessary to operate the applicable safety-related loads. The TS Table 3.3-4 Functional Unit 9.b degraded voltage relay setting will remain unchanged by this LAR.

The existing TS trip setpoint for the subject UV relays is 4830 V with an allowable value of 4692 V on safety buses 1A-SA and 1B-SB. This equates to a setting of 70% with an allowable value of 68% of bus nominal voltage rating (6900 V). On a motor rated-voltage base (which is 6600V), this equates to 73.2% for the setting and 71.1% for the allowable setting. Note that both of these values are less than the motor voltage ratings as explained below.

Safety-related (Class 1E) 6.9 kV motors are designed to start at 75% of motor rated voltage and have a transient running voltage rating of 75% at the motor terminals. Transient running voltage is defined as the voltage at the motor terminals at the time of another motor starting elsewhere in the auxiliary power distribution system or when a short circuit occurs in another part of the auxiliary power distribution system. 75% of motor rated voltage is 4950 V. Therefore, based on motor voltage ratings, the UV relay setpoint should be based on 4950 V at the motor terminals in consideration of protecting the motors against low voltage (below the motor voltage ratings). The existing settings are less than the motor voltage ratings and, therefore, do not assure adequate motor voltage under low system voltage conditions. The new proposed settings are based on 4950 V at the motor terminals. Voltage drop in the feeder cable from 6.9 kV bus to the motor is added to the motor terminal voltage of 4950 V; this is the new Analytical Limit for the UV relays.

The supporting information supplied in Attachment 4 provides the analysis used to determine the limits, setpoints and allowable values for the primary UV protection.

The proposed change incorporates those portions of Technical Specification Task Force (TSTF) Traveler TSTF-493-A, Option A, that are related to the Loss-of-Offsite Power instrumentation surveillance requirements. TSTF-493-A revises the Improved Standard TS to address NRC concerns that the TS requirements for Limiting Safety System Settings (LSSS) may not be fully in compliance with the intent of 10 CFR 50.36.

Under TSTF-493-A, Option A, two Notes are added in the Surveillance Requirements column in the specification's Function table. If the specification does not include a Surveillance Requirements column or a Function table, then the Notes are added to the applicable Surveillance Requirements. Notes are added to SRs that verify trip setpoint settings. These two Notes are applied to the Functions listed in Attachment A to TSTF-493-A, Option A. The loss of voltage function (i.e., the HNP Loss-of-Offsite Power Function) is not listed in Attachment A to TSTF-493-A, Option A. However, HNP TS Table 3.3-4 Functional Unit 6.e, Auxiliary Feedwater – Loss-of-Offsite Power Start Motor-Driven Pumps and Turbine-Driven Pump refers to TS Table 3.3-4 Item 9 for all Loss-of-Offsite Trip Setpoint and Allowable Values. Auxiliary Feedwater – Loss of Offsite Power is listed in Attachment A to TSTF-493, Option A. Therefore, the two Notes added by TSTF-493-A are incorporated for the TS Table 3.3-4 Functional Unit 9.a loss of voltage function. The two notes described above are consistent with TS Table 2.2-1, Reactor Trip System Instrumentation Setpoints, Notes 7 and 8.

In addition to the technical changes described above, the verbiage structure of the allowable value criterion is revised for consistency with the other criteria for trip setpoints and allowable values as an editorial enhancement.

4. Regulatory Evaluation

4.1 Applicable Regulatory Requirements/Criteria

The primary UV protection relay settings must meet the NRC Branch Technical Position (BTP) PSB-1, April 17, 1981.

BTP PSB-1 does not specify any specific requirements for the actual setpoint; instead it recommends the setting to be around 70% of system nominal voltage. The intent of BTP PSB-1 is that a loss of voltage is detected by UV relaying just at the right time without subjecting the connected equipment to unacceptable voltages and at the same time, the buses are not subjected to unnecessary / premature isolation from the electrical system grid due to short lived voltage transients. As documented in the HNP Corrective Action Program, the existing setting should be increased in order to provide adequate voltage at the motor terminals under abnormal / degrading grid conditions. The new setpoint and allowable value as determined above meet the intent of BTP PSB-1.

4.2 Precedent

No identical precedent is identified.

4.3 Significant Hazards Consideration

The proposed change would revise the Shearon Harris Nuclear Power Plant, Unit No. 1 (HNP), Renewed Facility Operating License No. NPF-63, Technical Specification (TS) to correct a non-conservative TS requirement by revising the trip setpoint and allowable value specified in Table 3.3-4, "Engineered Safety Feature Actuation System Instrumentation Trip Setpoints," for Functional Unit 9.a, Loss-of-Offsite Power, 6.9 kV Emergency Bus Undervoltage – Primary.

Duke Energy evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below. This evaluation is in conformance with the guidance provided in NRC Regulatory Issue Summary (RIS) 2001–22.

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

   Response: No.

   The proposed change revises the TS Table 3.3-4 Functional Unit 9.a, Loss-of-Offsite Power 6.9 kV Emergency Bus Undervoltage – Primary, instrumentation trip setpoint and allowable value. The Loss-of-Offsite Power, 6.9 kV Emergency Bus Undervoltage – Primary instrumentation is not an initiator to any accident previously evaluated. As such, the probability of an accident previously evaluated is not increased. The Loss-of-Offsite Power, 6.9 kV Emergency Bus Undervoltage – Primary instrumentation revised values continue to provide reasonable assurance that the Functional Unit 9.a will continue to perform its intended safety functions. As a result, the proposed change will not increase the consequences of an accident previously evaluated.

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

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

   Response: No.

   The proposed change revises the TS Table 3.3-4 Functional Unit 9.a, Loss-of-Offsite Power 6.9 kV Emergency Bus Undervoltage – Primary, instrumentation trip setpoint and allowable value. No new operational conditions beyond those currently allowed are introduced. This change is consistent with the safety analyses assumptions and current plant operating practices. This simply corrects the setpoint consistent with the accident analyses and therefore cannot create the possibility of a new or different kind of accident from any previously evaluated accident.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

   Response: No.

   The proposed change revises the TS Table 3.3-4 Functional Unit 9.a, Loss-of-Offsite Power 6.9 kV Emergency Bus Undervoltage – Primary, instrumentation trip setpoint and allowable value. Function 9.a protects the emergency power system against loss of voltage. This change is consistent with the safety analyses assumptions and current plant operating practices. No new operational conditions beyond those currently allowed are created by these changes.

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

Based on the above, Duke Energy concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92, and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusions

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

5. Environmental Consideration

The proposed change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, and would change an inspection or surveillance requirement. However, the proposed change does not involve (1) a significant hazards consideration, (2) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (3) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed change.

6. References

a. Inspection Report (IR) 05000400-11-008, March 21, 2011 – April 21, 2011, Shearon Harris Nuclear Power Plant – Component Design Bases Inspection, dated August 9, 2011 (ADAMS Accession No ML112220337).

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Enclosure

Shearon Harris Nuclear Power Plant / Unit 1
Docket No. 50-400

Evaluation of the Proposed Change

License Amendment Request to Revise
Technical Specification Table 3.3-4
Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

Attachment 1
Revised Technical Specification Mark-ups
(2 pages plus cover)

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

time delay

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
9. Loss of Offsite Power					
a. 6.9 kV Emergency Bus Undervoltage – Primary (Loss of Voltage)	N.A.	N.A.	N.A.	5454 ≥ ~~4830~~ volts with a ≤ ~~1.0~~ second time delay 1.46	5329 ≥ ~~4692~~ volts with a ~~time delay~~ ≤ 1.5 seconds
b. 6.9 kV Emergency Bus Undervoltage – Secondary (Degraded Voltage)	N.A.	N.A.	N.A. See NOTES 1, 2	≥ 6420 volts with a ≤ 12.88 second time delay (with Safety Injection).	≥ 6392 volts with a ≤ 13.21 second time delay (with Safety Injection).
				≥ 6420 volts with a ≤ 57.89 second time delay (non-accident).	≥ 6392 volts with a ≤ 59.62 second time delay (non-accident).
10. Engineered Safety Features Actuation System Interlocks					
a. Pressurizer Pressure,					
P-11	N.A.	N.A.	N.A.	≥ 2000 psig	≥ 1988 psig
Not P-11	N.A.	N.A.	N.A.	≤ 2000 psig	≤ 2012 psig
b. Low Low T_{avg}, P-12	N.A.	N.A.	N.A.	≥ 553°F	≥ 549.3°F

TABLE 3.3-4 (Continued)

TABLE NOTATIONS

* Time constants utilized in the lead-lag controller for Steam Line Pressure-Low are $\tau_1 \geq 50$ seconds and $\tau_2 \leq 5$ seconds. CHANNEL CALIBRATION shall ensure that these time constants are adjusted to these values.

** The time constant utilized in the rate-lag controller for Steam Line Pressure-Negative Rate--High is ≥ 50 seconds. CHANNEL CALIBRATION shall ensure that this time constant is adjusted to this value.

\# The indicated values are the effective, cumulative, rate-compensated pressure drops as seen by the comparator.

NOTE 1: If the as-found channel setpoint is outside its predefined as-found tolerance, the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

NOTE 2: The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Trip Setpoint in Table 3.3-4 (Nominal Trip Setpoint (NTSP)) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the surveillance procedures (field setting) to confirm channel performance. The methodologies used to determine NTSPs and the as-found and the as-left tolerances are specified in EGR-NGGC-0153, "Engineering Instrument Setpoints." The as-found and as-left tolerances are specified in PLP-106 "Technical Specification Equipment List Program and Core Operating Limits Report."

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Docket No. 50-400

Evaluation of the Proposed Change

License Amendment Request to Revise
Technical Specification Table 3.3-4
Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

Attachment 2
Revised Technical Specification Retyped Pages
(2 pages plus cover)

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
9. Loss of Offsite Power					
a. 6.9 kV Emergency Bus Undervoltage – Primary (Loss of Voltage)	N.A.	N.A.	N.A.	≥ 5454 volts with a ≤ 1.46 second time delay (See NOTES 1,2)	≥ 5329 volts with a ≤ 1.5 second time delay
b. 6.9 kV Emergency Bus Undervoltage – Secondary (Degraded Voltage)	N.A.	N.A.	N.A.	≥ 6420 volts with a ≤ 12.88 second time delay (with Safety Injection).	≥ 6392 volts with a ≤ 13.21 second time delay (with Safety Injection).
				≥ 6420 volts with a ≤ 57.89 second time delay (non-accident).	≥ 6392 volts with a ≤ 59.62 second time delay (non-accident).
10. Engineered Safety Features Actuation System Interlocks					
a. Pressurizer Pressure,					
P-11	N.A.	N.A.	N.A.	≥ 2000 psig	≥ 1988 psig
Not P-11	N.A.	N.A.	N.A.	≤ 2000 psig	≤ 2012 psig
b. Low Low T_{avg}, P-12	N.A.	N.A.	N.A.	≥ 553°F	≥ 549.3°F

TABLE 3.3-4 (Continued)

TABLE NOTATIONS

* Time constants utilized in the lead-lag controller for Steam Line Pressure--Low are $\tau_1 \geq 50$ seconds and $\tau_2 \leq 5$ seconds. CHANNEL CALIBRATION shall ensure that these time constants are adjusted to these values.

** The time constant utilized in the rate-lag controller for Steam Line Pressure-Negative Rate--High is ≥ 50 seconds. CHANNEL CALIBRATION shall ensure that this time constant is adjusted to this value.

The indicated values are the effective, cumulative, rate-compensated pressure drops as seen by the comparator.

