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RS-13-207

10 CFR 50.90

September 20, 2013

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

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: License Amendment Request to Revise Loss of Voltage Relay Settings for 4.16 kV ESF Buses

Reference: NRC Letter from A. M. Stone to M. J. Pacilio, "LaSalle County Station, Units 1 and 2 Component Design Bases Inspection (CDBI) 05000373/2010006(DRS); 05000374/2010006(DRS)," February 15, 2011

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS), Units 1 and 2. This amendment request proposes to revise allowable values for certain Functions in Technical Specifications (TS) Table 3.3.8.1-1, "Loss of Power Instrumentation." The changes to the allowable values are necessary to address the discovery of a non-conservative TS. As documented in the Referenced letter, EGC had not established the adequacy of the setpoints for degraded voltage relay time delay and the loss of voltage relay trip function described in TS 3.3.8.1, and the EGC analysis of record did not account for the potential worst case, non-accident degraded voltage condition, and, therefore, did not demonstrate the operability of permanently connected safety-related loads under those conditions.

Increasing the 4.16 kV ESF bus loss of voltage relay settings will provide assurance that, under non-accident conditions, normally operating safety related motors will not be damaged in the event of sustained degraded bus voltage during the time delay before initiation of the loss of voltage trip function. This change will involve alteration of nominal trip setpoints in the field, which will also be reflected in revisions to the calibration procedures.

Plant operations in TS 3.3.8.1 are currently administratively controlled under the provisions of NRC Administrative Letter (AL) 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," to assure that plant safety is maintained. This license amendment request is submitted in accordance with the guidance in AL 98-10. In accordance with the guidance of AL 98-10, EGC submits the proposed change as a required license amendment request to resolve a non-conservative TS. As such, this is not a "voluntary request from a licensee to change its licensing basis" and should not be subject to "forward fit" considerations.

The attached request is subdivided as follows:

- Attachment 1 provides a description and evaluation of the proposed changes.
- Attachment 2 provides the markup of the affected TS page.
- Attachment 3 provides Design Analysis L-002588.

The proposed changes have been reviewed by the LSCS Plant Operations Review Committee and approved by the Nuclear Safety Review Board in accordance with the requirements of the EGC Quality Assurance Program.

EGC requests approval of the proposed license amendment request by September 20, 2014, to support implementation activities during the LSCS Unit 2 spring 2015 refueling outage (L2R15) and LSCS Unit 1 spring 2016 refueling outage (L1R16) as changes to the loss of voltage relay settings cannot be completed online. Once approved, the amendment will be implemented for LSCS Unit 2 prior to entering MODE 4 following implementation of the revisions to the loss of voltage relay settings for the 4.16 kV ESF buses during the LSCS Unit 2 spring 2015 refueling outage (L2R15), and the amendment will be implemented for LSCS Unit 1 prior to entering MODE 4 following implementation of the revisions to the loss of voltage relay settings for the 4.16 kV ESF buses during the LSCS Unit 1 spring 2016 refueling outage (L1R16).

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC is notifying the State of Illinois of this application for license amendment by transmitting a copy of this letter and its attachments to the designated State Official.

There are no regulatory commitments contained within this letter. Should you have any questions concerning this letter, please contact Ms. Lisa A. Simpson at (630) 657-2815.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 20th day of September 2013.

Respectfully,

David M. Gullott
Manager – Licensing
Exelon Generation Company, LLC

Attachments:

1) Evaluation of Proposed Changes
2) Markup of Technical Specifications Page
3) Design Analysis L-002588

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, LaSalle County Station
Illinois Emergency Management Agency – Division of Nuclear Safety

ATTACHMENT 1
Evaluation of Proposed Changes

Subject: License Amendment Request to Revise Loss of Voltage Relay Settings for 4.16 kV ESF Buses

ATTACHMENT 1
Evaluation of Proposed Changes

1.0 SUMMARY DESCRIPTION

This evaluation supports a request to amend Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS), Units 1 and 2.

Exelon Generation Company, LLC, (EGC) proposes to revise allowable values for certain Functions in Technical Specifications (TS) Table 3.3.8.1-1, "Loss of Power Instrumentation." The changes to the allowable values are necessary to address the discovery of a non-conservative TS. As documented in NRC Inspection Report issued February 15, 2011, for the LaSalle Component Design Bases Inspection (CDBI), EGC had not established the adequacy of the setpoints for degraded voltage relay time delay and the loss of voltage relay trip function described in TS 3.3.8.1, and the EGC analysis of record did not account for the potential worst case, non-accident degraded voltage condition, and, therefore, did not demonstrate the operability of permanently connected safety-related loads under those conditions.

Increasing the 4.16 kV engineered safety feature (ESF) bus loss of voltage relay settings will provide assurance that, under non-accident conditions, normally operating safety related motors will not be damaged in the event of sustained degraded bus voltage during the time delay before initiation of the loss of voltage trip function. This change will involve alteration of nominal trip setpoints in the field, which will also be reflected in revisions to the calibration procedures.

In accordance with NRC Administrative Letter (AL) 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," (Reference 1), administrative controls implemented under EGC Operability Evaluation OE 10-006 (Reference 2) assure that plant safety is maintained. In accordance with the guidance of AL 98-10, EGC submits the proposed change as a required license amendment request to resolve a non-conservative TS. As such, this is not a "voluntary request from a licensee to change its licensing basis" and should not be subject to "forward fit" considerations.

Approval of this amendment application is requested by September 20, 2014, to support implementation activities during the LSCS Unit 2 spring 2015 refueling outage (L2R15) and LSCS Unit 1 spring 2016 refueling outage (L1R16) as revision of the loss of voltage relay settings cannot be completed online. Once approved, the amendment will be implemented for LSCS Unit 2 prior to entering MODE 4 following implementation of the revisions to the loss of voltage relay settings for the 4.16 kV ESF buses during the LSCS Unit 2 spring 2015 refueling outage (L2R15), and the amendment will be implemented for LSCS Unit 1 prior to entering MODE 4 following implementation of the revisions to the loss of voltage relay settings for the 4.16 kV ESF buses during the LSCS Unit 1 spring 2016 refueling outage (L1R16).

2.0 DETAILED DESCRIPTION

The requested amendment will revise the allowable values in TS Table 3.3.8.1-1, "Loss of Power Instrumentation," for the following Functions:

1) Function 1.a, Divisions 1, 2 and Opposite Unit Division 2 – 4.16 kV ESF Bus Undervoltage, Loss of Voltage – 4.16 kV Basis

2) Function 2.a, Division 3 – 4.16 kV ESF Bus Undervoltage, Loss of Voltage – 4.16 kV Basis

Current TS Table 3.3.8.1-1, Function 1.a Allowable Value states: ≥ 2422 V and ≤ 3091 V
Revised TS Table 3.3.8.1-1, Function 1.a Allowable Value states: ≥ 2870 V and ≤ 3127 V

Current TS Table 3.3.8.1-1, Function 2.a Allowable Value states: ≥ 2596 V and ≤ 3137 V
Revised TS Table 3.3.8.1-1, Function 2.a Allowable Value states: ≥ 2725 V and ≤ 3172 V

Attachment 2 provides mark-ups of the affected TS page for the proposed change.

3.0 TECHNICAL EVALUATION

Offsite power is supplied to LSCS by the Commonwealth Edison 345 kV system. There are four incoming lines, two for each unit. The 345 kV switchyard is arranged in a double ring bus.

Each unit's auxiliary electric system is served from two 6.9 kV and five 4.16 kV buses. The ESF loads are fed from the 4.16 kV buses (buses 141Y, 142Y, 143, 241Y, 242Y, and 243). Each 4.16 kV ESF bus has its own independent LOP instrumentation and associated trip logic. The voltage for the Division 1, 2, and 3 buses is monitored at two levels, which are considered as two different undervoltage functions: loss of voltage and degraded voltage.

Loss of voltage on a 4.16 kV ESF bus indicates that offsite power may be completely lost to the respective ESF bus, and the bus is unable to supply sufficient voltage for proper operation of the applicable equipment. Therefore, the power supply to the bus is transferred from the offsite power supply to onsite diesel generator. Undervoltage relays are provided for each ESF bus to initiate load shedding and transfer the ESF load to the onsite diesel generator in case offsite power is lost or degraded. The transfer is initiated prior to when the voltage on the bus drops below the minimum loss of voltage function allowable value but after the voltage drops below the maximum loss of voltage function allowable value. A short time delay of the undervoltage trip prevents inadvertent relay actuations due to momentary voltage transients. Because the minimum expected voltage during normal or emergency operation is well above the relay setting, transfer to the onsite power supply should not occur. The undervoltage relays incorporate sufficient time delay so that short circuits are cleared without undervoltage relay operation.

A degraded voltage condition on a 4.16 kV ESF bus indicates that while offsite power may not be completely lost to the respective ESF bus, voltage may be insufficient for starting large motors without risking damage to the motors that could disable the ECCS function. Therefore, power supply to the bus is transferred from offsite power to onsite diesel generator when the voltage on the bus drops below the degraded voltage function allowable values. The system also includes a timer that is initiated by the degraded voltage relays. If the degraded voltage is not corrected within the approximate 5-minute period of the timer, the bus will automatically transfer from the offsite power source to an onsite diesel generator. This ensures that adequate power will be available to the required equipment.

A loss of voltage signal or degraded voltage signal results in the start of the associated diesel generator, the trip of the normal and alternate offsite power supply breakers to the associated 4.16 kV ESF bus, and (for Divisions 1 and 2 only) the shedding of the appropriate 4.16 kV bus loads.

The bus undervoltage allowable values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that sufficient power is available to the required equipment. The time delay allowable values are long enough to provide time for the offsite power supply to recover to normal voltages following short system or grid perturbations, but short enough to ensure that sufficient power is available to the required equipment when a significant grid disturbance occurs.

LSCS TS Table 3.3.8.1-1 specifies the 4.16 kV ESF bus undervoltage allowable values as summarized in the following table:

	Function	Allowable Value (current values)
1.	Division 1, 2 and Opposite Unit Division 2 – 4.16 kV Emergency Bus Undervoltage	
	a. Loss of Voltage – 4.16 kV Basis	≥ 2422 V and ≤ 3091 V
	b. Loss of Voltage – Time Delay	≥ 3.1 seconds and ≤ 10.9 seconds
	c. Degraded Voltage – 4.16 kV Basis	≥ 3814 V and ≤ 3900 V
	d. Degraded Voltage – Time Delay, No LOCA	≥ 270.1 seconds and ≤ 329.9 seconds
	e. Degraded Voltage – Time Delay, LOCA	≥ 9.4 seconds and ≤ 10.9 seconds
2.	Division 3 – 4.16 kV Emergency Bus Undervoltage	
	a. Loss of Voltage – 4.16 kV Basis	≥ 2596 V and ≤ 3137 V
	b. Loss of Voltage – Time Delay	≤ 10.9 seconds
	c. Degraded Voltage – 4.16 kV Basis	≥ 3814 V and ≤ 3900 V
	d. Degraded Voltage – Time Delay, No LOCA	≥ 270.1 seconds and ≤ 329.9 seconds
	e. Degraded Voltage – Time Delay, LOCA	≥ 9.4 seconds and ≤ 10.9 seconds

Based on TS 3.3.8.1, the 4.16 kV buses for Division 1, 2 can remain above 2422 V for 340.8 seconds (i.e., 10.9 seconds for the loss of voltage relay time delay and 329.9 seconds for Degraded Voltage relay time delay for non loss-of-coolant accident (LOCA) case), with no action taken to rectify this condition. Under this condition of the 4.16 kV buses, the constant kilovolt-ampere (KVA) loads running on these buses (such as motors) may experience stall conditions and the over load protection may trip the load. Similarly, based on TS 3.3.8.1, the 4.16 kV buses for Division 3 can remain above 2596 V for 340.8 seconds (i.e., 10.9 seconds for the loss of voltage relay time delay and 329.9 seconds for Degraded Voltage relay time delay for non-LOCA case), and no action may be taken to rectify this condition. Under this condition

of the 4.16 kV buses, the constant KVA loads running on these buses (such as motors) may experience stall condition and/or the over load protection may trip these loads.

On February 15, 2011, the NRC issued an Inspection Report for the LaSalle Component Design Bases Inspection (CDBI) (Reference 3). The report describes a finding of very low safety significance (Green) and an associated non-cited violation (NCV) of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," involving "[EGC's] failure to have appropriate analyses for the loss of voltage relay setpoints and the second level undervoltage [degraded voltage] relay timer settings. Specifically, [EGC's] analysis and technical basis for the auxiliary power system (AP) second level undervoltage relay time delay settings failed to demonstrate the ability of the permanently connected safety-related loads to continue to operate during the 5.5 minutes relay time delay without sustaining damage during a worst case, non-accident degraded voltage condition (when voltage was still above the setpoint of the loss of voltage relay setpoint)."

Exelon performed an analysis of the relay setpoints to address the CDBI NCV issued in 2011. The degraded voltage relay timer is set to trip in 300 ± 29.9 seconds time delay following the 10.9 seconds time delay of the degraded voltage relay before transfer of all the loads to the diesel generators. The maximum time delay to trip the offsite source due to degraded bus voltage is therefore 340.8 seconds (5.7 minutes) (Reference TS Table 3.3.8.1-1). As documented in Exelon Design Analysis L-002588 (Reference 4), the purpose of the calculation was to evaluate relay setpoints to ensure that all safety related motors normally running from power supplied from the SAT would not trip in less than 5.7 minutes under a degraded voltage condition of the 4.16 kV ESF bus.

The upper analytical limit for Division 1, 2 and 3 bus loss of voltage relays was chosen to ensure that the minimum expected voltage during LOCA block start of all safety related loads remains above this value. This ensures that the loss of voltage relays do not trip the SAT feeder breaker when the SAT voltage is adequate to supply the power to the safety related loads. The minimum voltage at 4.16 kV buses for Division 1, 2 and 3 is more than 3190 V, when all the safety related loads were started at the same time. This voltage improves to a higher value in 2.5 seconds as the motors accelerate. Therefore, the upper analytical limit was chosen to be 3185 V to provide margin.

The lower analytical limit for Division 1, 2 and 3 bus loss of voltage relays are such that none of the safety related, normally running motors stall when subjected to this voltage for the entire time delay. The minimum bus voltage that ensures none of the safety related motors running in Division 1 and 2 will stall is 65.5% of 4.16 kV or 2725 V and for Division 3 is 65% of 4.16 kV or 2704 V. The analysis determined that for these analytical values, none of the safety related motors stalled. Therefore, the lower limit of the analytical limit for Division 1 and 2 is chosen as 2812 V to provide margin. Similarly, the lower analytical limit for Division 3 is chosen as 2712 V to provide margin.

Based on the upper and lower analytical limits provided in the two preceding paragraphs, Design Analysis L-002488 (Reference 4) provides a calculation that determines the new upper and lower allowable values for Loss of Voltage – 4.16 kV Basis Functions in accordance with the EGC setpoint methodology.

The following table provides the new upper and lower allowable values for Loss of Voltage – 4.16 kV Basis Functions:

Divisions 1 and 2:

TS Specification	Existing Allowable Values	Revised Allowable Values
TS Table 3.3.8.1-1, Function 1.a	≥ 2422 V and ≤ 3091 V	≥ 2870 V and ≤ 3127 V

Division 3:

TS Specification	Existing Allowable Values	Revised Allowable Values
TS Table 3.3.8.1-1, Function 2.a	≥ 2596 V and ≤ 3137 V	≥ 2725 V and ≤ 3172 V

The analysis shows that the auxiliary distribution system at LSCS has the capability to adequately handle worst case loading and maintain all voltages well within equipment ratings under the postulated most severe contingency conditions.

Design Analysis L-002588, included as Attachment 3 to this amendment request, is provided as a reference for additional information.

4.0 REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

The proposed change has been evaluated to determine whether applicable regulations and requirements continue to be met.

General Design Criterion 5, "Sharing of structures, systems, and components," states that no safety-related systems, structures, or components are shared unless such sharing has been evaluated to ensure that there will be no significant adverse impact on safety functions.

General Design Criterion 17, "Electric power systems," states that provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

Regulatory Guide 1.81, Revision 1, "Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants," states that, because of the low probability of a major reactor accident, a suitable design basis for multi-unit nuclear power plants is the assumption that an accident occurs in only one unit at a time, with all remaining units proceeding to an orderly shutdown and a maintained cooldown condition.

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Branch Technical Position (BTP) 8-6, "Adequacy of Station Electric Distribution System Voltages," March 2007, states, in part, as follows:

> The technical specifications should include limiting conditions for operations, surveillance requirements, trip setpoints, and maximum and minimum allowable values for the first level of undervoltage protection (LOOP [loss of offsite power]) relays and the second-level (degraded voltage) protection sensors and associated time delay devices.

Based on the considerations 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 continue to be conducted in accordance with the site licensing basis; and (3) the approval of the proposed change will not be inimical to the common defense and security or to the health and safety of the public.

In conclusion, EGC has determined that the proposed change does not require any exemptions or relief from regulatory requirements, other than the TS, and does not affect conformance with any regulatory requirements or criteria.

4.2 No Significant Hazards Consideration

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests an amendment to Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS), Units 1 and 2. The proposed change would revise allowable values for certain Functions in Technical Specifications (TS) Table 3.3.8.1-1, "Loss of Power Instrumentation." The changes to the allowable values are necessary to address the discovery of a non-conservative value in the affected TS.

As documented in NRC Inspection Report issued February 15, 2011, for the LaSalle Component Design Bases Inspection (CDBI), EGC had not established the adequacy of the setpoints for degraded voltage relay time delay and the loss of voltage relay trip function described in TS 3.3.8.1, and the EGC analysis of record did not account for the potential worst case, non-accident degraded voltage condition, and, therefore, did not demonstrate the operability of permanently connected safety-related loads under those conditions.

Increasing the 4.16 kV engineered safety feature (ESF) bus loss of voltage relay settings will provide assurance that, under non-accident conditions, normally operating safety related motors will not be damaged in the event of sustained degraded bus voltage during the time delay before initiation of the loss of voltage trip function.

According to 10 CFR 50.92, "Issuance of amendment," paragraph (c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or

(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) Involve a significant reduction in a margin of safety.

EGC has evaluated the proposed change for LSCS, using the criteria in 10 CFR 50.92, and has determined that the proposed change does not involve a significant hazards consideration. The following information is provided to support a finding of no significant hazards consideration.

Criteria

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

   Response: No.

   The proposed change to the 4.16 kV ESF bus loss of voltage allowable values allow the protection scheme to function as originally designed. (This change will involve alteration of nominal trip setpoints in the field and will also be reflected in revisions to the calibration procedures.) The proposed change does not affect the probability or consequences of any accident. Analysis was conducted and demonstrates that the proposed allowable values will allow the normally operating safety-related motors to continue to operate without sustaining damage or tripping during the worst-case, non-accident degraded voltage condition for the maximum possible time-delay of 5.7 minutes. Thus, these safety-related loads will be available to perform their safety function if a loss-of-coolant accident (LOCA) concurrent with a loss-of-offsite power (LOOP) occurs following the degraded voltage condition.

   The proposed changes do not adversely affect accident initiators or precursors, and do not alter the design assumptions, conditions, or configuration or the plant or the manner in which the plant is operated or maintained. The proposed allowable values ensure that the 4.16 kV distribution system remains connected to the offsite power system when adequate offsite voltage is available and motor starting transients are considered. The diesel start due to a LOCA signal is not adversely affected by this change. During an actual loss of voltage condition, the loss of voltage time delay will continue to isolate the 4.16 kV distribution system from offsite power before the diesel is ready to assume the emergency loads, which is the limiting time basis for mitigating system responses to the accident. For this reason, the existing loss of power / LOCA analysis continues to be valid.

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 accident previously evaluated?

Response: No.

The proposed change involves the revision of 4.16 kV ESF bus loss of voltage allowable values to satisfy existing design requirements. The proposed change does not introduce any changes or mechanisms that create the possibility of a new or different kind of accident. The proposed change does not install any new or different type of equipment, and installed equipment is not being operated in a new or different manner. No new effects on existing equipment are created nor are any new malfunctions introduced.

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

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

Response: No.

The proposed protection voltage allowable values are low enough to prevent inadvertent power supply transfer, but high enough to ensure that sufficient power is available to the required equipment. The diesel start due to a LOCA signal is not adversely affected by this change. During an actual loss of voltage condition, the loss of voltage time delays will continue to isolate the 4.16 kV distribution system from offsite power before the diesel is ready to assume the emergency loads.

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

Based on the above, EGC concludes that the proposed amendments do not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.3 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.

5.0 ENVIRONMENTAL CONSIDERATION

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

6.0 REFERENCES

1) NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," December 29, 1998

2) Operability Evaluation OE 10-006, Revision 3, "Non-Conservative Tech Spec Value for Loss of Voltage and Degraded Voltage," October 8, 2012

3) NRC Letter from A. M. Stone to M. J. Pacilio, "LaSalle County Station, Units 1 and 2 Component Design Bases Inspection (CDBI) 05000373/2010006(DRS); 05000374/2010006(DRS)," February 15, 2011

4) Design Analysis L-002588, Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 – Undervoltage Function," Revision 1E, September 5, 2012

ATTACHMENT 2

Markup of Technical Specifications Page

LASALLE COUNTY STATION
UNITS 1 AND 2

Docket Nos. 50-373 and 50-374

Facility Operating License Nos. NPF-11 and NPF-18

REVISED TS PAGE

3.3.8.1-3

Table 3.3.8.1-1 (page 1 of 1)
Loss of Power Instrumentation

FUNCTION	REQUIRED CHANNELS PER DIVISION	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Divisions 1, 2 and Opposite Unit Division 2 – 4.16 kV Emergency Bus Undervoltage		≥ 2870 V and ≤ 3127 V	
a. Loss of Voltage – 4.16 kV Basis	2	SR 3.3.8.1.3 SR 3.3.8.1.4 SR 3.3.8.1.5	~~≥ 2422 V and ≤ 3091 V~~
b. Loss of Voltage – Time Delay	2	SR 3.3.8.1.3 SR 3.3.8.1.4 SR 3.3.8.1.5	≥ 3.1 seconds and ≤ 10.9 seconds
c. Degraded Voltage – 4.16 kV Basis	2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	≥ 3814 V and ≤ 3900 V
d. Degraded Voltage – Time Delay, No LOCA	2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	≥ 270.1 seconds and ≤ 329.9 seconds
e. Degraded Voltage – Time Delay, LOCA	2[(a)(b)]	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	≥ 9.4 seconds and ≤ 10.9 seconds
2. Division 3-4.16 kV Emergency Bus Undervoltage		≥ 2725 V and ≤ 3172 V	
a. Loss of Voltage – 4.16 kV Basis	2	SR 3.3.8.1.3 SR 3.3.8.1.4 SR 3.3.8.1.5	~~≥ 2596 V and ≤ 3137 V~~
b. Loss of Voltage – Time Delay	2	SR 3.3.8.1.3 SR 3.3.8.1.4 SR 3.3.8.1.5	≤ 10.9 seconds
c. Degraded Voltage – 4.16 kV Basis	2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	≥ 3814 V and ≤ 3900 V
d. Degraded Voltage – Time Delay, No LOCA	2	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	≥ 270.1 seconds and ≤ 329.9 seconds
e. Degraded Voltage – Time Delay, LOCA	2[(a)(b)]	SR 3.3.8.1.1 SR 3.3.8.1.2 SR 3.3.8.1.5	≥ 9.4 seconds and ≤ 10.9 seconds

(a) In MODES 4 and 5, when associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, "ECCS–Shutdown."