NOTE 1: If the as-found channel setpoint is outside its predefined as-found tolerance, the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

NOTE 2: The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Trip Setpoint in Table 3.3-4 (Nominal Trip Setpoint (NTSP)) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the surveillance procedures (field setting) to confirm channel performance. The methodologies used to determine NTSPs and the as-found and the as-left tolerances are specified in EGR-NGGC-0153, “Engineering Instrument Setpoints.” The as-found and as-left tolerances are specified in PLP-106, “Technical Specification Equipment List Program and Core Operating Limits Report.”

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Docket No. 50-400

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License Amendment Request to Revise
Technical Specification Table 3.3-4
Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

Attachment 3
Revised Technical Specification Bases Markups
For Information Only
(4 pages plus cover)

threshold value for determination of OPERABILITY.

The methodology to derive the Trip Setpoints is based upon combining all of the uncertainties in the channels. Inherent to the determination of the Trip Setpoints are the magnitudes of these channel uncertainties. Sensor and rack instrumentation utilized in these channels are expected to be capable of operating within the allowances of these uncertainty magnitudes. Rack drift in excess of the Allowable Value exhibits the behavior that the rack has not met its allowance. Being that there is a small statistical chance that this will happen, an infrequent excessive drift is expected. Rack or sensor drift, in excess of the allowance that is more than occasional, may be indicative of more serious problems and should warrant further investigation.

Bases INSERT

The measurement of response time at the specified frequencies provides assurance that the reactor trip and the Engineered Safety Features actuation associated with each channel is completed within the time limit assumed in the safety analyses. No credit was taken in the analyses for those channels with response times indicated as not applicable. Response time may be demonstrated by any series of sequential, overlapping, or total channel test measurements provided that such tests demonstrate the total channel response time as defined. Response time may be verified by actual response time tests in any series of sequential, overlapping or total channel measurements; or by the summation of allocated sensor, signal processing and actuation logic response times with actual response time tests on the remainder of the channel. Allocations for sensor response times may be obtained from: (1) historical records based on acceptable response time tests (hydraulic, noise or power interrupt tests); (2) inplace, onsite, or offsite (e.g., vendor) test measurements; or (3) utilizing vendor engineering specifications. WCAP-13632-P-A, Rev. 2, "Elimination of Pressure Sensor Response Time Testing Requirements," provides the basis and methodology for using allocated sensor response times in the overall verification of the channel response time for specific sensors identified in the WCAP. Response time verification for other sensor types must be demonstrated by test.

WCAP 14036-P-A, Rev. 1, "Elimination of Periodic Response Time Tests," provides the basis and methodology for using allocated signal processing and actuation logic response times in the overall verification of the protection system channel response time. The allocations for sensor, signal conditioning, and actuation logic response times must be verified prior to placing the component into operational service and re-verified following maintenance or modification that may adversely affect response time. In general, electrical repair work does not impact response time provided the parts used for the repair are the same type and value. Specific components identified in the WCAP may be replaced without verification testing. One example where response time could be affected is replacing the sensing element of a transmitter.

The Engineered Safety Features Actuation System senses selected plant parameters and determines whether or not predetermined limits are being exceeded. If they are, the signals are combined into logic matrices sensitive to combinations indicative of various accidents events, and transients. Once the required logic combination is completed, the system sends actuation signals to those Engineered Safety Features components whose aggregate function best serves the requirements of the condition. As an example, the following actions may be initiated by the Engineered Safety Features Actuation System to mitigate the consequences of a steam line break or loss-of-coolant accident: (1) charging/safety injection pumps start and automatic valves position, (2) reactor trip, (3) feedwater isolation, (4) startup of the emergency diesel generators, (5) containment spray pumps start and automatic valves position (6) containment isolation, (7) steam line isolation, (8) turbine trip, (9) auxiliary feedwater pumps start and automatic valves position, (10) containment fan coolers start and automatic valves position, (11) emergency service water pumps start and automatic valves position, and (12) control room isolation and emergency filtration start.

Bases INSERT

Engineered Safety Features Actuation System Instrumentation Trip Setpoints and TSTF-493-A, Option A

This section applies only to the Functional Units to which Notes 1 and 2 in the Trip Setpoint Column are applicable. Those Functional Units have revisions in accordance with Technical Specification Task Force Traveler 493-A (TSTF-493-A), Revision 4, "Clarify Application of Setpoint Methodology for LSSS Functions," Option A. Those Functional Units are limited to Functional Unit 6.e, Auxiliary Feedwater, Loss of Offsite Power Start Motor-Driven Pumps and Turbine-Driven Pumps. Because HNP TS Table 3.3-4, Functional Unit 6.e refers to TS Table 3.3-4, Item 9 for all Loss-of-Offsite Trip Setpoint and Allowable Values, the two Notes are applied to TS Table 3.3-4, Functional Unit 9.a.

Notes 1 and 2 have been added to Table 3.3-4 that require verifying both trip setpoint setting as-found and as-left values during surveillance testing. In accordance with 10 CFR 50.36, these functions are Limiting Safety System Settings. Adding test requirements ensures that instruments will function as required to initiate protective systems or actuate mitigating systems at the point assumed in the applicable safety analysis. These notes address NRC staff concerns with Technical Specification Allowable Values. Specifically, calculated Allowable Values may be non-conservative depending upon the evaluation of instrument performance history, and the as-left requirements of the calibration procedures could have an adverse effect on equipment operability. In addition, using Allowable Values as the limiting setting for assessing instrument channel operability may not be fully in compliance with the intent of 10 CFR 50.36, and the existing surveillance requirements would not provide adequate assurance that instruments will always actuate safety functions at the point assumed in the applicable safety analysis. In the Harris Technical Specifications, the term Trip Setpoint is analogous to Nominal Trip Setpoint (NTSP) in TSTF-493-A, Option A.

Note 1 requires a channel performance evaluation when the as-found setting is outside its as-found tolerance. The performance evaluation verifies that the channel will continue to behave in accordance with safety analysis and instrument performance assumptions in the setpoint methodology. The purpose of this evaluation is to provide confidence in the performance prior to returning the channel to service. If the as-found setting is non-conservative with respect to the Allowable Value, the channel is inoperable. If the as-found setting is conservative with respect to the Allowable Value but is outside the as-found tolerance band, the channel is OPERABLE but degraded. The degraded channel condition will be further evaluated during performance of the surveillance. This evaluation will consist of resetting the channel setpoint to within the as-left tolerances applicable to the actual setpoint implemented in the surveillance procedures (field setting), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition is entered into the corrective action program for further analysis and trending.

Note 2 requires that the as-left channel setting be reset to a value that is within the as-left tolerances about the Trip Setpoint in Table 3.3-4 or within as-left tolerances about a more conservative actual (field) setpoint. As-left channel settings outside the as-left tolerances of PLP-106 and the surveillance procedures cause the channel to be INOPERABLE.

A tolerance is necessary because no device perfectly measures the process. Additionally, it is not possible to read and adjust a setting to an absolute value due to the readability and/or accuracy of the test instruments or the ability to adjust potentiometers. The as-left tolerance is considered in the setpoint calculation. Failure to set the actual plant trip setpoint to within as-left the tolerances of the NTSP or within as-left tolerances of a more conservative actual field setpoint would invalidate the assumptions in the setpoint calculation, because any subsequent instrument drift would not start from the expected as-left setpoint. The determination will consider whether the instrument is degraded or is capable of being reset and performing its specified safety function. If the channel is determined to be functioning as required (i.e., the channel can be adjusted to within the as-left tolerance and is determined to be functioning normally based on the determination performed prior to returning the channel to service), then the channel is OPERABLE and can be restored to service. If the as-left instrument setting cannot be returned to a setting within the prescribed as-left tolerance band, the instrument would be declared inoperable.

The methodologies for calculating the as-found tolerances and as-left tolerances about the Trip Setpoint or more conservative actual field setpoint are specified in EGR-NGGC-0153, “Engineering Instrument Setpoints,” which is incorporated by reference into the FSAR. The actual field setpoint and the associated as-found and as-left tolerances are specified in PLP-106, “Technical Specification Equipment List Program and Core Operating Limits Report,” the applicable section of which is incorporated by reference into the FSAR.

Limiting Trip Setpoint (LTSP) is generic terminology for the setpoint value calculated by means of the setpoint methodology documented in EGR-NGGC-0153. HNP uses the plant-specific term NTSP in place of the generic term LTSP. The NTSP is the LTSP with margin added, and is always equal to or more conservative than the LTSP. The NTSP may use a setting value that is more conservative than the LTSP, but for Technical Specification compliance with 10 CFR 50.36, the plant-specific setpoint term NTSP is cited in Note 2. The NTSP meets the definition of a Limiting Safety System Setting per 10 CFR 50.36 and is a predetermined setting for a protective channel chosen to ensure that automatic protective actions will prevent exceeding Safety Limits during normal operation and design basis anticipated operational occurrences, and assist the Engineered Safety Features Actuation System in mitigating the consequences of accidents. The Allowable Value is the least conservative value of the as-found setpoint that the channel can have when tested, such that a channel is OPERABLE if the as-found setpoint is within the as-found tolerance and is conservative with respect to the Allowable Value during a CHANNEL CALIBRATION or CHANNEL OPERATIONAL TEST. As such, the Allowable Value differs from the NTSP by an amount greater than or equal to the expected instrument channel uncertainties, such as drift, during the surveillance interval. In this manner, the actual NTSP setting ensures that a Safety Limit is not exceeded at any given point of time as long as the channel has not drifted beyond expected tolerances during the surveillance interval. Although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance band, in accordance with uncertainty assumptions stated in the setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria).

Field setting is the term used for the actual setpoint implemented in the plant surveillance procedures, where margin has been added to the calculated field setting. The as-found and as-left tolerances apply to the field settings implemented in the surveillance procedures to confirm channel performance. A trip setpoint may be set more conservative than the NTSP as necessary in response to plant conditions. However, in this case, the instrument operability must be verified based on the field setting and not the NTSP.

HNP-14-043

Enclosure

Shearon Harris Nuclear Power Plant / Unit 1
Docket No. 50-400

Evaluation of the Proposed Change

License Amendment Request to Revise
Technical Specification Table 3.3-4
Loss of Offsite Power 6.9 kV Emergency Undervoltage Primary Setpoints

Attachment 4
Supporting Information Regarding Loss-of-Offsite Power
Instrumentation Setpoint Revision
(36 pages plus cover)

SYSTEM# 5165
CALC. SUB-TYPE 69R
QUALITY CLASS A

NUCLEAR GENERATION GROUP

0054-JRG
(Calculation #)

PSB-1 LOSS OF OFFSITE POWER RELAY SETTINGS
(Title including structures, systems, components)

☐ BNP UNIT _____

☐ CR3 ☒ HNP ☐ RNP ☐ NCP ☐ ALL

APPROVAL ☐ Electronically Approved

REV	PREPARED BY	REVIEWED BY	SUPERVISOR
4	Signature Name Mike Shepard (URS) Date 11/8/13	Signature Name Steve Kimura (URS) Date 11/8/13	Signature Name Thad Wingo (URS) Date 11/8/13

(For Vendor Calculations)

Vendor URS Vendor Document No. N/A

Owner's Review By Jim Deitrick Date See Passport

LIST OF EFFECTIVE PAGES

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				D1-D15	3/DEL
				E1-E5	3/DEL
				F1-F2	2
				G1-G2	2
				H1-H3	2
				I1-I6	3/DEL
				J1-J7	2
				K1-K5	3/DEL
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REVISION SUMMARY

Rev. #	Revision Summary
0	Original Issue.
1	General Update
2	General Update in support of new MST-E0075 (formerly MST-E0034 and MST-E0044) and to meet format requirements of Procedure ENP-011, Rev. 6. New MTE addressed.
3	**Incorporated the following ECs**: ECs 6330, 6331 & 6335 (ESR 97-00416 various revisions) Revised to incorporate HNP specific model number for relays 27-1/1729, 27-2/1729, 27-3/1729, 27-1/1730, 27-2/1730, and 27-3/1730. **Miscellaneous changes**: Updated references Revised wording in Sections 3.0 & 4.1 based on new procedures
4	This revision develops analytical limits and new allowable values, setpoints, as-found and as-left tolerances for the undervoltage relay dropout and pickup voltage and the time delay relay. This revision is a rewrite of the calculation. This revision incorporates ECs 82988 and 82989.