(b) With no fuel in the reactor vessel, not required to be OPERABLE.

ATTACHMENT 3

Design Analysis L-002588

LASALLE COUNTY STATION
UNITS 1 AND 2

Docket Nos. 50-373 and 50-374

Facility Operating License Nos. NPF-11 and NPF-18

Design Analysis L-002588, Revision 1E, "Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 – Undervoltage Function"

ATTACHMENT 1
DESIGN ANALYSIS APPROVAL
Page 1 of 2

CALCULATION NO: L-002588	REV: 01	Page No.1 of 28

[ ] BRAIDWOOD STATION [ ] BYRON STATION [ ] DRESDEN STATION [X] LASALLE CO. STATION [ ] QUAD CITIES STATION [ ] Unit 0 [X] Unit 1 [X] Unit 2 [ ] Unit 3	DESCRIPTION CODE: (C018)	E07
	DISCIPLINE CODE: (C011)	E
	SYSTEM CODE: (C011)	AP
	ELEVATION CODE: (C016)	687, 710, 731

TITLE: Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 – Undervoltage Function

[XX] Safety Related [ ] Augmented Quality [ ] Non-Safety Related

REFERENCE NUMBERS: (C011 Panel)

Type	Number

COMPONENT EPN: (C014 Panel)

EPN	Component Type
1(2)AP037A	R19
1(2)AP037B	R19
1(2)AP040A	R19
1(2)AP040B	R19
1(2)AP041A	R19
1(2)AP041B	R19

DOCUMENT NUMBERS: (C012 Panel) (Calculation References)

Doc Type/ Sub Type	Document Number
PROC / Sta	LES-OA-101
PROC / Sta	LES-OA-201
DWGC /	See Section 5.3
CALC / ENG	See Section 5.6

REMARKS:

E-FORM

ComEd

NEP-12-02.01
Effective Date:
01/07/00

CALCULATION TITLE PAGE

CALCULATION NO: L-002588 **Page No.** 1.1

[ ] BRAIDWOOD STATION
[ ] BYRON STATION
[ ] DRESDEN STATION
[X] LASALLE CO. STATION
[ ] QUAD CITIES STATION

[ ] Unit 0 [X] Unit 1 [X] Unit 2 [ ] Unit 3

DESCRIPTION CODE: (C018)	E07
DISCIPLINE CODE: (C011)	E
SYSTEM CODE: (C011)	AP
ELEVATION CODE: (C016)	687, 710, 731

TITLE: Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 – Undervoltage Function

[XX] Safety Related [ ] Augmented Quality [ ] Non-Safety Related

REFERENCE NUMBERS: (C011 Panel)

Type	Number

COMPONENT EPN: (C014 Panel)

EPN	Component Type
1(2)AP037A	R19
1(2)AP037B	R19
1(2)AP040A	R19
1(2)AP040B	R19
1(2)AP041A	R19
1(2)AP041B	R19

DOCUMENT NUMBERS: (C012 Panel) (Calculation References)

Doc Type/ Sub Type	Document Number
PROC /Sht*	LES-OA-101
PROC /Sht*	LES-OA-201
DWGC /	See Section 5.3
CALC / ENG	See Section ~~5.4~~ 5.6 *

REMARKS:
Revision Initiated 4/7/00.

REV. No.	REVISING ORGANIZATION	APPROVED (Print & Sign)	DATE
0	Sargent & Lundy	W. A. Barasa	7-27-00

PEPP-E FORM

REVISION SUMMARY

CALCULATION NO.	L-002588		
		REV: 0	PAGE NO. 2

REVISION SUMMARY:

Revision 0:

This calculation was prepared in order to support the Improved Technical Specifications (ITS) requirements for a setpoint error analysis which evaluates drift for a 24 month refuel cycle calibration interval.

Electronic Calculation Data Files:
(Program Name, Version, File Name extension/size/date/hour/min)

MS Word, 97 SR-1, L-002588.doc/153KB/7-25-00/2:02 PM

Prepared By: M. C. Warpehoski / [signature] 7/25/00
(Print/Sign/Initial) Date

Reviewed By: E. Kaczmarski / EAK [signature] / EAK 7-26-00
(Print/Sign/Initial) Date

Type of Review: [XX] Detailed [ ] Alternate [ ] Test [ ] Repetitive Calculation

Supplemental Review Required [ ] Yes [X] No

Supervisor [signature] / 8/1/00

Do any ASSUMPTIONS / ENGINEERING JUDGMENTS required later verification? [ ] Yes [X] No

Tracked By: (AT#, etc.) N/A

PEPP-E FORM

ATTACHMENT 1
DESIGN ANALYSIS APPROVAL
Page 2 of 2

DESIGN ANALYSIS NO. L-002588 **REV:** 01 **PAGE NO.** 2 of 28

Revision Summary:

Revised Calculation Sections 2.7 to address negligible uncertainties due to seismic effects. The Calculation was transferred to new forms in accordance with the requirements of CC-AA-309 and NES-G-14.

Electronic Calculation Data Files: Attachments were not revised. Also incorporated Editorial Comments. Pen Revised to 1.1
(Program Name, Version, File Name extension/size/date/hour/min)

Design impact review completed? [X] Yes [ ] No

Significant design impact from results? [ ] Yes [X] No (If yes, attach impact review sheet.)

Prepared by: E. ZACHARIAS / Elizabeth Zacharias / 9/15/00
Print Sign Date

Reviewed by: W. KIRCHHOFF / [signature] / 9/29/00
Print Sign Date

Method of Review: [X] Detailed [ ] Alternate [ ] Test

This Design Analysis supersedes:

Supplemental Review Required? [ ] Yes [X] No

[ ] Additional Review [ ] Special Review Team

Additional Reviewer or Special Review Team Leader: _____ / _____ / _____
Print Sign Date

Special Review Team: (N/A for Additional Review)

Reviewers: 1) _____ / _____ / _____ 2) _____ / _____ / _____
Print Sign Date Print Sign Date

3) _____ / _____ / _____ 4) _____ / _____ / _____
Print Sign Date Print Sign Date

Supplemental Review Results:

Approved by: Mark Mursky / [signature] / 10/3/00
Print Sign Date

External Design Analysis Review (Attachment 3 Attached)

Reviewed by: _____ / _____ / _____ **Approved by:** _____ / _____ / _____
Print Sign Date Print Sign Date

Do any ASSUMPTIONS / ENGINEERING JUDGEMENTS require later verification? [ ] Yes [X] No

(Tracked By: ATI, etc.) _____

E-FORM

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E-FORM

1. PURPOSE/OBJECTIVE

The purpose of this calculation is to evaluate relay setpoint errors associated with an extended 24 month calibration interval, to ensure adequate margin between the Analytical Limit (AL) and the setpoint. The analytical limits are based on LaSalle NDIT LS-1202 (Ref. 5.5.2).

In addition, a calculation is performed to determine an allowable value. It should be noted that an expanded tolerance calculation is NOT performed. No expanded tolerance evaluation is performed because the calibration of the device is a check to ensure the relay will actuate when voltage is removed.

This calculation is applicable for both normal and accident operating conditions.

This calculation is applicable for the following undervoltage relays that perform the Loss of Voltage identification function and initiate load shedding at Emergency Safe Shutdown (ESS) buses 141Y, 142Y, 241Y, 242Y, 143, and 243:

Relay	Bus	Relay Type
1(2)AP037A & B	141Y(241Y)	Inverse Time UV Relay
1(2)AP040A & B	142Y(242Y)	Inverse Time UV Relay
1(2)AP041A & B	143(243)	Undervoltage Relay

Based on the component classification for the subject equipment (Ref. 5.5.1), this calculation is classified as safety-related.

For analysis of the time delay functions of these relays, refer to LaSalle calculation L-002589.

2. METHODOLOGY AND ACCEPTANCE CRITERIA

2.1 Basic Methodology

This calculation is performed in accordance with NES-EIC-20.04 (Ref. 5.1.2) and the main body of Reference 5.1.3 with the clarifications and additions identified below. Appendix 1 of Reference 5.1.3 does not apply to this calculation because the Appendix is a documentation of guidelines for the ComEd calculations prepared under a different scope of work.

2.2 Classification Level

A Level 1 evaluation is performed which provides the highest level of confidence as defined in Appendix D of NES-EIC-20.04 (Ref. 5.1.2). As a Level 1 evaluation, the random errors (σ) are converted to a 2σ value and added to the non-random errors (Σe). Thus, the total error (Z) is

$$Z = 2\sigma + \Sigma e$$

2.3 Vendor Specifications

Published instrument vendor specifications are considered to be based on sufficiently large samples so that the probability and confidence level meets the 2σ criteria, unless stated otherwise by the vendor.

2.4 Negligible Uncertainties

Per Appendix I of NES-EIC-20.04 (Ref. 5.1.2), the effects of radiation (eR), humidity (eH), power supply (eV), calibration standard equipment (STD), and seismic (eS) under normal operating conditions may typically be considered negligible. For the evaluation of normal operating conditions, these errors are considered negligible unless otherwise noted.

2.5 Other Environmental Effects

For environmental effects not considered negligible (Section 2.4), if the vendor does not provide a separate specification but the environmental limits are bounded by the vendor operating limits, then the effect is considered included in the reference accuracy.

2.6 Drift Specifications

The calculated drift specification (Drift Tolerance Interval - DTIc) based on As-Left / As-Found data is used in place of the specifications for reference accuracy (RA), calibration error (CAL), setting tolerance (ST) and drift (DR).

2.7 Seismic

Based on NES-EIC-20.04, Appendix I, Section 3.1, the combined seismic and environmental errors for all the instrument types during normal operation are assumed accounted for in the published reference accuracy for the device unless specifically stated by the vendor. The under voltage relays are all installed in a mild environment. Therefore, the only accident of consequence is a design basis earthquake. These relays are installed in Class 1E switchgear (1,2AP04E, 1,2AP06E, and 1,2AP07E) and are seismically qualified (EWCS D030 panel component data). The vendor specifications do not provide separate error effects for a seismic event, therefore, the error due to seismic effects is considered encompassed and included in the published reference accuracy (References 5.7.1 and 5.7.2).

2.8 Calculated Setpoint

A calculated setpoint will be determined utilizing the following equations from Appendix C of Reference 5.1.2 where applicable:

$SPc \geq AL + Z^{+} + MAR$ [lower limit]

$SPc \leq AL - |Z^{-}| - MAR$ [upper limit]

where, SPc: is the calculated setpoint
AL: is the Analytical Limit
Z^{+}, Z^{-}: is the total error (positive, negative) for the device including all estimated effects
MAR: is a selected margin used to provide additional conservatism

Note: The names of the terms in the generic equations shown above may be modified in accordance with specific loop designations.

The errors (Z) included in the determination of the calculated setpoint are all applicable instrument errors and environmental effects

The calculated setpoint is determined using DTIc(See Section 2.6).

2.9 Allowable Value

An allowable value will be determined utilizing the following equations from Appendix C of 5.1.2 as applicable:

$AV \geq SPc - |Zav^{+}|$ [lower limit]

$AV \leq SPc + |Zav^{-}|$ [upper limit]

where, AV: is the allowable value
SPc: is the calculated setpoint
Zav^{+}, Zav^{-}: is the total error (positive, negative) applicable during calibration

Note: The names of the terms in the generic equations shown above may be modified in accordance with specific loop designations.

The errors that are included for the determination of the allowable values (Zav) are only those applicable during calibration. Thus, only reference accuracy (RA), calibration errors (CAL), setting tolerance (ST), drift (DR) and if applicable, the input error (σin) are included. If DTIc is available, RA, CAL, ST and DR errors are replaced by the calculated drift (DTIc).

2.10 Acceptance Criteria

The acceptance criteria for this calculation is that the field calibration setpoints (SPf) associated with the subject instrument loops are set such that the UV analytical limits are not exceeded.

There are no acceptance criteria for the allowable value determination. The allowable value is calculated in accordance with the methodology and the results are provided for use.

2.11 Minimum / Maximum Calculated Values

The minimum/maximum operating voltage taking into account the field setpoint and the total negative/positive error will be calculated. These calculations are for information only. These values will be calculated as follows:

$MaxVal = SPf + |Z^{-}|$ Upper Limit
$MinVal = SPf - |Z^{+}|$ Lower Limit

3. ASSUMPTIONS

3.1 It is assumed that the burden on the PT is within the standard test burden of the PT. Per engineering judgement documented in LaSalle calculation 4266/19AN71 (Ref 5.6.4), the expected variation in burden connected to the PT over time will be less than half of the rated burden, and the expected error associated with the PT was determined to be ±0.175%. Therefore, use of the standard published error of ±0.3% for the PT is conservative. This assumption does not require verification.

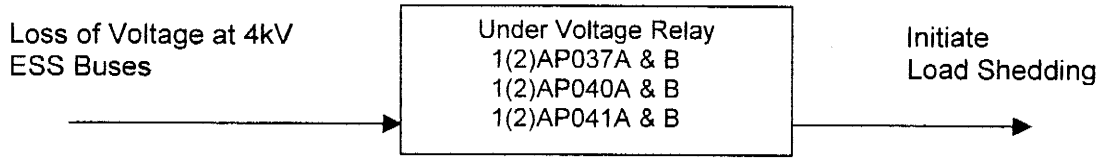
3.2 To determine the temperature error associated with the Division 1 & 2 undervoltage relays, it is assumed that the relays are calibrated at the minimum and maximum normal ambient temperatures for the zone they are located in. This assumption is conservative and does not require verification.

3.3 To determine the control voltage error associated with the Division 1 & 2 undervoltage relays, it is assumed that the relays are calibrated at the minimum and maximum control voltage variation specified for the relay by the vendor. This assumption is conservative and does not require verification.

4 DESIGN INPUT

4.1 Instrument Channel Configuration

Per Reference 5.3.1, the under voltage relay is used to detect a loss of voltage at the 4kV ESS buses (141Y, 142Y, 143, 241Y, 242Y, and 243). Hence, the under voltage relay is considered the first and only module in the loop making this a single module bistable loop.



4.2 Loop Element Data

Unit 1 & 2, Division 1 & 2	**Inverse Time Under Voltage Relay**	
EPN	1(2)AP037A & B 1(2)AP040A & B	[Ref. 5.5.1]
Manufacturer	ABB	[Ref. 5.6.1]
Model No.	ITE-27 (211R1175)	[Ref. 5.6.1]
Voltage Tap Range	60 – 110V	[Ref. 5.7.1]
Available Voltage Taps	60, 70, 80, 80, 100, 110V	[Ref. 5.7.1]
Differential Between Operate and Reset Voltage	≤ 0.5%	[Ref. 5.7.1]
Setting Tolerance – Operating Voltage	± 5% (Based on printed dial markings)	[Ref. 5.7.1]
Setting Tolerance – Operating Time	± 10% (Based on printed dial markings)	[Ref. 5.7.1]
Control Voltage Allowable Variation (125V Nominal)	100-140V	[Ref. 5.7.1]
Repeatability – Control Voltage Affects	0.2V for a 10V variation in control voltage	[Ref. 5.7.1]
Repeatability – Temperature Affects	0.5V over temperature range of 20-40°C (68°F - 104°F)	[Ref. 5.7.1]

Unit 1 & 2, Division 3	**Under Voltage Relay**	
EPN	1(2)AP041A & B	[Ref. 5.5.1]
Manufacturer	General Electric	[Ref. 5.6.2]
Model No.	NGV-13A	[Ref. 5.6.2]
Dropout Voltage Adjustment Range	70 – 100V	[Ref. 5.7.2]
Pick-up Voltage	≤ 110% of dropout voltage	[Ref. 5.7.2]

Unit 1 & 2, Division 1 & 2	**Potential Transformer**
EPN	Not assigned EPNs
Manufacturer/Model No.	(See engineering judgement below)
Voltage Ratio	4200-120 [Ref. 5.6.4]
Accuracy Class	0.3 W,X,Y; 1.2 Z. [Ref. 5.6.4] (See engineering judgement below)
Frequency	60 Hz [Ref. 5.6.4]

Engineering Judgement (Taken from Reference 5.6.4 and restated here for clarification)

The 4200/120 V PT at 4 kV SWGR 141X for Unit 1 is a Westinghouse PC-60, 4200-120 V Style No. 2780A99G02, 0.3 W, X, Y; 1.2 Z Accuracy Class. Because all 4 kV SWGR at LaSalle Station were purchased from the same manufacturer using one specification, it is expected that the 4200-120 V PTs at Unit 1 4kV SWGR 141Y and 142Y and Unit 2 4kV SWGR 241Y and 242Y have an accuracy class equal to or better than that of the 4kV PTs at SWGR 141X.

Unit 1 & 2, Division 3	**Potential Transformer**
EPN	Not assigned EPNs
Manufacturer	GE [Ref. 5.6.4]
Model No.	Type JVM-3; Model 763X21G18 [Ref. 5.6.4]
Voltage Ratio	4200-120 [Ref. 5.6.4]
Accuracy Class	0.3 W,X,M,Y ; 1.2 Z [Ref. 5.6.4]
Frequency	60 Hz [Ref. 5.6.4]

4.3 Local Service Environments

Per References 5.3.1, 5.3.3 and 5.5.1, the Loss of Voltage Relays 1AP037A & B, 1AP040A & B, 2AP037A & B, and 2AP040A & B are located at Buses 141Y, 142Y, 241Y, and 242Y, respectively. Also per References 5.3.1, 5.3.3 and 5.5.1, the Loss of Voltage Relays for Buses 143 and 243 are located at their respective SWGR. Both normal and accident operating conditions are evaluated.

The conditions that are evaluated are summarized below based on References 5.4.1,2,3, and 4 for normal and worst case environmental conditions.

Panel	Bus 143 / 243	Bus 141Y / 142Y	Bus 241Y / 242Y
Location (Row-Column)	L-10 / L-20	N-10	N-20
Elevation	687'	710' / 731'	710' / 731'
EQ Zone	Zone C3	Zone C2	
Operating Conditions			
Ambient Temperature Range	80-119°F (40-119°F during maintenance or plant shutdown)	70-104°F	
Ambient Pressure	+0.5" W.G.	+0.125" W.G.	
Humidity	21 to 38% RH (10 to 90% during maintenance or plant shutdown)	36 to 57% RH	
Radiation	1.0E03 RADS gamma (integrated)		

4.4 Calibration Procedure Data

Per the most recent Relay Setting Order [Ref. 5.8.1], the present settings for the Division 1 & 2 Loss of Voltage relays are provided below. The ratio for the P.T. supplying these relays is 35:1.

Relay Tap	70V	[Ref 5.8.1]
Relay Setting	75V min pickup (2625V on primary)	[Ref 5.8.1]
Surveillance Interval	24 months	[Ref 5.1.3]
Late Factor (LF)	25%	[Ref 5.1.3]

Per the most recent Relay Setting Order [Ref. 5.8.1], the present settings for the Division 3 Loss of Voltage relays are provided below. The ratio for the P.T. supplying these relays is 35:1.

Relay Setting	82V Dropout (2870V on primary)	[Ref 5.8.1]
Surveillance Interval	24 months	[Ref 5.1.3]
Late Factor (LF)	25%	[Ref 5.1.3]

4.5 Analytical Limit (AL)

Per Reference 5.5.2, the Division 1 and 2 Loss of Voltage relay Analytical Limit (AL) is 2363 V ≤ AL ≤ 3150 V at the bus. Also, per reference 5.5.2, the Division 3 Loss of Voltage relay Analytical Limit (AL) is 2583 V ≤ AL ≤ 3150 V at the bus. These voltages are transformed to a control voltage through a PT with a turns ration of 35:1 (Ref. 5.8.1).

Control Voltage = Bus Voltage / 35

Thus, the transformed control voltage AL bands are as shown below:

Control Voltage AL	Division
67.52 V ≤ AL ≤ 90.00 V	1 & 2
73.80 V ≤ AL ≤ 90.00 V	3

4.6 Calculated Drift Specifications

Per Calculation L-002470 (Ref. 5.6.1), the 2σ drift for 24 months surveillance interval (30 months with late factor) for the BBC/ABB ITE-27 4.16kV Bus Undervoltage Relays is a random ± 1.389 V with a bias of +0.460 / -0.791 Vac.

Per Calculation L-002472 (Ref. 5.6.2), the 2σ drift for 24 months surveillance interval (30 months with late factor) for the GE model NGV-13A Undervoltage Relays is a random ± 3.608 V with a bias of +0 / -0.190 Vac.

The bias drift is the drift determined by subtracting the as-left value from the as-found value per Section 2.2.2 of calculations L-002470 and L-002472 [Ref. 5.6.1 and 5.6.2]. Therefore, a positive drift implies that the actual trip value (as-found) is higher than the previously indicated trip value (as-left). This would reflect a negative bias instrument error effect, since bias is defined as indicated value minus actual value. Conversely, a negative bias drift implies a positive bias instrument error effect. Therefore, the bias drift effect is re-stated for use in this calculation as follows:

Division 1&2 Undervoltage drift bias = +0.791 Vac / -0.460 Vac
Division 3 Undervoltage drift bias = +0.190 Vac / -0.000 Vac

REFERENCES

5.1 METHODOLOGY

5.1.1 ANSI/ISA-S67.04-1994, "Setpoints for Nuclear Safety Related Instrumentation."

5.1.2 NES-EIC-20.04, Rev.2, "Analysis of Instrument Channel Setpoint Error and Instrument Loop Accuracy."

5.1.3 "Improved Technical Specifications (ITS) and 24-Month Technical Specifications Project Technical Plan.", Revision 2 dated 04/28/2000.