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this calculation is to:

1. Determine the analytical limits, setpoints and allowable values for the 6.9kV Emergency Bus 1A-SA and 1B-SB PSB-1 “loss of voltage” undervoltage relays as listed below:

27-1/1729	Undervoltage Relay For Bus 1A-SA
27-2/1729	Undervoltage Relay For Bus 1A-SA
27-3/1729	Undervoltage Relay For Bus 1A-SA
27-1/1730	Undervoltage Relay For Bus 1B-SB
27-2/1730	Undervoltage Relay For Bus 1B-SB
27-3/1730	Undervoltage Relay For Bus 1B-SB

2. Determine the analytical limits, setpoints and allowable values for the 6.9kV Emergency Bus 1A-SA and 1B-SB PSB-1 “loss of voltage” undervoltage time delay relays as listed below:

2/1731	Undervoltage Time Delay Relay For Bus 1A-SA
2/1732	Undervoltage Time Delay Relay For Bus 1B-SB

This calculation serves as the basis for the setpoints shown on Drawing CPL 2166-S-0302 for the relays listed above.

2.0 LIST OF REFERENCES

2.1 Drawings 6-B-041 and 6-B-401 sheet numbers and revision levels as shown below:

BUS	CUB	EDBS TAG #.	6-B-041	6-B-401
1A-SA	10	27-1/1729	Sh 45 R14	Sh 1729 R15, Sh 1731 R24
		27-2/1729	Sh 45 R14	Sh 1729 R15, Sh 1731 R24
		27-3/1729	Sh 45 R14	Sh 1729 R15, Sh 1731 R24
		2/1731	N/A	Sh 1731 R24
1B-SB	6	27-1/1730	Sh 46 R14	Sh 1730 R15, Sh 1732 R23
		27-2/1730	Sh 46 R14	Sh 1730 R15, Sh 1732 R23
		27-3/1730	Sh 46 R14	Sh 1730 R15, Sh 1732 R23
		2/1732	N/A	Sh 1732 R23

2.2 GE Relay Instruction Book GEI-90805E "Undervoltage Relays Types NGV11A&B, 12 A,B&C, 13 A&B" (see Reference 2.17)

2.3 Purchase Specification CAR-SH-E-006B, Rev. 7 “Metal-clad Switchgear - Removable Circuit Breaker Type Class 1E 6.9 kv Switchgear”

2.4 Telecon between Jim Deitrick of CP&L and Jim Teague of GE (see Attachment G)

2.5 CSP-NGGC-2505, R14 “Software Quality Assurance and Configuration Control of Business Computer Systems”

2.6 EGR-NGGC-0005, R35 “Engineering Change”

2.7 EGR-NGGC-0016, R3 “Engineering Analysis Software – Dedication and Benchmark Requirements”

2.8 EGR-NGGC-0017, R8 “Preparation and Control of Design Analyses and Calculations”

2.9 Procedure MST-E0075, R7 “6.9KV Emergency Bus 1A-SA and 1B-SB Undervoltage (Loss of Voltage) Channel Calibration”.

2.10 Design Basis Document DBD-202, Rev. 28 “Plant Electrical Distribution System”

2.11 Not Used

2.12 Drawing 6-S-0302 0020, Rev. 10 “Medium Voltage Relay Settings 6900V Emergency Bus 1A-SA”

2.13 Drawing 6-S-0302 0023, Rev. 6 “Medium Voltage Relay Settings 6900V Emergency Bus 1B-SB”

2.14 Technical Specification 3 / 4.3.2 & TABLE 3.3-4 (see Attachment H)

2.15 Calculation E-6000, Rev. 11 “Auxiliary System Load Study”

2.16 Vendor Manual VM-BLV, Rev. 7 “Multimeters”

2.17 Vendor Manual VM-PQE, Rev. 22 “Relays, Contactors & Starters”

2.18 Procedure EGR-NGGC-0153, Rev. 11 “Engineering Instrument Setpoints”

2.19 Vendor Manual VM-UYB, Rev. 2 “Test Equipment”

2.20 deleted

2.21 deleted

2.22 deleted

2.23 NRC Branch Technical Position PSB-1, April 17, 1981

2.24 FSAR Table 15.0.6-1 and Sections 3.1.17, 7.4.2.1.1, 8.3.1.1.2.4, 8.3.1.1.2.5, 8.3.1.1.2.8, 8.3.1.1.2.11, & 8.3.1.1.3 (excerpts in Attachment J)

2.25 Purchase Specification CAR-SH-E-006A, Rev. 8 “Metal-clad Switchgear - Removable Circuit Breaker Type 6.9 kv Switchgear” (excerpts in Attachment F)

2.26 ANSI Std C50.41-1982 “Polyphase Induction Motors for Power Generating Stations”

2.27 Telecon Memo Between Jim Deitrick and Steve Hawkins on PT Accuracy (Attach F)

2.28 Calculation E2-0002.01, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1A2-SA & 1B2-SB” (excerpts in Attachment L)

2.29 Drawing 6-S-0302, Sheet 22, Rev. 2 “Medium Voltage Relay Settings 6900V Emergency Bus 1A-SA”

2.30 Drawing 6-S-0302, Sheet 24, Rev. 10 “Medium Voltage Relay Settings 6900V Emergency Bus 1B-SB”

2.31 Drawing 6-S-0302, Sheet 26, Rev. 2 “Medium Voltage Relay Settings 6900V Emergency Bus 1B-SB”

2.32 ESR 97-00416, “6.9KV Emergency Bus Undervoltage Protection Circuitry”

2.33 NRC Regulatory Issue Summary RIS-2011-12, Rev. 1 “Adequacy of Station Electric Distribution System Voltages”

2.34 EC 82811, Setpoint Change for 6.9KV Emergency Bus Primary UV Relays

2.35 Calculation E2-0002.06, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1D3, IE3, 1-4A2, 1-4A3, 1-4A6” (excerpts in Attachment L)

2.36 Calculation E2-0002.07, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1A1 & 1B1” (excerpts in Attachment L)

2.37 EDC-0020, Rev. 2 “Adequacy of Safety-Related Bus Voltage”

2.38 TSTF-493, Rev 4 “Clarify Application of Setpoint Methodology for Limiting Safety System Settings”

2.39 Calculation E2-0002.02, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1A3-SA & 1B3-SB”

2.40 Calculation E2-0002.03, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1D1, 1D2, 1E1, 1E2, 1-4A103 & 1-4B103”

2.41 Calculation E2-0001.01, Rev. 1 “Analysis for Overcurrent Protection for 6.6 kV Motors Component Cooling Pumps 1A-SA, 1B-SB, & 1C-SAB”

2.42 Calculation E2-0001.02, Rev. 1 “Analysis for Overcurrent Protection for 6.6 kV Motors Water Chiller 2 Compressors 1A-SA & 1B-SB”

2.43 Calculation E2-0001.03, Rev. 1 “Analysis for Overcurrent Protection for 6.6 kV Motors Emergency Service Water Pumps 1A-SA & 1B-SB”

2.44 Calculation E2-0001.04, Rev. 1 “Analysis for Overcurrent Protection for 6.6 kV Motors Auxiliary Feed Water Pumps 1A-SA & 1B-SB”

2.45 Calculation E2-0001.05, Rev. 1 “Analysis for Overcurrent Protection for 6.6 kV Motors Charging Safety Injection Pumps 1A-SA, 1B-SB, & 1C-SAB”

2.46 Calculation E2-0001.09, Rev. 0 “Analysis for Overcurrent Protection for 6.6 kV Motors Normal Service Water Pumps 1A & 1B”

2.47 Calculation E2-0001.12, Rev. 0 “Analysis for Overcurrent Protection for 6.6 kV Motors Heater Drain Pumps 1A & 1B”

2.48 Calculation E2-0001.13, Rev. 0 “Analysis for Overcurrent Protection for 6.6 kV Motors Cooling Tower Make-Up Pumps 1X & Units 1 & 2 Common”

2.49 Purchase Specification CAR-SH-E-012, Rev. 6 “Motors for Station Auxiliary Service Furnished with Driven Equipment Rated up to 460 Volt and 250 HP”

2.50 Purchase Specification CAR-SH-E-012A, Rev. 4 “Motors for Station Auxiliary Service Furnished with Driven Equipment Rated 300 HP and Above”

2.51 Calculation E2-0005.09, Rev. 4 “Degraded Grid Voltage Protection for 6.9kV Busses 1A-SA & 1B-SB”

2.52 Drawing 6-B-041, Sheet 12, Rev. 6 “Unit No. 1 Power Distribution & Motor Data 6900V Auxiliary Bus 1D”

2.53 Drawing 6-B-041, Sheet 13, Rev. 7 “Unit No. 1 Power Distribution & Motor Data 6900V Auxiliary Bus 1E”

2.54 Drawing 6-B-041, Sheet 16, Rev. 9 “Unit No. 1 Power Distribution & Motor Data 6900V General Services Bus 1-4A”

2.55 Drawing 6-B-041, Sheet 16A, Rev. 9 “Unit No. 1 Power Distribution & Motor Data 6900V General Services Bus 1-4A”

2.56 Calculation E2-0001.14, Rev. 1 “Analysis for Overcurrent Protection for 6.6 kV Motors Compressors for Water Chillers 3 & 4”

2.57 Calculation E2-0001.15, Rev. 0 “Analysis for Overcurrent Protection for 6.6 kV Motors Waste Processing Building Cooling Water Pumps 1-4A & 1-4B”

2.58 Calculation E2-0002.04, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1-4A1, 1-4A102 & 1-4B1” (excerpts in Attachment L)

2.59 Calculation E2-0002.05, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1-4A8” (excerpts in Attachment L)

2.60 Calculation E2-0002.08, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1-4A9” (excerpts in Attachment L)

2.61 Calculation E2-0002.10, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1-4A101” (excerpts in Attachment L)

2.62 Calculation E2-0002.12, Rev. 0 “6.9 kV Overcurrent Protection of Station Service Transformers 1-4A4 & 1-4B4” (excerpts in Attachment L)

2.63 Design Basis Document DBD-313, Rev. 4 “Time Response”

3.0 ENGINEERING ANALYSIS SOFTWARE

Per Procedure EGR-NGGC-0017, Section 9.8, personnel using a computer for calculations are responsible for understanding the Software Quality Level and the computer system required to perform calculations for systems, structures or components that are considered safety related or are assigned safety classifications such as Safety Classes 1, 2 or 3, or Seismic Class 1 or 2, or Seismic Category I. See Procedures CSP-NGGC-2505 and EGR-NGGC-0016 to determine the requirements (such as benchmark test) and limitations of computer generated calculations. Confirm that the computer software and version is listed and approved for use by checking the Equipment Database in PassPort. Update PassPort to reflect the software and version in accordance with CSP-NGGC-2505, if necessary. Determine if the software version being used has any software errors which may adversely impact the calculation and evaluate their impact on completed or ongoing work, as appropriate. For new software installations, review and evaluate Action Requests written for software errors with keyword type “FI”. Computer output design information used in the preparation of calculations should be added to the calculation package as an attachment. Software used in the calculation should be listed on the Document Indexing Table.