5.2 PROCEDURES

5.2.1 NEP 12-02, Rev. 9, "Preparation, Review, and Approval of Calculations."

5.2.2 LES-OA-101, Revision 2, "Unit 1, Emergency Bus "Loss of Voltage" Relay Calibrations by OAD"

5.2.3 LES-OA-201, Revision 0, "Unit 2, Emergency Bus "Loss of Voltage" Relay Calibrations by OAD"

5.3 DRAWINGS

5.3.1 LaSalle Schematic Drawings

1E-1-4005AM, Rev. L, "4160V Switchgear 141Y Auxiliary Compartment System "AP" Part 12"

1E-1-4005AT, Rev. N, "4160V Switchgear 142Y Auxiliary Compartment System "AP" Part 18"

1E-1-4223AC, Rev. S, "4160V Switchgear 143 Auxiliary Compartment System "HP" (E22B) Part 3"

1E-2-4005AM, Rev. K, "4160V SWGR 241Y Auxiliary Compt. System AP Pt. 12"

1E-2-4005AT, Rev. K, "4160V SWGR 242Y Auxiliary Compt. System AP Pt. 18"

1E-2-4223AC, Rev. Q, "4160V Switchgear 243 Auxiliary Compartment System "HP" (E22B) Part 3"

5.3.2 LaSalle Single Line Drawings

1E-1-4000B, Rev. N, "Part 2 Standby Generators and 4160V Buses"

1E-2-4000B, Rev. L, "Stand-by Generators & 4160V Buses Part 2"

5.3.3 LaSalle Relaying and Metering Diagram

1E-1-4000PG, Rev. N, "4160V Switchgear 141Y"

1E-1-4000PJ, Rev. L, "4160V Switchgear 142Y"

1E-1-4000PK, Rev. N, "4160V Switchgear 143"

1E-2-4000PG, Rev. L, "4160V Switchgear 241Y"

1E-2-4000PJ, Rev. K, "4160V Switchgear 242Y"

1E-2-4000PK, Rev. K, "4160V Switchgear 243"

5.4 ENVIRONMENTAL PARAMETERS

5.4.1 LaSalle UFSAR, Revision 13, Section 3.11, "Environmental Design of Mechanical and Electrical Equipment"

5.4.2 LaSalle UFSAR, Revision 13, Table 3.11-26, "Controlled Environment Zone C2 – Conditions Inside the Essential Switchgear Rooms"

5.4.3 LaSalle UFSAR, Revision 13, Table 3.11-27, "Controlled Environment Zone C3 – Conditions Inside the Diesel Generator Rooms, RHR Service Water Pump Rooms and HPCS DG Cooling Water Pump Rooms"

5.4.4 LaSalle UFSAR, Revision 13, Figure 3.11-5, Sheets 1 through 5.

5.5 OTHER STATION DOCUMENTS

5.5.1 ComEd EWCS Records

1AP037A	[002]	2AP037A	[002]
1AP037B	[002]	2AP037B	[002]
1AP040A	[002]	2AP040A	[002]
1AP040B	[002]	2AP040B	[002]
1AP041A	[002]	2AP041A	[002]
1AP041B	[002]	2AP041B	[002]
1AP04E	[002]	2AP04E	[003]
1AP06E	[002]	2AP06E	[002]
1AP07E	[002]	2AP07E	[002]

Note: The number in the brackets that follows the Equipment Part Number (EPN) is the EWCS record revision.

5.5.2 LaSalle NDIT LS-1202 – Transmittal of Improved Technical Specification (ITS) Analytical Limits. (Attachment D).

5.5.3 LaSalle UFSAR, Revision 13, Section 8.2.3.3, "Undervoltage Relays"

5.5.4 Telecon between M.C. Warpehoski of Sargent & Lundy and L. Cabrera of ComEd dated 7/25/00 verifying the relay setting orders for the loss of voltage relays (Attachment E).

5.6 CALCULATIONS

5.6.1 L-002470, Revision 0; "Instrument Drift Analysis for BBC/ABB Model ITE-27 4.16kV Bus Undervoltage Time Delay Relays – Undervoltage Function"

5.6.2 L-002472, Revision 0, "Instrument Drift Analysis for General Electric Model NGV-13A Undervoltage Relays"

5.6.3 4266-EAD6, Revision 3; "Voltage Relay Settings for 4160V and 480V ESF Buses"

5.6.4 4266/19AN71, Revision 1; "Second Level Undervoltage Relay Setpoint"

5.7 VENDOR DOCUMENTS

5.7.1 ABB Instructions, IB 18.4.7-2 Issue E, Single Phase Voltage Relays, Types 27, 27D, 27H, 59D, and 59H (Attachment A).

5.7.2 General Electric Instructions, GEI-90805J, for Voltage Relay Types NGV-11A & B, 12A,B, & C, and 13A & B, Forms 21 and Up. (Attachment B).

5.8 MISCELLANEOUS REFERENCES

5.8.1 Present Relay Setting Orders for relays 1(2)AP037A & B, 1(2)AP040A & B, and 1(2)AP041A & B. (Attachment C).

6 CALCULATIONS

6.1 Process / Input Error Evaluation

The potential transformer (PT) has a standard published error of ± 0.3% [Ref. 5.6.4].

Per assumption 3.1, the burden on the PT is within the standard test burden of the PT. Therefore, the maximum error of ±0.3% will be considered in this calculation.

Therefore,

$e1p = 120V * 0.003$
$e1p_{DIV1\&2} = \pm 0.36V$
$e1p_{DIV3} = \pm 0.36V$

6.2 Loss of Voltage Relay (Module 1) Errors

6.2.1 Module 1 – Random Errors

6.2.1.1 Standard Specifications (RA, CAL, ST, DR)

The Loss of Voltage relay's standard specifications of reference accuracy (RA), calibration errors (CAL), setting tolerances (ST), and drift (DR) are considered included in the calculated drift (DTIc) per Section 2.6. Thus, these errors are not included in the errors evaluated by this calculation.

6.2.1.2 As-Left / As-Found Drift Data (DTI1c)

Per Section 4.6, the 2σ calculated drift for Division 1 & 2 is ± 1.389 V. Thus,

$DTI1c_{DIV1\&2} = \pm 1.389 V / 2$

$DTI1c_{DIV1\&2} = \pm 0.695 V$ [1σ]

Per Section 4.6, the 2σ calculated drift for Division 3 is ± 3.608 V. Thus,

$DTI1c_{DIV3} = \pm 3.608 V / 2$

$DTI1c_{DIV3} = \pm 1.804 V$ [1σ]

6.2.1.3 Random Input Errors (σ1in)

There are no random input errors for this instrument (Ref. 5.1.2). Thus,

$\sigma 1in_{DIV1\&2} = 0$ V
$\sigma 1in_{DIV3} = 0$ V

6.2.1.4 Total Random Errors (σ1)

Per Section 2.8, all potential errors are used in calculating the setpoint. Per Section 6.2.1.2, the calculated drift DTI1c is used in place of RA, CAL, ST, and DR. Therefore, the total random errors for the calculation of the setpoint are:

$\sigma 1 = \pm [DTI1c^2 + \sigma 1in^2]^{1/2}$

$\sigma 1_{DIV1\&2} = \pm [(0.695 \text{ V})^2 + (0 \text{ V})^2]^{1/2}$
$\sigma 1_{DIV1\&2} = \pm 0.695$ V [1σ]

$\sigma 1_{DIV3} = \pm [(1.804 \text{ V})^2 + (0 \text{ V})^2]^{1/2}$
$\sigma 1_{DIV3} = \pm 1.804$ V [1σ]

Per Section 2.9, DTI1c is used for the allowable value random errors for single module loops. Thus,

$\sigma 1av = DTI1c$

$\sigma 1av_{DIV1\&2} = \pm 0.695$ V [1σ]

$\sigma 1av_{DIV3} = \pm 1.804$ V [1σ]

6.2.2 Module 1 – Non-Random Errors

6.2.2.1 Temperature Effects (e1T)

For the Division 1 & 2 relays, the temperature error associated with the undervoltage function as taken from Section 4.2 is 0.5 V over a temperature range of 20°C to 40°C (68°F to 104°F). Per section 4.3, the local environment in which the relays are located has an ambient temperature range of 70°F to 104°F. Therefore, assuming that the relays are calibrated at their maximum or minimum ambient temperature (Assumption 3.2), the published error of ± 0.5V will be used.

$e1T_{DIV1\&2} = \pm 0.5$ V

For the Division 3 relays, there is no specific temperature errors or operating temperature range described in the vendor's specification for the undervoltage relay. From Section 4.3, these relays are installed in a controlled environment with an ambient temperature of 80°F to 119°F under normal operating conditions. Per Appendix I of Ref 5.1.2, environmental errors such as those associated with Temperature Effects are assumed to be accounted for in the published reference accuracy of the device. Additionally, as these type relays are typically installed in a controlled environment and expected to perform their function under normal operating conditions, the effect of temperature related errors is considered negligible. Therefore, temperature related error associated with the Division 3 relays is considered to be included in the reference accuracy specification.

$e1T_{DIV3} = 0$ V

6.2.2.2 Ambient Pressure Effects (e1P)

The voltage relay is an electrical device and as such is not affected by ambient pressure changes (Ref. 5.1.2). Therefore,

$e1P_{DIV1\&2} = 0$ V
$e1P_{DIV3} = 0$ V

6.2.2.3 Humidity Effects (e1H)

Appendix I of NES-EIC-20.04 (Ref. 5.1.2) recommends consideration of humidity effects in a condensing environment. Therefore, since the environment is non-condensing in this situation, humidity effects are considered negligible unless specifications by the vendor indicate otherwise.