No engineering analysis software has been used in the development of this calculation. Therefore, no benchmarking or software error evaluations are required.

4.0 BODY OF CALCULATION

4.1 EC Screen

Calculation changes are subjected to the “EC screens” as defined in Procedure EGR-NGGC-0005 unless the changes are the result of “rollup” to incorporate previously approved design changes (ESRs, ECs, etc). For calculation changes which are not the result of “rollup”, changes screened as impacting other plant/design documents or other plant programs, procedures or processes are processed via an EC[1]. Those screened as not impacting the aforementioned items are processed without an EC.

Revision 4 includes analytical limits and new allowable values for the primary undervoltage (loss of voltage) time delay and voltage setpoints (as noted in the Revision Summary). All changes that impact any other documents, programs, procedures or processes have already been identified by Revision 2 of EC 82811. That EC will be completed once this calculation is issued. Therefore, an additional EC is not required to revise this calculation.

4.2 Undervoltage Relay Settings

4.2.1 Background Information (Bases, etc.)

The purpose of the Emergency Bus 1A-SA and 1B-SB “Loss of Voltage” undervoltage relay (also known as the primary undervoltage relay) is to protect the class 1E motors connected to the Emergency Busses from excessively low voltages indicative of complete loss of voltage or serious degradation of the offsite power source. This function is performed by isolating the bus from the preferred power source (offsite power) upon loss of electrical power and initiating load shedding and Emergency Diesel Generator starting.

Harris Nuclear Plant motors are specified for continuous operation at 90% terminal voltage and for operation at 75% terminal voltage for a minimum of 1 minute to account for routine motor starts and other system transients. The second level undervoltage relays (degraded voltage) are set to ensure motor terminal voltage does not go below 90% for more than 60 seconds. In order to ensure full protection of the motors, the primary undervoltage relay drop-out setting shall be high enough (minimum drop out voltage or lower analytical limit) to ensure a minimum of 75% terminal voltage at all connected motors at all applicable voltage levels.

The relay setting should also prevent spurious operation of the relay (and resulting disconnection from the preferred power source) during expected transient voltage dips caused by motor starting or by faults. Therefore, the maximum dropout voltage of the relay (or upper analytical limit) should be below the bus voltage value caused by

1 Other documents, programs, procedures and processes impacted by changes to the calculation being revised must be listed on the EC module ADL along with the calculation being revised.

starting of the largest motor for the worst case normal loading condition and minimum allowable switchyard voltage.

There is also a time delay associated with the primary undervoltage protection. The primary undervoltage protection is intended to protect equipment and maintain its availability in the event of a significant voltage collapse to levels where connected equipment is incapable of performing their design function (e.g., motors stall or trip on time overcurrent). Therefore, the time delay should be short enough to prevent damage to equipment and/or tripping of equipment protective relays, but long enough to avoid spurious operation due to momentary voltage dips caused by faults or other system disturbances.

Derivation of the Lower Analytical Limit (Voltage Drop-out)

The primary undervoltage relay setpoint lower analytical limit is that voltage on the 6.9kV Emergency Bus which results in the worst case continuous duty motor (at any system voltage level) having a terminal voltage of 75% of nameplate rating.

Per specifications CAR-SH-E-012 (reference 2.49) and CAR-SH-E-012A (reference 2.50) Class 1E motors must be able to start and accelerate driven equipment and be capable of running for a minimum of one minute at 75% rated voltage. This criteria result in the following required voltages at the motor terminals:

Table 4-1: Required voltage at Motor Terminals

Motor Voltage Rating	Required Voltage at the Motor Terminals
6.6KV	4950V (0.75 * 6600)
460V (powered from load center)	345V (0.75 * 460)
460V (powered from MCC)	345V (0.75 * 460)

To determine the minimum voltage required for the 6.9 kV safety busses to achieve 75% voltage at the motor terminals, the following approach is used.

Per EDC-0020 sections 2.2.1, 2.2.2 and 2.2.3 feeder cables shall be allowed a maximum voltage drop of 0.5% between 6.9kV Class 1E buses and equipment terminals, 1% between 480V Class 1E MCC's and equipment terminals, and 2% between 480V Class 1E load centers and equipment terminals. The resultant voltage is identified in Table 4-2. To calculate the cable's voltage drop at 75% voltage at the motor terminals, the voltage drop is calculated to be 33% higher (1 / 0.75 = 1.33). The voltage drop is calculated by multiplying using the EDC-0020 percent drop multiplied by 1.33. These results are shown in the *Max Feeder V_{Drop} at 75%* column.

Table 4-2: Determination of Cable Voltage Drop

Motors Powered From	Max V_{Drop} at Nom. Voltage	Max Feeder V_{Drop} at 75%
6.9KV Safety Bus	34.5V (0.5% of 6900V)	46V (0.665% of 6900V)
480V Load Center	9.6V (2% of 480V)	13V (2.66% of 480V)
480V MCC	4.8V (1% of 480V)	7V (1.33% of 480V)

The criteria above is used in the E-6000 ETAP model (Attachment Q) to ensure running motors fed from the emergency power system have at least 75% of rated nameplate voltage. Using the E-6000 ETAP model, LOCA Load Block 9 loading is used to maximize voltage drop between the 6.9kv emergency bus (where the LOOP UV Relays are monitoring voltage) and the downstream power centers and MCCs supplying these motors.

The only power centers directly supplying safety related motors are 1A2-SA (for Train A) and 1B2-SB (for Train B). With the worst case motor feeder cable voltage drop of 13v, a minimum of 358v must be maintained on these two power centers (0.75 x 460v + 13v = 358v). All of the safety related MCCs directly supply safety related motors. With the worst case motor feeder cable voltage drop of 7v, a minimum of 352v must be maintained on every safety related MCC (0.75 x 460v + 7v = 352v). The attached ETAP runs show that MCCs 1A36-SA (Train A) and 1B36-SB (Train B) are the worst case MCCs (i.e. have the lowest voltage for a given 6.9kv emergency bus voltage). The 6.9kv emergency buses themselves also supply safety related motors. With a worst case motor feeder voltage drop of 46v, a minimum of 4996v must be maintained on the 6.9kv emergency bus (0.75 x 6600v + 46v = 4996v).

Using the LOCA LB9 ETAP model, the switchyard voltage is decreased until one of the following power supplies reaches the criteria listed in Table 4-3.

Table 4-3: Minimum Bus Voltage with 75% V_t at Motors

Motors Powered From	Required Voltage at the Buses
6.9KV Safety Bus (1A-SA & 1B-SB)	4996V
480V Power Center (1A2-SA & 1B2-SB)	358V
480V MCC (1A36-SA & 1B36-SB)	352V

The attached ETAP run (Attachment Q) demonstrates the limiting power supply is Power Center 1A2-SA (for Train A) and Power Center 1B2-SB (for Train B). With Emergency Bus 1A-SA at 5272vac (page 32 of 66), limiting power supply Power Center 1A2-SA is at the criteria voltage of 358vac (page 28 of 66). The voltage is above the criteria voltage at all other Train A power supplies.

Note: A separate ETAP run was not performed for Train B. The Train B voltages shown in the UV Case 1 run can be "pro-rated" to determine the Train B voltages. With Emergency Bus 1B-SB at 5247v (page 36 of 66), limiting power supply Power Center 1B2-SB is at 356v (page 33 of 66). The 1B-SB voltage necessary to ensure 358vac at 1B2-SB would be approximately 5247 * 358/356 = 5276v. The voltage is above the criteria voltage at all other Train B power supplies.

Note: The data provided in Attachment Q uses preliminary information from the new revision of E-6000 (see basis 4.4.1.k).

Based on the above data, in order for all safety related motors to have at least 75% voltage at the motor terminals the voltage at Bus 1A-SA must be at least 5272v and at Bus 1B-SB it must be at least 5276v. For conservatism in this calculation a value of 5279v will be used for the lower analytical limit.

Therefore, the drop-out voltage lower analytical limit for UV relays will be AL_L = 5279V

Upper Analytical Limit

There are two criteria for the primary undervoltage relay dropout voltage setpoint upper analytical limit. First, the maximum allowable dropout voltage should be below the minimum calculated voltage reached on the 6.9kV safety bus during starting of the worst case motor. The motor start is assumed to occur with the 6.9kV safety buses at the minimum dropout voltage setting of the degraded voltage relay and normal Mode 1 loading. The second criteria is that the maximum allowable dropout voltage should be below the minimum calculated voltage that would occur for the worst case fault on a load fed from 6.9 kV bus sections 1D, 1E, 1-4A, 1A-SA, or 1B-SB. The fault is assumed to occur with the 6.9kV safety buses at the minimum dropout voltage setting of the degraded voltage relay and normal Mode 1 loading. For the purpose of the primary undervoltage relay setting analysis, the worst case fault is considered the highest fault on a load feeder that is less than the instantaneous setting of the feeder breaker (i.e., in the time overcurrent region) and takes more than 0.875 seconds to clear. 0.875 seconds is determined to be the lower analytical limit for the time delay setting in section 4.3.1. Note - if the fault current is above the instantaneous trip setting, the fault will be interrupted without intentional delay such that the resultant voltage dip cannot result in spurious tripping of the primary undervoltage relay. This calculation also evaluates the time delay to confirm its adequacy.

Motor Starting Transient

Safety buses 1A-SA and 1B-SB and non-safety bus 1-4A are normally powered from BOP buses 1D and 1E respectively. 1D and 1E buses are powered from Y windings of either UATs or SATs. The remaining electrical distribution system 6.9kv buses are powered from X windings of UATs/SATs. A transient caused by starting a BOP motor powered from X winding will have a negligible effect on safety bus voltages, since they are powered from Y winding. Therefore, for this evaluation, the motors on buses 1D, 1E, 1-4A, 1A-SA and 1B-SB only need to be considered for starting transient.

Bus 1A-SA		Bus 1B-SB	
Motor	HP	Motor	HP
Aux. Feedwater Pump 1A-SA	500	Aux. Feedwater Pump 1B-SB	500
Charging Safety Injection Pump 1A-SA	900	Charging Safety Injection Pump 1B-SB	900
Water Chiller WC-2 Compressor 1A-SA	840	Water Chiller WC-2 Compressor 1B-SB	840
Comp. Cooling Water Pump 1A-SA	800	Comp. Cooling Water Pump 1B-SB	800
Comp. Cooling Water Pump 1C-SAB	800	Comp. Cooling Water Pump 1C-SAB	800
Emergency Service Water Pump 1A-SA	1300	Emergency Service Water Pump 1B-SB	1300

Bus 1D		Bus 1E	
Motor	HP	Motor	HP
Cooling Tower Makeup Pump 1X	1250	Heater Drain Pump 1B	1500
Heater Drain Pump 1A	1500	Normal Service Water Pump 1-B	3000
Normal Service Water Pump 1-A	3000		

Bus 1-4A	
Motor	HP
Waste Processing Bldg & Fuel Handling Bldg Water Chiller Compressor (WC-3) 1-4X-NNS	925
Waste Processing Bldg Cooling Water Pump 1-4A	500
Waste Processing Bldg & Fuel Handling Bldg Water Chiller Compressor (WC-4) 1-4X-NNS	925
Waste Processing Bldg Cooling Water Pump 1-4B	500
Cooling Tower Make Up Pump Units 1 & 2 Common	1250

The largest motors on these buses are the 3000HP NSW pump motors. The “Full Power” ETAP model was used since it is not necessary to use a scenario which maximizes emergency power system voltage drop (the concern here is only for the voltage at the 6.9kv emergency bus, not at downstream power centers and MCCs). For this ETAP run (Attachment R) the switchyard voltage was lowered until the 6.9kv Emergency Bus 1A-SA “pre motor-start” voltage was at the DGVR dropout setting of 6404v (page 86 of 198). The NSWP-1A & NSWP-1B motors were then started (as indicated by page 66 of 198) and the voltage at 6.9kv Emergency Bus 1A-SA during the NSWP motor start was determined to be 5925v (page 129 of 198). A separate run was not performed for Train B, so the Train B results are “prorated”. Prior to the start, 1B-SB was at 6375v (page 90 of 198) and during the start it was at 5891v (page 133 of 198). If the 1B-SB voltage would have been 6404v initially (instead of 6375v), the voltage during the motor start would have been approximately 5891 * 6404/6375 = 5918v.

Therefore, for motor starting, the upper analytical limit is 5925v for Bus 1A-SA and 5918v for Bus 1B-SB.

Fault Clearing Transient

Only the feeders supplying 6600V motors and transformers fed from the 6.9 kV Emergency Buses and upstream buses 1-4A, 1D and 1E need to be considered in this evaluation. This is because the fault current through the UAT/SAT Y winding resulting from faults occurring on the 480V buses or the systems supplied from the UAT/SAT X windings will be significantly less due to additional impedance involved.

For 6600V motor or transformer feeders, a fault can occur resulting in fault current below the instantaneous setting for that breaker. If the fault current is above the instantaneous trip setting, the fault will be interrupted without intentional delay such that the resultant voltage dip cannot result in spurious tripping of the primary undervoltage relay. If the faulted feeder overcurrent protection takes less time than the undervoltage relay time delay setting, actuation of the undervoltage relays will not occur. At this fault current, if the breaker overcurrent relay takes more time than the undervoltage relay time delay setting to clear the fault, the undervoltage relays on the safety buses could actuate and trip the bus if the bus voltage dips down to the undervoltage relay setpoint.

The current Technical Specifications have a maximum allowable value of 1.5 seconds for the undervoltage relay time delay. This value was initially chosen to determine which breakers were to be considered. It is determined in section 4.3.1 that the lower analytical limit for the time delay setting is 0.875 seconds. Since none of the breakers have a time to clear between 0.875 and 1.5 seconds the evaluation is the same for both values.

Based on this approach, a fault less than the largest instantaneous setting where the overcurrent relay for that feeder takes more than 0.875 seconds to clear will be used to calculate the voltage dip on safety buses for this evaluation.

Bus 1A-SA / 1B-SB			
Equipment	Inst. Fault Current	Time To Clear	Reference
Aux. Feedwater Pump 1A-SA / 1B-SB	450 A	≈5 s	E2-0001.04
Charging Safety Injection Pump 1A-SA / 1B-SB	860 A	≈4.5 s	E2-0001.05
Water Chiller WC-2 Compressor 1A-SA / 1B-SB	700 A	≈7 s	E2-0001.02
Comp. Cooling Water Pump 1A-SA / 1B-SB	740 A	≈4 s	E2-0001.01
Comp. Cooling Water Pump 1C-SAB	740 A	≈4 s	E2-0001.01
Emergency Service Water Pump 1A-SA / 1B-SB	1200 A	≈5.5 s	E2-0001.03
Station Service Transformer 1A1 / 1B1	4000 A	0.45 s	E2-0002.07
Station Service Transformer 1A2-SA / 1B2-SB	5280 A	0.5 s	E2-0002.01
Station Service Transformer 1A3-SA / 1B3-SB	5040 A	0.52 s	E2-0002.02

Bus 1D / 1E			
Equipment	Inst. Fault Current	Time To Clear	Reference
Cooling Tower Makeup Pump 1X (on Bus 1D only)	1050 A	≈2.3 s	E2-0001.13
Heater Drain Pump 1A / 1B	1400 A	≈2.2 s	E2-0001.12
Normal Service Water Pump 1A / 1B	3000 A	≈7 s	E2-0001.09
Station Service Transformer 1D1 / 1E1	4800 A	0.45 s	E2-0002.03
Station Service Transformer 1D2 / 1E2	4800 A	0.45 s	E2-0002.03
Station Service Transformer 1D3 / 1E3	4020 A	0.45 s	E2-0002.06

Bus 1-4A			
Equipment	Inst. Fault Current	Time To Clear	Reference
Waste Processing Bldg & Fuel Handling Bldg Water Chiller Compressor(WC-3) 1-4X-NNS	860 A	≈5.6 s	E2-0001.14
Waste Processing Bldg Cooling Water Pump 1-4A	480 A	≈4.7 s	E2-0001.15
Waste Processing Bldg & Fuel Handling Bldg Water Chiller Compressor(WC-4) 1-4X-NNS	860 A	≈5.6 s	E2-0001.14
Waste Processing Bldg Cooling Water Pump 1-4B	480 A	≈4.7 s	E2-0001.15
Cooling Tower Make Up Pump Units 1 & 2 Common	1050 A	≈2.2 s	E2-0001.13
Station Service Transformer 1-4A1	4920 A	0.43 s	E2-0002.04
Station Service Transformer 1-4A103	4800 A	0.45 s	E2-0002.03
Station Service Transformer 1-4A101	2910 A	0.45 s	E2-0002.10
Station Service Transformer 1-4A102	4920 A	0.43 s	E2-0002.04
Station Service Transformer 1-4B4	940 A	0.45 s	E2-0002.12
Station Service Transformer 1-4A6	4020 A	0.45 s	E2-0002.06
Station Service Transformer 1-4B3	4020 A	0.45 s	E2-0002.06
Station Service Transformer 1-4A2	4020 A	0.45 s	E2-0002.06
Station Service Transformer 1-4A3	4020 A	0.45 s	E2-0002.06
Station Service Transformer 1-4B1	4920 A	0.43 s	E2-0002.04
Station Service Transformer 1-4A4	940 A	0.45 s	E2-0002.12
Station Service Transformer 1-4B103	4800 A	0.45 s	E2-0002.03
Station Service Transformer 1-4A9	2700 A	0.4 s	E2-0002.08
Station Service Transformer 1-4A8	4800 A	0.45 s	E2-0002.05

Based on the data above, the Normal Service Water Pump motor feeder powered from 1D or 1E has the highest instantaneous setting (for the feeders that take more than 0.875 second to clear the fault) of 3000A. A review of the time-current curves (Attachment L) indicates that the slowest Station Service Transformer breaker listed above will clear a fault of 3000A in 0.60 seconds. The “Full Power” ETAP model was used since it is not necessary to use a scenario which maximizes emergency power system voltage drop (the concern here is only for the voltage at the 6.9kv emergency bus, not at downstream power centers and MCCs). For the pre-fault condition (Attachment S), the switchyard voltage was lowered until 6.9kv Emergency Bus 1A-SA was at the DGVR dropout setting of 6404v, 106.73v on the secondary (page 89 of 144). Note that Bus 1B-SB was at 6372v instead of the desired 6404v (page 93 of 144). The running NSWP motors were then replaced with 3000 amp loads simulating a fault below the instantaneous trip setting to determine the resulting 6.9kv Emergency

Bus 1A voltage (Attachment T). 6.9kv Bus 1A-SA would be at 5792v during the fault until the time overcurrent relay trips the breaker (page 89 of 164). A separate run was not performed for Train B, so the Train B results are "prorated". Prior to the fault, 1B-SB was at 6372v and during the start it was at 5744v (page 93 of 164). If the 1B-SB voltage would have been 6404v initially (instead of 6372v), the voltage during the fault would have been approximately 5744 * 6404/6372 = 5773v until the breaker trips. Therefore, for fault clearing, the upper analytical limit is 5792v for Bus 1A-SA and 5773v for Bus 1B-SB.

Therefore, the drop-out voltage upper analytical limit for UV relays will be AL_U = 5773V.

4.2.2 Undervoltage Relay (Relay 27) Setpoint Evaluation

Per Passport EDB, the undervoltage relays are GE model number 12NGV13B25A, utilizing a 7200/120V ratio potential transformer.

Note: The installed model number for relays 27-1/1729, 27-2/1729, 27-3/1729, 27-1/1730, 27-2/1730, and 27-3/1730 is 12NGV13B25AMOD in EDB. Per ESR 97-00416 an additional target relay coil was added to the relay and the modified relay was given an HNP specific model number (12NGV13B25AMOD). The modification did not state any change to the reference accuracy of these relays.

Ref. Accuracy: Per previous revisions of this calculation and confirmed in a telephone conversation memorandum between Jim Deitrick of CP&L and Jim Teague of GE (see attachment G), the GE 12NGV13B25A undervoltage relay has a repeatability of ±2% of the setpoint. Based on EGR-NGGC-0153, if only the repeatability of a device is stated, that value can be used as the reference accuracy. In this case it is ±2% of setpoint or ±2V for a setting of 100V (100V is used for conservatism instead of actual setpoint, which is calculated below based on total loop uncertainty)

Drift: ±2% of setpoint or ±2V per recommendation of EGR-NGGC-0153, past surveillances were used to establish drift. (See Attachment P for test results which support using 2% as drift)

$RA_{(27\text{-}do)} = \pm 2V$
$DR_{(27\text{-}do)} = \pm 2V$

Potential Transformer (ITE model number FP-7200-1)

The following data associated with the 7200/120V potential transformers (Refer to Passport and Attachment F):

Catalog ID #	72413412
Siemens-Allis Part #	61-300-010-072
Siemens-Allis SO #	1-1800-90365 and 1-1800-88460
ITE Model #	FP-7200-1
Type	FPXFMR
Primary Volts	7200
Voltage Ratio	7200 / 120
Insulation Class	15kV
BIL	95kV
Frequency	50 - 60 Hz
Thml Burden	1000 va
Accuracy Class	0.3Y 0.6Z
PO #	NY-435112 (Passport), 6D9472 (Attachment F)
Specification #	CAR-SH-E-006A
T/L #	88-1209-VI

Ref. Accuracy: ±0.3% of PT voltage rating or ±0.36V for a PT rating of 120V

$$\mathbf{PE_{(27)} = \pm 0.36V}$$

Test Equipment

Three different types of test equipment will be evaluated and the final determination of the allowable dropout setting will be based upon the “worst case” test equipment. Therefore any of the following three test equipments may be used to monitor dropout voltage in the performance of MST-E0075.

Digital Voltmeter (Fluke model number 45)

Per Vendor Manual VM-BLV, pages S10b-113 and S10b-116, the accuracy of the Fluke 45 DMM while reading ac voltage (50 Hz to 10 kHz) using the medium reading rate is 0.2% of the reading and 10 “digits”. Per page S10b-38, TABLE 3-2, the auto-ranging feature of the meter would select the 300V range which reads to “hundredths” of a volt. Thus the 10 “digits” would introduce another 0.1 volts of tolerance. When measuring 100V, the accuracy would be:

$$\mathbf{MTE_{(F45\text{-}do)} = 0.2V + 0.1V = \pm 0.3V}$$

Digital Voltmeter (Fluke model number 8600A)

Per Vendor Manual VM-BLV, page S1b-26, the accuracy of the Fluke 8600A DMM is 0.2% of input and 0.015% of the meter range. When measuring 100v with a meter range of 200V, the accuracy would be:

$$\mathbf{MTE_{(F8600A\text{-}do)} = 0.2V + (0.00015 * 200) = \pm 0.23V}$$

Test Set (Multi-Amp Pulsar Universal Relay Test Unit)

Per Vendor Manual VM-UYB, the accuracy of the Multi-Amp Pulsar test set voltage amplifier module is 0.5% of input and 0.1V resolution (upper range, i.e. 300v scale). When measuring 100V, the accuracy would be:

$$\mathbf{MTE_{(Pulsar\text{-}do)} = [(0.005 * 100)V \pm 0.1V] = 0.6V\ to\ 0.4V}$$

The highest value, ±0.6V,is chosen as the the accuracy of the Multi-Amp Pulsar Universal Relay Test Unit and will be used in the determination of the undervoltage relay allowed dropout setting, since it is less accurate than the two Fluke digital voltmeters. The MST procedure specifies the use of the Pulsar Test Set.