There is no humidity errors described in the vendor's specification for the devices. As discussed above, the humidity effects are considered to be negligible. Therefore,

$e1H_{DIV1\&2} = 0$ V
$e1H_{DIV3} = 0$ V

6.2.2.4 Power Supply Effects (e1V)

For the Division 1 & 2 undervoltage relays, the variation in operating voltage for a 10V variation in control voltage is 0.2V (typical) per Section 4.2. Also per section 4.2, the control voltage is 125Vdc nominal with an allowable variation of 100V to 140V. As documented in LaSalle calculation 4266/19AN71 (Ref 5.6.4), there is a maximum dc system voltage of 135.1 Vdc during the battery equalization period and the minimum calculated voltage at the relays will be greater than 100V when using a minimum voltage of 105V at the battery. Therefore, the voltage at the relays will be within the upper and lower limits of the range identified above. Therefore, assuming that the relays are calibrated at their maximum or minimum allowable control voltage (Assumption 3.3), the relay control voltage effect is as follows:

$e1V_{DIV1\&2} = \pm [0.2V * (140V - 100V)]$
$e1V_{DIV1\&2} = \pm 0.8V$

There are no power supply errors specified in the vendor specification for the Division 3 undervoltage relays. Per Section 2.4, these errors are considered negligible with respect to other errors terms. Therefore,

$e1V_{DIV3} = 0\ V$

6.2.2.5 Radiation Effects (e1R)

There are no radiation effects described in the vendor's specifications for the undervoltage relays. Per Section 2.4, radiation effects are considered included in the reference accuracy or capable of being calibrated out for normal conditions. Per Section 4.3, the total integrated dose the undervoltage relays will be exposed to is the same for accident and normal operating conditions. Thus, per Section 2.4, radiation effects for normal and accident conditions are considered to be negligible. Thus,

$e1R_{DIV1\&2} = 0\ V$
$e1R_{DIV3} = 0\ V$

6.2.2.6 Seismic Effects (e1S)

Per Section 2.7, seismic effects are not included in this calculation. Thus,

$e1S_{DIV1\&2} = 0\ V$
$e1S_{DIV3} = 0\ V$

6.2.2.7 Insulation Resistance Effects (e1IR)

Per Section 4.1, this is a single module bistable loop and IR leakage errors are not applicable. Therefore,

$e1IR_{DIV1\&2} = 0\ V$
$e1IR_{DIV3} = 0\ V$

6.2.2.8 Process Error Effects (e1p)

Per Section 6.1, the process error effects are:

$e1p_{DIV1\&2} = \pm 0.36\ V$
$e1p_{DIV3} = \pm 0.36\ V$

6.2.2.9 As-Found / As-Left Drift Bias Effects (e1DTIc)

Per Section 4.6, the bias drift effect is:

$e1DTIc_{DIV1\&2} = +0.791\ V \ / \ -0.460\ V$
$e1DTIc_{DIV3} = +0.190\ V \ / \ -0.000\ V$

6.2.2.10 Non-Random Input Errors (e1in)

There are no input errors associated with the voltage relays. Thus,

$e1in_{DIV1\&2} = 0\ V$
$e1in_{DIV3} = 0\ V$

6.2.2.11 Total Non-Random Errors (Σe1)

In accordance with Section 2.8, the total positive and negative bias non-random errors for determining the calculated setpoint are

$$\Sigma e1^{+} = e1T + e1P + e1H + e1V + e1R + e1S + e1IR + e1p^{+} + e1DTIc^{+} + e1in$$

$\Sigma e1_{DIV1\&2}^{+} = +(0.5V + 0V + 0V + 0.8V + 0V + 0V + 0V + 0.36V + 0.791V + 0V)$
$\Sigma e1_{DIV1\&2}^{+} = +2.451\ V$

$\Sigma e1_{DIV3}^{+} = +(0V + 0V + 0V + 0V + 0V + 0V + 0V + 0.36V + 0.190V + 0V)$
$\Sigma e1_{DIV3}^{+} = +0.550\ V$

$\Sigma e1^{-} = e1T + e1P + e1H + e1V + e1R + e1S + e1IR + e1p^{-} + e1DTIc^{-} + e1in$

$\Sigma e1_{DIV1\&2}^{-} = -(0.5V + 0V + 0V + 0.8V + 0V + 0V + 0V + 0.36V + 0.460V + 0V)$
$\Sigma e1_{DIV1\&2}^{-} = -2.12\ V$

$\Sigma e1_{DIV3}^{-} = -(0V + 0V + 0V + 0V + 0V + 0V + 0V + 0.36V + 0V + 0V)$
$\Sigma e1_{DIV3}^{-} = -0.36\ V$

In accordance with Section 2.9, only the drift bias effect is included as a non-random error applicable for the determination of the allowable value. Thus,

$\Sigma e1av = e1DTIc$

$\Sigma e1av_{DIV1\&2} = +0.791\ V \quad / \quad -0.460\ V$
$\Sigma e1av_{DIV3} = +0.190\ V \quad / \quad -0.000\ V$

6.3 Total Errors

In accordance with Section 2.2, the total errors for determining the calculated setpoint are:

$Z^+ = 2*\sigma 1 + \Sigma e1^+$

$Z_{DIV1\&2}^+ = 2 * 0.695\ V + 2.451\ V$
$Z_{DIV1\&2}^+ = +3.841\ V$

$Z_{DIV3}^+ = 2 * 1.804\ V + 0.550\ V$
$Z_{DIV3}^+ = +4.158\ V$

$Z^- = 2*\sigma 1 + \Sigma e1^-$

$Z_{DIV1\&2}^- = 2 * (-0.695\ V) + (-2.12\ V)$
$Z_{DIV1\&2}^- = -3.51\ V$

$Z_{DIV3}^- = 2 * (-1.804\ V) + (-0.36\ V)$
$Z_{DIV3}^- = -3.968\ V$

In accordance with Section 2.9, the total errors for determining the Allowable Value are

$Zav^+ = 2*\sigma 1av + \Sigma e1av^+$

$Zav_{DIV1\&2}^+ = 2 * 0.695\ V + 0.791\ V$
$Zav_{DIV1\&2}^+ = +2.181\ V$

$Zav_{DIV3}^+ = 2 * 1.804\ V + 0.190\ V$
$Zav_{DIV3}^+ = +3.798\ V$

$Zav^- = 2*\sigma 1av + \Sigma e1av^-$

$Zav_{DIV1\&2}^- = 2 * (-0.695\ V) + (-0.460\ V)$
$Zav_{DIV1\&2}^- = -1.85\ V$

$Zav_{DIV3}^- = 2 * (-1.804\ V) + (-0.000\ V)$
$Zav_{DIV3}^- = -3.608\ V$

6.4 Calculated Setpoint

The values calculated for the parameters associated with the calculated setpoint are

$AL_{DIV1\&2} \leq 90.00\ V$ $AL_{DIV1\&2} \geq 67.52\ V$ [Section 4.5]

E-FORM

AL_{DIV3} $\leq$ 90.00 V AL_{DIV3} $\geq$ 73.80 V [Section 4.5]

$Z_{DIV1\&2}$ = +3.841 V / -3.51 V [Section 6.3]
Z_{DIV3} = +4.158 V / -3.968 V [Section 6.3]

Per References 5.6.1 and 5.6.2, the DTI1c is calculated based on a sufficiently large historical data, and per Reference 5.1.2, additional margin may be omitted in calculating the setpoint. Thus,

MAR = 0 V

Therefore, in accordance with Section 2.8, the calculated setpoints for upper and lower limits are:

$SPc(UL) \leq AL(UL) - |Z^-| - MAR$ [upper limit]

$SPc(UL)_{DIV1\&2} \leq 90.00\ V - 3.51\ V - 0\ V$
$SPc(UL)_{DIV1\&2} \leq 86.49\ V$

$SPc(UL)_{DIV3} \leq 90.00\ V - 3.968\ V - 0\ V$
$SPc(UL)_{DIV3} \leq 86.032\ V \approx 86.03\ V$

$SPc(LL) \geq AL(LL) + Z^+ + MAR$ [lower limit]

$SPc(LL)_{DIV1\&2} \geq 67.52\ V + 3.841\ V + 0\ V$
$SPc(LL)_{DIV1\&2} \geq 71.361\ V \approx 71.37\ V$

$SPc(LL)_{DIV3} \geq 73.80\ V + 4.158\ V + 0\ V$
$SPc(LL)_{DIV3} \geq 77.958\ V \approx 77.96\ V$

Division 1&2: Per Section 4.4, the field calibration setpoint (SPf) for this loop is 75 V [Ref. 5.8.1]. The field calibration setpoint value is within the calculated setpoint limits of $\geq$ 71.37 V and $\leq$ 86.49 V. Therefore, as the field calibration setpoint is bounded by the calculated setpoint limits, the field setpoint is acceptable.

Division 3: Per Section 4.4, the field calibration setpoint (SPf) for this loop is 82 V [Ref. 5.8.1]. The field calibration setpoint value is within the calculated setpoint limits of $\geq$ 77.96 V and $\leq$ 86.03 V. Therefore, as the field calibration setpoint is bounded by the calculated setpoint limits, the field setpoint is acceptable.

6.5 Allowable Value

The values calculated for the parameters associated with the allowable value are

$SPc(UL)_{DIV1\&2} \leq 86.49$ V $SPc(LL)_{DIV1\&2} \geq 71.37$ V [Section 6.4]
$Zav_{DIV1\&2} = +2.181$ V / -1.85 V [Section 6.3]

$SPc(UL)_{DIV3} \leq 86.03$ V $SPc(LL)_{DIV3} \geq 77.96$ V [Section 6.4]
$Zav_{DIV3} = +3.798$ V / -3.608 V [Section 6.3]

Therefore, in accordance with Section 2.9, the calculated allowable value is

$AV(UL) \leq SPc(UL) + |Zav^-|$ [upper limit]

$AV(UL)_{DIV1\&2} \leq 86.49 \text{ V} + 1.85 \text{ V}$
$AV(UL)_{DIV1\&2} \leq 88.34 \text{ V}$

$AV(UL)_{DIV3} \leq 86.03 \text{ V} + 3.608 \text{ V}$
$AV(UL)_{DIV3} \leq 89.638 \text{ V} \approx 89.63 \text{ V}$

$AV(LL) \geq SPc(LL) - Zav^+$ [lower limit]

$AV(LL)_{DIV1\&2} \geq 71.37 \text{ V} - 2.181 \text{ V}$
$AV(LL)_{DIV1\&2} \geq 69.189 \text{ V} \approx 69.19 \text{ V}$

$AV(LL)_{DIV3} \geq 77.96 \text{ V} - 3.798 \text{ V}$
$AV(LL)_{DIV3} \geq 74.162 \text{ V} \approx 74.17 \text{ V}$

6.6 Expanded Tolerances

Expanded Tolerances are not calculated for these Loss of Voltage relays because the calibration of these devices is to check to ensure the relay will actuate when voltage is removed.

6.7 Minimum / Maximum Calculated Values

The minimum/maximum calculated values define the minimum/maximum operating values based on the recommended field settings. These values are calculated as follows (See Section 2.11):

$$MaxVal = SPf + |Z^-|$$
$$MinVal = SPf - |Z^+|$$

$$MaxVal_{DIV1\&2} = SPf_{DIV1\&2} + |Z_{DIV1\&2}^-|$$
$$= 75V + 3.51V = 78.51V \quad \text{(2748V on primary side)}$$

$$MinVal_{DIV1\&2} = SPf_{DIV1\&2} - |Z_{DIV1\&2}^+|$$
$$= 75V - 3.841V = 71.159V \quad \text{(2490V on primary side)}$$

$$MaxVal_{DIV3} = SPf_{DIV3} + |Z_{DIV3}^-|$$
$$= 82V + 3.968V = 85.968V \quad \text{(3009V on primary side)}$$

$$MinVal_{DIV3} = SPf_{DIV3} - |Z_{DIV3}^+|$$
$$= 82V - 4.158V = 77.842V \quad \text{(2724V on primary side)}$$

7 SUMMARY AND CONCLUSIONS

The results summarized below are applicable for normal and accident operating conditions.

7.1 Calculated Values Summary

Calculated Setpoint: $71.37V \leq SPc_{DIV1\&2} \leq 86.49V$
$77.96V \leq SPc_{DIV3} \leq 86.03V$

Allowable Value: $69.19V \leq AV_{DIV1\&2} \leq 88.34V$
$74.17V \leq AV_{DIV3} \leq 89.63V$

Analytical Limit $67.52V \leq AV_{DIV1\&2} \leq 90.00V$
$73.80V \leq AV_{DIV3} \leq 90.00V$

The minimum and maximum operating voltage values based on the recommended (existing) field settings are as follows:

$Min/Max_{DIV1\&2}$ = 71.16 / 78.51 V (2490V / 2748V)

Min/Max_{DIV3} = 77.84 / 85.97 V (2724V / 3009V)

7.2 Calibration Summary

The calibration information used to support the results of this calculation is defined below.