Since the above tolerances and accuracies are independent of each other, they may be combined using the “square root of the sum of the squares” methodology.

$$\text{Total Device Uncertainty (TDU)} = [(RA_{(27\text{-}do)})^2 + (MTE_{(Pulsar)})^2 + (DR_{(27\text{-}do)})^2]^{1/2}$$
$$\mathbf{TDU_{(27\text{-}do)} = [(2)^2 + (0.6)^2 + (2)^2]^{1/2} = \pm 2.89V}$$

$$\text{Total Loop Uncertainty (TLU)} = [(PE)^2 + (TDU)^2]^{1/2}$$
$$\mathbf{TLU_{(do)} = [(0.36)^2 + (2.89)^2]^{1/2} = \pm 2.91V}$$

The Minimum Setpoint that can protect the Lower Analytical Limit is:

$AS_{(min)} = AL_L + TLU$

= 5279V + 2.91V*60 (where 60 = the PT ratio)

= 5279V + 174.6V = 5453.6V (90.89V on the secondary)

This will be the Tech Spec minimum Trip Setpoint.

The Maximum Setpoint that can protect the Upper Analytical Limit is:

$AS_{(max)} = AL_U - TLU$

= 5773V – 174.6V = 5598.4V (93.31V on secondary)

This will be the maximum Setpoint.

The Field Setpoint is chosen between the minimum and maximum setpoints. A setpoint of 5526V (80% of bus nominal voltage) leaves a margin of 72.4V below and 72.4V above the setpoint.

Field Setpoint = 5526V (92.1 on the secondary)

Allowable Value Determination

For this decreasing trip function, the Allowable Value (AV) is determined as follows:

AV = Maximum Allowable Setpoint - Group As-Found Tolerance (GAFT)

The GAFT is the As-Found Tolerance for the "Group" of devices subjected to calibration during a Tech Spec Surveillance Test. In this case, the "Group" consists of only the UV Relay and the GAFT is determined as follows.

GAFT:

$$GAFT = [DR_{(27\text{-}do)}{}^2 + MTE_{(Pulsar)}{}^2]^{1/2}$$
$$= [(2)^2 + (0.6)^2]^{1/2}$$
$$= \pm 2.09V \text{ on PT secondary side, or } \pm 125.4V \text{ on 6900V side}$$

Minimum Allowable Value:

$$AV_{(min)} = AS_{(min)} - GAFT$$
$$= 5453.6V - 125.4V$$
$$= 5329.2V \text{ (88.82V on the secondary)}$$

This will be the Tech Spec minimum Allowable Value.

Maximum Allowable Value:

$$AV_{(max)} = AS_{(max)} + GAFT$$
$$= 5598.4V + 125.4V$$
$$= 5723.8V \text{ (95.4V on the secondary)}$$

This will be the maximum Allowable Value.

Surveillance Test Tolerance Determination

Margin has been added to the Minimum Allowable Setpoint to determine the actual field Dropout Trip Setpoint. Therefore, Surveillance Test tolerances must be defined relative to the actual field Dropout Trip Setpoint.

Surveillance Test As-Found Tolerance Determination

The magnitude of the Surveillance Test As-Found Tolerance is equal to the GAFT established in the previous section. That tolerance will be applied as a symmetrical ± tolerance around the Field Setpoint.

Surveillance Test As-Found Tolerance = Field Setpoint ± GAFT
= 5526V ± 125.4V (92.1V ± 2.09V on the secondary side)
= 5400.6V to 5651.4V (90.01V to 94.19V on the secondary side)

This tolerance may be reflected in a revision to MST-E0075. On the Attachment 1 Data Sheet, for the Under Voltage Relay Dropout Voltage, this As-Found Tolerance may be added to identify this tolerance as applicable to "As-Found" only results. It DOES NOT replace the existing column labeled as "Allowable Range", which (with new values per below) remains mandatory for As-Left settings. This new "As-Found" Allowable Tolerance may be added to the data sheet in the optimum format determined by the Maintenance procedure writer (e.g., either embedded into the table or added in a note).

Surveillance Test As-Left Tolerance Determination

The magnitude of the Surveillance Test As-Left Tolerance is chosen to be 1% of the setpoint. That tolerance will be applied as a ± tolerance around the actual field Dropout Trip Setpoint.

Surveillance Test As-Left Tolerance = Field Setpoint ± 1%
= 5526V ± (1% of 5526V)
= 5526V ± 55.26V (92.1V ± 0.921V on the secondary)
= 5470.74V to 5581.26V (91.18V to 93.02V on the secondary)

The Pulsar test equipment has an accuracy of ± 0.6V and the as-left tolerance is ± 0.921V. An SRSS of these terms $[(0.6)^2 + (0.921)^2]^{1/2}$ equals 1.1V. Since this value is less than the 1.2V margin between the field setpoint and the allowable setpoint, the as-left tolerance is appropriate.

See Attachment N for a display of setpoints.

4.2.3 Undervoltage Relay Pickup Setting Evaluation

The “pickup” (reset) setpoint of the safety bus undervoltage relays is not as critical as the dropout setpoint and does not have Technical Specification requirements. If the dropout is set as discussed above, the undervoltage relay will not actuate during the worst case motor starting transient, therefore, there would be no need to “reset” the relay while starting a motor. It is possible that the dropout setpoint could be reached during fault clearing transients; however, these transients are very short-lived with the voltage returning to normal levels immediately after the breaker “clears” the fault. Per vendor manual PQE, the pickup voltage is 110% or less of the setpoint. The pickup setting is not field adjustable. Therefore, all pickup values will be based on 110% of the corresponding Surveillance Test As-Left Tolerance value. The pickup voltage must be below the minimum expected normal bus voltage to ensure that the relay resets following a system fault.

Pickup Setpoint = 1.1 * Field Setpoint
= 1.1 * 5526V = 6078.6V (101.31V on the secondary)

Max As-Left Pickup = 1.1 * Max As-Left Tolerance
= 1.1 * 5581.26V = 6139.39V (102.32V on the secondary)

Min As-Left Pickup = 1.1 * Min As-Left Tolerance
= 1.1 * 5470.74V = 6017.81V (100.3V on the secondary)

An “as-left” pickup setting of 102.32V could result in an actual value, at some later time, as high as 105.23V (102.32V + 2.91V) considering relay drift and tolerances listed in Section 4.2.2. A pickup value of 105.23V is acceptable because it is less than the minimum DGVR dropout setting of 106.73V.

4.3 Time Delay Relay Settings

4.3.1 Background Information (Bases, etc.)

The purpose of the time delay relays in the undervoltage relay scheme is to prevent separation of the Emergency Buses as a result of normally expected short duration transients (e.g., faults). The time delay should be long enough to avoid spurious trips from faults or other very short term transients and short enough to prevent damage or protective device trip due to exposure to voltage substantially below the rated value. The time delay should also be substantially less than the time delay associated with the second level undervoltage relays since damage or protective device actuation is expected to occur much quicker at the lower voltage.

Derivation of Time Delay Lower Analytical Limit

The time delay relay lower analytical limit will be equal to the sum of the overcurrent relay operating time for the smallest bus feeder fault capable of causing the undervoltage relay to drop out, the breaker operating time, and the safety factor per IEEE 242-1975.

$$LAL_{(TD)} = \text{Overcurrent Relay}_{(Op\ Time)}\ \text{Time} + Bkr_{(Op\ Time)} + SF$$

As determined in section 4.2.1, for a 3000 amp fault current, the maximum overcurrent relay operating time for the affected breakers is 0.60 seconds. The breaker operating time for a 3-cycle breaker is 0.05 seconds and the safety factor is 0.225 seconds.

$$LAL_{(TD)} = 0.60 + 0.05 + 0.225$$
$$\mathbf{LAL_{(TD)} = 0.875s}$$

Upper Analytical Limit

An upper analytical limit of 1.503 seconds was chosen as it is significantly below the degraded grid time delay. Since motors are designed to withstand stalls at starting current for a period of time which is longer than the acceleration time of the motor (typically several seconds), a stall at 75% voltage for 1.503 seconds would cause no damage to the motor. Also, since overcurrent protective devices supplying motors are sized/set to ensure the ability to start the motor without spuriously tripping, the amount of current that the motor would draw at 75% of rated voltage (during a stall) would be lower than normal starting current and the duration will be less. Therefore, the primary undervoltage protection will react and trip the emergency bus main breaker without individual motor overcurrent protective devices actuating.

$$\mathbf{UAL_{(TD)} = 1.503s}$$

4.3.2 Time Delay Relay Setpoint Evaluation

Per above references and EDBS, the undervoltage time delay relays are GE model number 12SAM11B22A. Per instruction manual GEK-7393H (VM-PQE) and previous revisions to this calculation, the repeatability of the GE 12SAM11B22A time delay relay is 1% of the setting (1.5 seconds chosen since it is the Tech Spec Allowable Value).

$\mathbf{RA_{(TD)} = 0.01 * 1.5 = \pm 0.015}$ **seconds**

Per assumption 4.2.2.c drift is assumed to be ±1% of the maximum relay setting (3s) over 18 months. Allowing for a 25% grace period for Technical Specification surveillances

$\mathbf{DR_{(TD)} = .01 \times 3\ s \times 1.25 = \pm 0.0375}$ **seconds**

The calibration tolerance for the time delay relay is selected as ±1%, equal to the reference accuracy.

$\mathbf{CAL_{(TD)} = .01 \times 1.5\ s = \pm 0.015}$ **seconds**

Per Reference 2.19 (VM-UYB), the accuracy of the Multi-Amp Pulsar test set timer module is 0.002% of reading.

$\mathbf{MTE_{(TD)} = 0.00002 * 1.5 = \pm 0.00003}$ **seconds**

In the above tolerances and accuracies M&TE Error and Cal Tolerance are random, but dependant and are summed algebraically before being combined using the "square root of the sum of the squares" methodology.

Total Device Uncertainty (TDU) = $[(RA_{(TD)})^2 + (MTE_{(TD)} + CAL_{(TD)})^2 + (DR_{(TD)})^2]^{1/2}$

$\mathbf{TDU_{(TD)} = [(0.015)^2 + (0.01503)^2 + (0.0375)^2]^{1/2} = \pm 0.0431s}$

Since there is no primary element in a loop, the Total Loop Uncertainty (TLU) = Total Device Uncertainty (TDU).

$\mathbf{TLU_{(TD)} = TDU_{(TD)} = \pm 0.0431s}$

The Minimum Setpoint that can protect the Lower Analytical Limit is:

$AS_{(min)} = LAL_{(TD)} + TLU_{(TD)}$

$= 0.875s + 0.0431s = 0.918s$

The Maximum Setpoint that can protect the Upper Analytical Limit is:

$AS_{(max)} = UAL_{(TD)} - TLU$

$= 1.503s – 0.0431s = 1.46s$

The Field Setpoint is chosen in between the minimum and maximum allowable setpoints. A setpoint of 1.2s (approximately halfway in between the maximum and minimum allowable setpoints) leaves a margin of 0.282s below and 0.26s above.

Field Setpoint = 1.2s

Allowable Value Determination

For this decreasing trip function, the Allowable Value (AV) is determined as follows:

AV = Maximum Allowable Setpoint - Group As-Found Tolerance (GAFT)

The GAFT is the As-Found Tolerance for the "Group" of devices subjected to calibration during a Tech Spec Surveillance Test. In this case, the "Group" consists of only the UV Relay. The As-Left Tolerance (ALT) is not included in the GAFT determination. This provides a more conservative value. The GAFT is determined as follows.

GAFT:

$$GAFT = [DR_{(TD)}^2 + MTE_{(TD)}^2 + CAL_{(TD)}^2]^{1/2}$$
$$= [(0.0375)^2 + (0.00003)^2 + (0.015)^2]^{1/2}$$
$$= \pm 0.0404s$$

Minimum Allowable Value:

$$AV_{(min)} = AS_{(min)} - GAFT$$
$$= 0.918s – 0.0404s = 0.878s$$

Maximum Allowable Value:

$$AV_{(max)} = AS_{(max)} + GAFT$$
$$= 1.46s + 0.0404s$$
$$= 1.5004s \text{ (rounded 1.5s for conservatism)}$$

Time Delay Relay Settings, Allowable Values, and Tolerances

The following setpoints, allowable values and tolerances are shown in Attachment N Page N5 for the Time Delay Relay:

Allowable Value - ≥0.878 seconds and ≤1.5 seconds
Setpoint - ≥0.918 seconds and ≤ 1.46 seconds

The actual setpoint selected for these relays is 1.2s. This setting includes suitable margin to both the maximum and minimum allowable setpoints as shown on Page N5.

As-left tolerances for input to MST-E0075 are 1.2 ± 0.012 seconds
As-left range = 1.188 to 1.212 seconds

As-found tolerances for input to MST-E0075 are 1.2 ± 0.0404 seconds
As-found range = 1.16 to 1.24 seconds

4.4 Bases and Assumptions

4.4.1 Bases

a. The bases for the MST-E0075 setpoint and allowed range for the Emergency Bus “loss of voltage” undervoltage relays and associated time delay relays is Drawing 6-S-0302, sheets 20, 23 & 24 and this calculation.

b. The basis for the setpoints for the Emergency Bus “loss of voltage” undervoltage relays and associated time delay relays presented on drawing 6-S-0302, sheets 20, 23 & 24 is this calculation.

c. The bases for the GE model number NGV13B undervoltage relay accuracy are previous revisions to this calculation and confirming telephone conversation memorandum between Jim Deitrick of CP&L and Jim Teague of GE (Attach G).

   NGV 13B relays are mounted in PT cubicles of buses 1A-SA and 1B-SB located in RAB-286 switchgear rooms. This area is a temperature controlled environment maintained at a constant temperature (80ºF is the temperature controller setting) per DBD-137 and calculations 9-RAB-006A and -006B.

   Per procedure AOP-028, normal operating range for grid frequency is 59.5 to 60.5Hz with a nominal value of 60Hz. This represents a variation in frequency of less than 0.84%. Based on engineering judgment, the grid frequency is considered stable and constant to cause any adverse impact on any equipment connected to plant’s aux electrical distribution system.

   Therefore, it is concluded that repeatability and accuracy of NGV 13B relays will not be affected by area temperature and grid frequency in reference to page G2 of Attachment G.

d. The basis for the Fluke model numbers 8600A and 45 digital multimeter accuracy is Vendor Manual VM-BLV.

e. The bases for the PT tolerance is Purchase Specification CAR-SH-E-006A, Calculation E2-0005.09, R0, Page 10 and Attachment F.

f. The basis for the Multi-Amp Pulsar Universal Relay Test Unit accuracy is the manufacturer’s instruction book, Reference 2.19.

g. The bases for the GE model number SAM11B time delay relay accuracy are previous revisions to this calculation and Instruction Manual GEK-7393H, Reference 2.17.

h. The basis for the 6.9 kv Emergency Bus 1A-SA & 1B-SB voltages during and after motor starting is Calculation E6000.

i. Procedure EGR-NGGC-0153 is used as "guidance" in the development of this calculation. As stated in EGR-NGGC-0153, Section 9.1, this procedure is intended to be used in the development of process instrument setpoint calculations. It is also stated that protective relay calculations are excluded from the scope. However, the methodology is acceptable for use in deriving setpoints and allowable values for devices other than process instruments and is used as the bases in this calculation for determining setpoints and allowable values.

j. The bases for omitting Potential Transformer drift is Calculation E2-0005.09, R4 and engineering judgment that the output of the PT is a function of its winding ratio and a reference accuracy measured by the manufacturer.

k. This calculation is prepared using preliminary information of E-6000 Rev 12. The preliminary voltages being used from revision 12 are higher than those from revision 11 resulting in a more conservative undervoltage relay setting. Since the information being used in this calculation is bounded within the approved revision 11 parameters it is considered acceptable.

4.4.2 Assumptions

a. It is assumed that "equivalent" test equipment, as allowed by MST-E0075 includes equivalent (or better) test equipment accuracy. The Fluke 8600A DMM or the Fluke 45 DMM may be substituted for the Pulsar when measuring voltages since both are more accurate.

b. It is assumed that the temperature range in the area where the Multi-Amp Pulsar Test Set is being used is 23^0C +/- 2^0C.

c. The manufacturer for the 12SAM11B22a relay does not specify a value for drift. Per guidance in EGR-NGGC-0153, a value of ±1% of maximum time delay setting for the relay over 18 months is assumed.

5.0 CONCLUSIONS

5.1 EMERGENCY BUS 1A-SA & 1B-SB PSB-1 “LOSS OF VOLTAGE” UNDERVOLTAGE RELAY DROPOUT SETTING

RELAY TAG NUMBER	TECH SPEC TABLE 3.3-4		FIELD SETPOINT		MST-E0075				
						“AS-FOUND” ALLOWED		“AS-LEFT” ALLOWED	
	SETPOINT	ALLOWED	SETPOINT	ALLOWED	SETPOINT	MIN	MAX	MIN	MAX
27-1/1729	≥ 5453.6V	≥ 5329.2V	≤93.31 and >90.89	≤95.4 and >88.82	92.1	90.01	94.19	91.18	93.02
27-2/1729	≥ 5453.6V	≥ 5329.2V	≤93.31 and ≥90.89	≤95.4 and >88.82	92.1	90.01	94.19	91.18	93.02
27-3/1729	≥ 5453.6V	≥ 5329.2V	≤93.31 and ≥90.89	≤95.4 and >88.82	92.1	90.01	94.19	91.18	93.02
27-1/1730	≥ 5453.6V	≥ 5329.2V	≤93.31 and ≥90.89	≤95.4 and >88.82	92.1	90.01	94.19	91.18	93.02
27-2/1730	≥ 5453.6V	≥ 5329.2V	≤93.31 and ≥90.89	≤95.4 and >88.82	92.1	90.01	94.19	91.18	93.02
27-3/1730	≥ 5453.6V	≥ 5329.2V	≤93.31 and ≥90.89	≤95.4 and >88.82	92.1	90.01	94.19	91.18	93.02

Note: Tech Spec values are given in primary side voltage while MST values are in secondary side voltage

5.2 EMERGENCY BUS 1A-SA & 1B-SB PSB-1 “LOSS OF VOLTAGE” UNDERVOLTAGE RELAY PICKUP SETTING

RELAY TAG NUMBER	TECH SPEC TABLE 3.3-4		MST-E0075				
				“AS-FOUND” ALLOWED		“AS-LEFT” ALLOWED	
	SETPOINT	ALLOWED	SETPOINT	MIN	MAX	MIN	MAX
27-1/1729	N/A	N/A	101.31	N/A	N/A	100.3	102.32
27-2/1729	N/A	N/A	101.31	N/A	N/A	100.3	102.32
27-3/1729	N/A	N/A	101.31	N/A	N/A	100.3	102.32
27-1/1730	N/A	N/A	101.31	N/A	N/A	100.3	102.32
27-2/1730	N/A	N/A	101.31	N/A	N/A	100.3	102.32
27-3/1730	N/A	N/A	101.31	N/A	N/A	100.3	102.32

5.3 EMERGENCY BUS PSB-1 "LOSS OF VOLTAGE"UNDERVOLTAGE TIME DELAY RELAY SETTING

RELAY TAG NUMBER	TECH SPEC TABLE 3.3-4		FIELD SETPOINT		MST-E0075				
						"AS-FOUND" ALLOWED		"AS-LEFT" ALLOWED	
	SETPOINT	ALLOWED	SETPOINT	ALLOWED	SETPOINT	MIN	MAX	MIN	MAX
2/1731	≤ 1.46s	≤ 1.5s	≥0.918s and ≤1.46s	≥0.878s and ≤1.5s	1.2s	1.16s	1.24s	1.188s	1.212s
2/1732	≤ 1.46s	≤ 1.5s	≥0.918s and ≤1.46s	≥0.878s and ≤1.5s	1.2s	1.16s	1.24s	1.188s	1.212s

5.4 **Voltage measurements may be taken with a Fluke 8600A DMM, a Fluke 45 DMM or with a Multi-Amp Pulsar Universal Relay Test Unit.**

Listing Device Uncertainties Form

Device Type LOOP Undervoltage Relays Device Name(s) 27 Undervoltage Relays (Dropout Evaluation)

ERROR/EFFECT	VALUE	TYPE	COMMENTS
Ref. Accuracy	±2.0V	Random	±2% of setpoint 100V chosen for setpoint
Cal. Tolerance (ALT)	N/A		
M&TE Error	±0.6V	Random	Worst case is the Pulsar Relay Test Unit with ref. accuracy of ±0.5% of reading + 0.1V for resolution. 100V chosen for reading
Drift	±2.0V	Random	Assumed same as Ref. Accuracy
Temp. Effect	N/A		
Pwr. Supply Effect	N/A		
Readability	N/A		
Seismic Effect	N/A		
Acc. Temp. Effect	N/A		
Acc. Press. Effect	N/A		
Acc. Rad. Effect	N/A		
Insul. Resist. Effect	N/A		
Other	N/A		
Total Device Uncertainty (TDU)	±2.89V		$[(2)^2 + (0.6)^2 + (2)^2]^{1/2}$

(EGR-NGGC-0153-1-2)

Note: All errors/effects must be converted to the same basis (i.e. units) prior to entering their values onto the form.

Listing Device Uncertainties Form

Device Type Potential Transformers Device Name(s) Primary Element - PE (Dropout Evaluation)

ERROR/EFFECT	VALUE	TYPE	COMMENTS
Ref. Accuracy	±0.36V	Random	±0.3% of PT voltage (120V)
Cal. Tolerance (ALT)	N/A		
M&TE Error	N/A		
Drift	N/A		
Temp. Effect	N/A		
Pwr. Supply Effect	N/A		
Readability	N/A		
Seismic Effect	N/A		
Acc. Temp. Effect	N/A		
Acc. Press. Effect	N/A		
Acc. Rad. Effect	N/A		
Insul. Resist. Effect	N/A		
Other	N/A		
Total Device Uncertainty (TDU)	±0.36V		

(EGR-NGGC-0153-1-2)

Note: All errors/effects must be converted to the same basis (i.e. units) prior to entering their values onto the form.