Calibration Setpoint / Allowable Value:

EPN	Parameter	Process Units
Div 1 & 2 1AP037A & B 1AP040A & B 2AP037A & B 2AP040A & B	Field Calibration Setpoint	75 V
	Allowable Value	≥ 69.19 V and ≤ 88.34 V
	Analytical Limit	≥ 67.52 V and ≤ 90.00V
Div 3 1AP041A & B 2AP041A & B	Field Calibration Setpoint	82 V
	Allowable Value	≥ 74.17 V and ≤ 89.63 V
	Analytical Limit	≥ 73.80 V and ≤ 90.00V

Calibration Frequency, Setting Tolerances and Expanded Tolerances (Div 1,2,3):

	Surveillance Interval	Setting Tolerance	Expanded Tolerance
Channel Calibration	24 months	N/A	N/A

7.3 Acceptance Criteria

The acceptance criteria (Section 2.10) associated with the setpoints are met since the field calibration setpoint (SPf) is within the enveloping calculated setpoints (SPc) and therefore ensures that the analytical limits will not be exceeded.

There are no acceptance criteria for the allowable value determination.

8 ATTACHMENTS

Attachment A: ABB Instructions, IB 18.4.7-2 Issue E, for Single Phase Voltage Relays, Types 27, 27D, 27H, 59D, and 59H

Attachment B: GE Instruction Manual GEI-90805J, for Voltage Relay types NGV11A, B, 12A, B, C and 13A, B, Forms 21 and up.

Attachment C: Present Relay Setting Orders for Loss of Voltage Relays 1(2)AP037A&B, 1(2)AP040A7B, and 1(2)AP041A&B.

Attachment D: LaSalle NDIT LS-1202 – Transmittal of Improved Technical Specification (ITS) Analytical Limits

Attachment E: Telecon confirming RSO data – see Ref 5.5.4

Final
[Last Page]

DESIGN ANALYSIS NO.: L-002588 **PAGE NO.** 1 of 6

Major REV Number: 001 **Minor REV Number:** A

- ☐ BRAIDWOOD STATION
- ☐ BYRON STATION
- ☐ CLINTON STATION
- ☐ DRESDEN STATION
- ☒ LASALLE CO. STATION
- ☐ QUAD CITIES STATION

Unit: ☐ 0 ☒ 1 ☒ 2 ☐ 3

DESCRIPTION CODE: (C018)	E07
DISCIPLINE CODE: (C011)	E
SYSTEM CODE: (C011)	AP

TITLE: Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 – Undervoltage Function

☒ **Safety Related** ☐ **Augmented Quality** ☐ **Non-Safety Related**

ATTRIBUTES (C016)

TYPE	VALUE	TYPE	VALUE
Elevation			
Software			

COMPONENT EPN: (C014 Panel)

EPN	Type
1AP06E-2-AB	T10
1AP06E-2-BC	T10

DOCUMENT NUMBERS: (C012 Panel) (Design Analysis References)

Type/Sub	Document Number	Input (Y/N)
~~Calc/Eng~~	~~L-002588~~	~~Y~~
Calc/Eng	AN71	Y
~~DCP/MOD~~	334178	Y
/		
/		
/		
/		

REMARKS: n/a

DESIGN ANALYSIS NO. L-002588 **REV:** 001A **PAGE NO.** 2 of 6

Revision Summary: (including EC's incorporated):

This minor change was prepared to determine the adequacy of new ABB model VIY-60 potential transformers being installed in the Class 1E 4160V switchgear buses (141Y, 142Y, 241Y & 242Y) by various engineering changes. Engineering change 334178 installs these new PTs on switchgear bus 142Y. Other similar ECs will install these same PTs on remaining three switchgear buses (141Y, 241Y & 242Y).

Electronic Calculation Data Files:
(Program Name, Version, File Name extension/size/date/hour/min)

Design impact review completed? ☐ Yes ☒ N/A, Per EC#: 334178
(If yes, attach impact review sheet)

Prepared by: Glenn P. McCarthy (Print) / [signature] (Sign) / 12-18-01 (Date)

Reviewed by: Scott R. Shephard (Print) / [signature] (Sign) / 12-18-01 (Date)

Method of Review: ☒ Detailed ☐ Alternate ☐ Test

This Design Analysis supersedes: n/a **in its entirety.**

Supplemental Review Required? ☐ Yes ☒ No

☐ Additional Review ☐ Special Review Team

Additional Reviewer or Special Review Team Leader: _____ (Print) / _____ (Sign) / _____ (Date)

Special Review Team: (N/A for Additional Review)

Reviewers: 1) _____ (Print) / _____ (Sign) / _____ (Date) 2) _____ (Print) / _____ (Sign) / _____ (Date)

3) _____ (Print) / _____ (Sign) / _____ (Date) 4) _____ (Print) / _____ (Sign) / _____ (Date)

Supplemental Review Results:

Approved by: T.A. Khan (Print) / [signature] (Sign) / 12-18-01 (Date)

External Design Analysis Review (Attachment 3 Attached)

Reviewed by: E.L Seckinger (Print) / [signature] (Sign) / 12/20/01 (Date)

Approved by: Mark Murski (Print) / [signature] (Sign) / 12/20/01 (Date)

Do any ASSUMPTIONS / ENGINEERING JUDGEMENTS require later verification? ☐ Yes ☒ No
(Tracked By: AT#, etc.) n/a

CALCULATION TABLE OF CONTENTS

CALCULATION NO.: L-002588 **REV. NO.:** 001A **PG NO.** 3 of 6

1. **PURPOSE/OBJECTIVE:**

This minor revision is being prepared to determine the adequacy of new ABB model VIY-60 potential transformers being installed in the Class 1E 4160V switchgear buses (141Y, 142Y, 241Y & 242Y) by various engineering changes. Engineering change EC 334178 installs these new PTs on switchgear bus 142Y. Other similar ECs will install these same PTs on remaining three switchgear buses (141Y, 241Y & 242Y). The ratings of the new PTs will be compared to those previously evaluated in this calculation to determine if the new PT ratings are acceptable. The vendor information for the new PTs will be included as an attachment to this calculation minor revision.

2. **METHODOLOGY/ACCEPTANCE CRITERIA:**

Methodology

This EC replaces the bus 142Y, Westinghouse model PC-60, PTs with new ABB model VIY-60 PTs. The methodology used for this minor calculation revision is to compare the ratings of the new PTs with those previously analyzed and document this comparison. Any differences in ratings will be addressed.

Acceptance Criteria

The acceptance criteria for the new PTs are as follows:

The new PTs must have the same voltage ratio as the existing PTs.

The new PTs must have the same accuracy class or better for a given burden as the existing PTs.

The new PTs must be rated for the same frequency as the existing PTs.

The power rating of the new PTs must be at least as high as the existing PTs.

3. **REFERENCES:**

In addition to the references established in the current revision of this calculation, the following references apply to this pending revision:

3.1. Calculation L-002588, Revision 001, "Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 – Undervoltage Function"

3.2. Calculation AN71, Revision 001, "Second Level Undervoltage Relay Setpoint"

3.3. EC 334178

3.4. Asea Brown Boveri, Product Bulletin 42-951, dated Sept 1991, "Type VIY-60 Voltage Transformer" (see Attachment A).

4. **ASSUMPTIONS:**

4.1. none

5. INPUT DATA:

5.1. The ratings of the new ABB PTs are as follows (see reference 3.4):

ANSI metering accuracy (60Hz)

Accuracy Class: 0.3 W, X, Y and 1.2 Z burdens at 120VAC

Voltage Ratio: 4200-120V (35:1)

VA rating: 1000VA thermal at 30°C

6. CALCULATION RESULTS:

Based on page 10 of reference 3.1, and page A6 of reference 3.2, the calculation was performed using the following PT information for bus 142Y.

Voltage Ratio: 4200-120V (35:1)

Accuracy Class: 0.3 W, X, Y and 1.2 Z burdens at 120VAC

Frequency: 60 Hz

VA rating: 1000VA thermal at 30°C

A comparison of the existing PT information with the Input Data from reference 3.4 for the new ABB PTs, shows that the ratings for these two types of PTs are the same. Therefore, all of the acceptance criteria were met:

The new PTs have the same voltage ratio as the existing PTs.

The new PTs have the same accuracy class for a given burden as the existing PTs.

The new PTs are rated for the same frequency as the existing PTs.

The power rating of the new PTs is the same as the existing PTs.

7. **SUMMARY AND CONCLUSIONS:**

The comparison of rating information for the existing Westinghouse model (PC-60) PTs in the Class 1E 4160V switchgear buses (141Y, 142Y, 241Y & 242Y) and new ABB model, VIY-60, PTs has determined that the two types of PTs have equivalent ratings. Since the PT rating information is the same, there is no effect on the remaining calculations performed in Calculation L-002588. The new ABB model VIY-60 rating information is included in Attachment A of this minor revision. This PT information should become an attachment to Calculation L-002588 when the next formal revision is performed.

CC-AA-309 - ATTACHMENT 1 - Design Analysis Approval
Page 1 of 2

DESIGN ANALYSIS NO.: L-002588 Major REV Number:001 Minor Rev Number: B	PAGE NO.1
[ ] BRAIDWOOD STATION [ ] BYRON STATION [ ] CLINTON STATION [ ] DRESDEN STATION [X] LASALLE CO. STATION [ ] QUAD CITIES STATION Unit: [ ]0 [X]1 [X]2 [ ]3	DESCRIPTION CODE:(C018) I03 DISCIPLINE CODE: (C011) I SYSTEM CODE: (C011) AP
TITLE: Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 - Undervoltage Function	
[Y] Safety Related [ ] Augmented Quality [ ] Non-Safety Related	

ATTRIBUTES (C016)

TYPE	VALUE	TYPE	VALUE
Elevation			
Software			

COMPONENT EPN: (C014 Panel)		DOCUMENT NUMBERS: (C012 Panel) (Design Analyses References)		
EPN	TYPE	Type/Sub	Document Number	Input (Y/N)
See Rev 1		CALC/ENG	L-002589 Revision 1A	Y
2APO1B use R20				
Due to R19 not in Bargain		/		
Passport 6/4 5/21/02		/		
		/		
		/		
		/		

REMARKS:

DESIGN ANALYSIS NO. L-002588 **REV:001B PAGE NO.** 2

Revision Summary (including EC's incorporated): Revised calculation to change setpoints to checkpoints for Div 1&2. Revised or added sections 2.1, 2.8, 2.9, 3.4, 4.7, 4.8, 5.1.2, 5.5.5, 5.6.5, 6.4, 6.6, 6.7, 6.8, 7.1, 7.2, 7.3 and 7.4 plus Attachment F.