Decreasing Setpoints Form (LOOP Dropout)

PE	±0.36V	$Bias_1$	N/A
PME	N/A	$Bias_2$	N/A
TDU_{sensor}	N/A	$Bias_3$	N/A
TDU_1	±2.89V	Total Bias	N/A
TDU_2	N/A		
TDU_3	N/A		

$TLU = (PE^2 + TDU_1^2)^{½}$

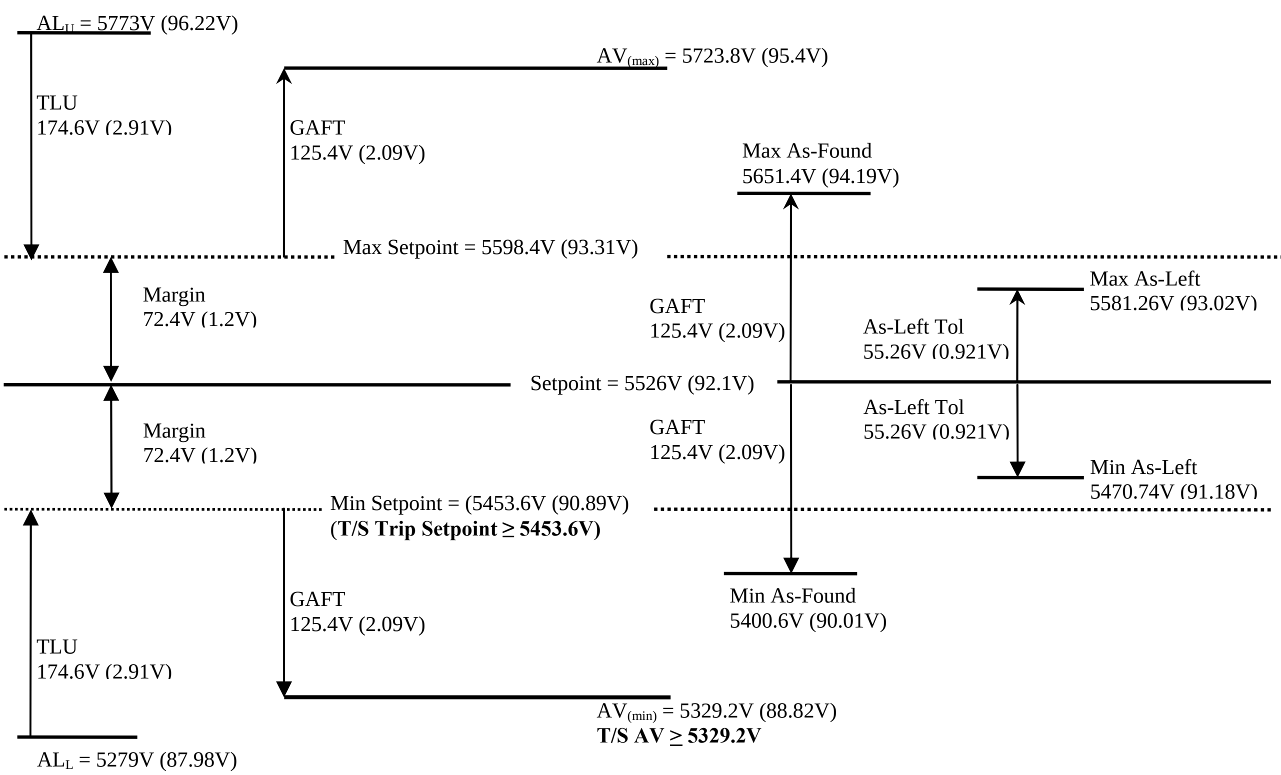
TLU	±2.91V
Margin	±72.4V

$GAFT = (DR_1^2 + MTE_1^2)^{½}$

GAFT	±2.09V

$LAFT = (GAFT^2 + ALT_{sensor}^2 + DR_{sensor}^2 + MTE_{sensor}^2)½$

LAFT	N/A



Listing Device Uncertainties Form

Device Type LOOP Time-Delay Relays Device Name(s) 2 Time Delay Relays

ERROR/EFFECT	VALUE	TYPE	COMMENTS
Ref. Accuracy	±0.015	Random	All values are in seconds
Cal. Tolerance (ALT)	±0.015	Random	
M&TE Error	±0.00004	Random	
Drift	±0.0375	Random	
Temp. Effect	N/A	N/A	
Pwr. Supply Effect	N/A	N/A	
Readability	N/A	N/A	
Seismic Effect	N/A	N/A	
Acc. Temp. Effect	N/A	N/A	
Acc. Press. Effect	N/A	N/A	
Acc. Rad. Effect	N/A	N/A	
Insul. Resist. Effect	N/A	N/A	
Other	N/A	N/A	
Total Device Uncertainty (TDU)	±0.0431 seconds		M&TE Error and Cal Tolerance are random, but dependant and are summed algebraically before SRSS $[(0.015)^2 + (0.01504)^2 + (0.0375)^2]^{1/2}$

(EGR-NGGC-0153-1-2)

Note: All errors/effects must be converted to the same basis (i.e. units) prior to entering their values onto the form.

Increasing Setpoint Form (LOOP Time Delay Relay)

PE	N/A	$Bias_1$	N/A
PME	N/A	$Bias_2$	N/A
TDU_{sensor}	N/A	$Bias_3$	N/A
TDU_1	±0.0431	Total Bias	N/A
TDU_2	N/A		
TDU_3	N/A		

$TLU = (PE^2 + TDU_1^2)^{½}$ + Total Bias

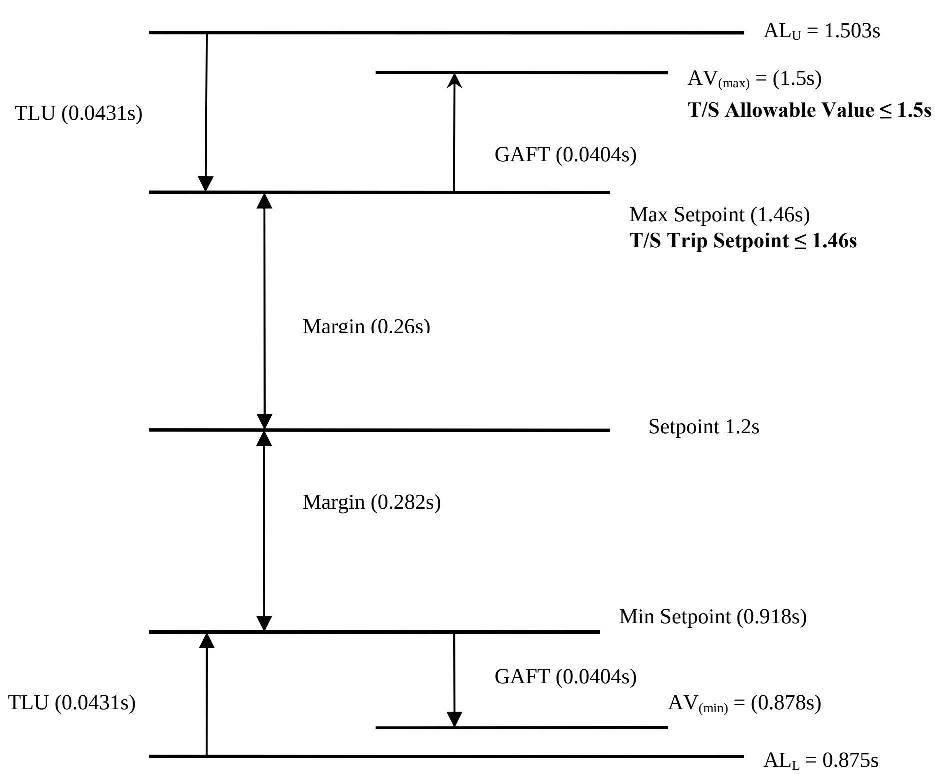
TLU	±0.0431
Margin	Upper 0.26 Lower 0.282

$GAFT = (ALT_1^2 + DR_1^2 + MTE_1^2)^{½}$ + Total Bias

GAFT	±0.0404

$LAFT = (GAFT^2 + ALT_{sensor}^2 + DR_{sensor}^2 + MTE_{sensor}^2)½$

LAFT	N/A



A TRAIN UV RELAY DROPOUT TEST RESULTS

Test Date	27-1/1729			27-2/1729			27-3/1729		
	As-Found	As-Left	Drift	As-Found	As-Left	Drift	As-Found	As-Left	Drift
3/22/10	81.8/81.8	81.8/81.8	0.4	83.8/82.6	81.6/81.1	3.6	80.1/80.2	80.1/80.2	0.3
1/26/09	79.7/79.8	81.4/81.4	1.1	77.0/77.1	80.2/80.1	3.7	77.5/77.7	80.4/80.4	3.8
4/26/07	79.6/79.9	80.8/80.8	0.7	80.7/80.4	80.7/80.4	0.2	74.5/74.8	81.3/80.4	5.9
12/8/05	81.2/81.4	80.3/80.5	0.8	82.8/82.7	80.7/80.2	1.2	81.6/81.5	80.4/80.6	0.5
9/23/04	80.7/80.6	80.7/80.6	0.4	81.6/81.5	81.6/81.5	0.2	81.1/81.0	81.1/81.0	0.4
5/3/03	80.4/81.0	80.4/81.0	0.2	81.4/81.7	81.4/81.7	0.1	80.7/80.8	80.7/80.8	0.5
9/22/01	80.2/80.8	80.2/80.8	-	81.3/81.6	81.3/81.6	-	78.7/78.7	81.2/80.6	-

B TRAIN UV RELAY DROPOUT TEST RESULTS

Test Date	27-1/1730			27-2/1730			27-3/1730		
	As-Found	As-Left	Drift	As-Found	As-Left	Drift	As-Found	As-Left	Drift
7/28/10	80.9/80.9	80.9/80.9	0.6	80.4/80.7	80.4/80.7	0.2	80.9/80.5	80.9/80.5	0.5
2/10/09	79.6/79.7	81.5/81.3	0.9	80.6/80.7	80.6/80.7	0.9	80.7/80.6	80.4/80.4	0.8
6/13/07	80.5/80.2	80.5/80.2	0.4	81.5/81.2	81.5/81.2	0.4	81.2/81.4	81.2/81.4	0.5
6/8/06	80.7/80.6	80.7/80.6	0.2	81.8/81.6	81.8/81.6	0.5	81.7/81.7	81.7/81.7	0.4
8/4/04	80.5/80.7	80.5/80.7	0.2	82.3/82.1	82.3/82.1	1.6	81.5/81.3	81.5/81.3	0.2
4/27/03	80.7/80.7	80.7/80.7	0.1	80.8/80.5	80.8/80.5	1.3	81.4/81.5	81.4/81.5	0.9
10/28/01	80.6/80.8	80.6/80.8	-	81.2/81.8	81.2/81.8	-	80.7/80.6	80.7/80.6	-

NOTES

1. Values in As-Found and As-Left columns: First value is dropout voltage when terminals 3-4 are monitored changing state and the second value is when terminals 7-8 are monitored changing state, e.g. 83.8/82.6 represents measured dropout voltage when monitored terminals 3-4 changed state was 83.8V and it was 82.6V when monitored terminals 7-8 changed state. Values in these two columns are in volts.
2. Drift is the largest of the difference between the As- Found and the last (previous) As-Left value (largest of the two - when terminals 3-4 were monitored vs. when terminals 7-8 were monitored). It is used in calculating the relay uncertainty, where the setpoint used is 100V (max of the relay range of 70 to 100V); therefore, the drift column is in percent as well as in volts.
3. As is evident from the above test data, 4 values out of a total of 36 (about 11%) for the drift are more than 2%. AR 316381 investigation documents that the starting voltage for testing the relay using Pulsar was changed in 2009 from 95V used in the past to 120V. This was as a result of change in software used in Pulsar for relay testing from PulseMaster to AVTS in 2007. Until this time, it was not known (even to the Pulsar vendor) that the test starting voltage affects the results. It is reasonable to believe that 3 out the 4 values in question are a result of this change in test starting voltage required by change in software in 2007. Since the majority of the drift values (about 89%) for the last approx. 10 years for UV relays are less than 2%, using a drift value of 2% is considered “enveloping” and is recommended / justified based on these past test results.