Electronic Calculation Data Files:
(Program Name, Version, File Name extension/size/date/hour/min)

Design impact review completed? [ ] Yes [x] N/A, Per EC#: 0000336949
(If yes, attach impact review sheet)

Prepared by: R. Fredricksen / [signature] / 5/15/02
Print / Sign / Date

Reviewed by: E. Seckinger / [signature] / 5/15/02
Print / Sign / Date

Method of Review: [X] Detailed [ ] Alternate [ ] Test

This Design Analysis supersedes: None **in its entirety.**

Supplemental Review Required? [ ] Yes [X] No

[ ] Additional Review [ ] Special Review Team

Additional Reviewer or Special Review Team Leader: ____ / ____ / ____
Print / Sign / Date

Special Review Team: (N/A for Additional Review)

Reviewers: 1) ____ / ____ / ____ 2) ____ / ____ / ____
Print / Sign / Date Print / Sign / Date

3) ____ / ____ / ____ 4) ____ / ____ / ____
Print / Sign / Date Print / Sign / Date

Supplemental Review Results:

Approved by: Mark Murskyj / [signature] / 5/15/02
Print / Sign / Date

External Design Analysis Review (Attachment 3 Attached)

Reviewed by: ____ / ____ / ____
Print / Sign / Date

Approved by: ____ / ____ / ____
Print / Sign / Date

Do any ASSUMPTIONS / ENGINEERING JUDGEMENTS require later verification? [ ] Yes [X] No
Tracked By: AT#, EC# etc.) ____

CALCULATION TABLE OF CONTENTS

CALCULATION NO. **L-002588**	**REV. NO. 001B**	**PAGE NO. 3**
SECTION:	PAGE NO.	SUB-PAGE NO.

E-FORM

CALCULATION PAGE

Purpose/Objective

The purpose of this revision to the calculation is to revise the computed values to provide a set of acceptance criteria such that the calibration of the ITE-27 type inverse time low voltage trip relay will better coordinate with the requirements of the design and still meet Technical Specification requirements.

Methodology and Acceptance Criteria

Replace paragraph 2.1 with the following:

2.1 Basic Methodology

The settings of the ITE-27 Inverse Time Delay Low Voltage Relays consist of a pickup voltage tap setting and a time delay tap setting, both of which can be slightly adjusted. The determination of where these taps are set is made by T&D Protection Engineering and this calculation will provide this group with the required acceptance criteria for these relays for the purpose of compliance with Technical Specifications.

This calculation of uncertainty for the instrument is performed in accordance with NES-EIC-20.04 (Ref. 5.1.2) and the main body of Reference 5.1.3 with the clarifications and additions identified below.

Once the uncertainties are known, then, using the time delay requirements of Reference 5.6.5, the following will be determined:

1. The maximum pickup voltage setting for the relay that would ensure that the relay is energized before the voltage reaches the minimum expected bus voltage during a transient will be determined.

   Determining this point will be done by subtracting the uncertainty of the ITE-27 voltage setting as computed in the uncertainty section of the calculation from the analytical limit for the high voltage.

2. The acceptance criteria for calibration of the ITE-27 relays will be determined, to ensure that the requirements of Technical Specifications are met. This will be done by providing a range of times vs. voltages, in a graphical form, that will ensure that the relay meets it's technical specification requirements if it is set to pass through these ranges.

   This will be done by taking two points, one near the high end of the technical specification voltage range and one near the low end of the technical specification range and looking at the expected results considering the uncertainties in the relays. Both voltage and time delay uncertainties will be considered, causing a range of acceptable results that can be plotted.

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3. The minimum time delay that can be accepted at a voltage that corresponds to 60% of bus voltage.

Revise paragraph 2.8 with the following:

2.8 Nominal Setpoint

A nominal setpoint will be determined utilizing the following equations from Appendix C of Reference 5.1.2 where applicable:

$SPc \geq AL + Z^{+} + MAR$ [lower limit]

$SPc \leq AL - |Z^{-}| - MAR$ [upper limit]

Where, SPc: is the nominal setpoint
AL: is the Analytical Limit
Z^{+}, Z^{-}: is the total error (positive, negative) for the device including all estimated effects
MAR: is a selected margin used to provide additional conservatism

Note: The names of the terms in the generic equations shown above may be modified in accordance with specific loop designations.

The errors (Z) included in the determination of the calculated setpoint are all applicable instrument errors and environmental effects

This nominal setpoint is determined using DTIc(See Section 2.6).

These setpoints are not values that will be set into the ITE-27 relay as discrete values but will be used as the basis for the acceptance criteria for calibration.

Revise paragraph 2.9 as follows:

2.9 Allowable Value

An allowable value will be determined utilizing the following equations from Appendix C of 5.1.2 as applicable:

$AV \geq SPc - |Zav^{+}|$ [lower limit]

$AV \leq SPc + |Zav^{-}|$ [upper limit]

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where, AV: is the allowable value
SPc: is the calculated nominal setpoint
Zav^+, Zav^-: is the total error (positive, negative) applicable during calibration

Note: The names of the terms in the generic equations shown above may be modified in accordance with specific loop designations.

The errors that are included for the determination of the allowable values (Zav) are only those applicable during calibration. Thus, only reference accuracy (RA), calibration errors (CAL), setting tolerance (ST), drift (DR) and if applicable, the input error (σin) are included. If DTIc is available, RA, CAL, ST and DR errors are replaced by the calculated drift (DTIc).

The computed AV will provide a sufficient safety margin because it is computed from the developed nominal setpoint, and the setpoint is being checked with an acceptance criteria that ensures that the relay follows it's expected curve.

Assumptions / Engineering Judgments

Add the following assumption/engineering judgement:

3.4 The ITE-27 is an inverse time delay low voltage trip relay. The relay follows a set inverse function based on a time tap and voltage tap setting. If two points on this curve are verified to be within a given tolerance, then the curve is assumed to be "true" within those tolerances throughout the range of concern. These points are close enough to each other that there is little probability that the curve could deviate enough to fall outside the desired region if the calibration checkpoints are within their ranges.

Design Inputs

Add the following design input:

4.7 The time delays associated with these relays are computed in Reference 5.6.5 and the values for Division 1 and 2 are as specified below:

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Calculated Upper Allowable Value ($AV1_U$)	≤ 10.9 seconds
Calculated Setpoint ($SP1c_U$)	≤ 8.3 seconds
Calculated Lower Limit Setpoint ($SP1c_L$)	≥ 4.3 seconds
Calculated Lower Allowable Value ($AV1_L$)	≥ 3.1 seconds

Calibration Frequency and Tolerances		
Surveillance Interval	**Setting Tolerance**	**Expanded Tolerance**
24 months	Point1: ± 10% (± 0.83 seconds) Point 2: ± 10% (± 0.43 seconds)	Point1: ± 25.5% (± 2.12 seconds) Point 2: ± 23.9% (± 1.03 seconds)

4.8 Calibration checkpoints will be at or near the high and low technical specification range when setting tolerance is included. From Design Input 4.2 the setting tolerance for voltage is ± 5.0 %. The low checkpoint is approximately 75 Volts computed from the value in section 6.4 of 71.37 volts adjusted up by 5% tolerance. The high checkpoint is approximately 82 volts computed from the value in section 6.4 of 86.49 V when adjusted down by 5% tolerance. These two voltages, 75 Volts and 82 Volts, will be used for calibration checkpoints. These adjusted calibration points will provide some additional conservatism in that the inverse voltage curve that will fit them will meet tighter constraints.

References

Revise Reference 5.1.2 to Revision 3.

Add the following references:

5.5.5 LaSalle Technical Specification 3.3.8.1

5.6.5 L-002589, Instrument Setpoint Analysis for 4.16KV Undervoltage (Loss of Voltage) Relay – Time Delay Function, Revision 1A

Calculations

Revise section 6.4 as follows:

Change title to

6.4 Nominal Calculated Setpoint

CALCULATION PAGE

After the calculations:

$SPc(LL)_{DIV3} \geq 73.80\ V + 4.158\ V + 0\ V$
$SPc(LL)_{DIV3} \geq 77.958\ V \approx 77.96\ V$

Revise the Division 1 & 2 statement to read:

Division 1 & 2: The upper setpoint, $SPc(UL)_{DIV1\&2} \leq 86.49$ V, is the maximum value that the pickup voltage of the relay can be set at. This is the maximum voltage as the uncertainty of the relay voltage setting is taken into account.

The lower setpoint, $SPc(LL)_{DIV1\&2} \geq 71.361\ V \approx 71.37$ V, is representative of the voltage value that will be above the lower analytical limit but will be used to check for compliance with the expected values near the low end of the voltage range.

Revise paragraph 6.6 to read as follows:

6.6 Expanded Tolerances

Expanded Tolerances are not calculated for these relays because the calibration of these devices does not check to ensure the relay will actuate at a specific setpoint.

In paragraph 6.7 delete the MinVal and MaxVal equations for division 1 and 2.

Add paragraph 6.8 as follows:

6.8 Acceptance Criteria for Calibration Testing

The acceptance points that should be tested are for PT Secondary voltages as specified in Design Input 4.8.

For the 82 Volt checkpoint the upper time delay limit from design input 4.7 will be used. Thus for a simulated bus voltage that generates 82, within the range of the 5% setting tolerance of ± 4.1 Volts, at the PT secondary, the time delay should be 8.3 ± 0.83 seconds.

For the 75 Volt checkpoint the lower time delay limit from design input 4.7 will be used. Thus for a simulated bus voltage that generates 75, within the range of the 5% setting

tolerance of ± 3.75 Volts, at the PT secondary, the time delay should be 4.3 ± 0.43 seconds.

SUMMARY AND CONCLUSIONS

In paragraph 7.1 delete the MinVal/MaxVal Values for Division 1 and 2.

Revise the table in 7.2 as shown below:

EPN	Parameter	Process Units
Div 1 & 2 1AP037A & B 1AP040A & B 2AP037A & B 2AP040A & B	Field Calibration Checkpoints	75 V 82 V
	Allowable Value	≥ 69.19 V and ≤ 88.34 V
	Analytical Limit	≥ 67.52 V and ≤ 90.00V
Div 3 1AP041A & B 2AP041A & B	Field Calibration Setpoint	82 V
	Allowable Value	≥ 74.17 V and ≤ 89.63 V
	Analytical Limit	≥ 73.80 V and ≤ 90.00V

Calibration Frequency, Setting Tolerances and Expanded Tolerances (Div 1,2,3):

	Surveillance Interval	Setting Tolerance	Expanded Tolerance
Channel Calibration	24 months	± 10%	N/A

Replace 7.3 with the following:

7.3 Acceptance Criteria for Division 3

The acceptance criteria (Section 2.10) associated with the setpoints for Division 3 are met since the field calibration setpoint (SPf) is within the enveloping calculated setpoints (SPc) and therefore ensures that the analytical limits will not be exceeded.

There are no acceptance criteria for the allowable value determination.

CALCULATION PAGE

Add a new paragraph 7.4 as follows:

7.4 Calibration Checkpoint Acceptance Criteria for Division 1 and 2

The verification that the ITE-27 inverse voltage curve will meet the requirements of this calculation for Division 1 and 2 is to test the relay to ensure that:

A. The pickup voltage is not set higher than 86.49 V.

B. That, when the relay trips with a simulated bus voltage that equals 60% of the normal bus voltage that the time delay is greater than the minimum allowable value of 3.1 seconds.

C. That when the relay trips with simulated bus voltages of 75 and 82 ± 10% Volts the time delays will be within expected zones as shown on Attachment F pages 1 and 2.

ATTACHMENTS

Attachment F: Acceptance Regions for Calibration Checkpoints for ITE-27 Relays.

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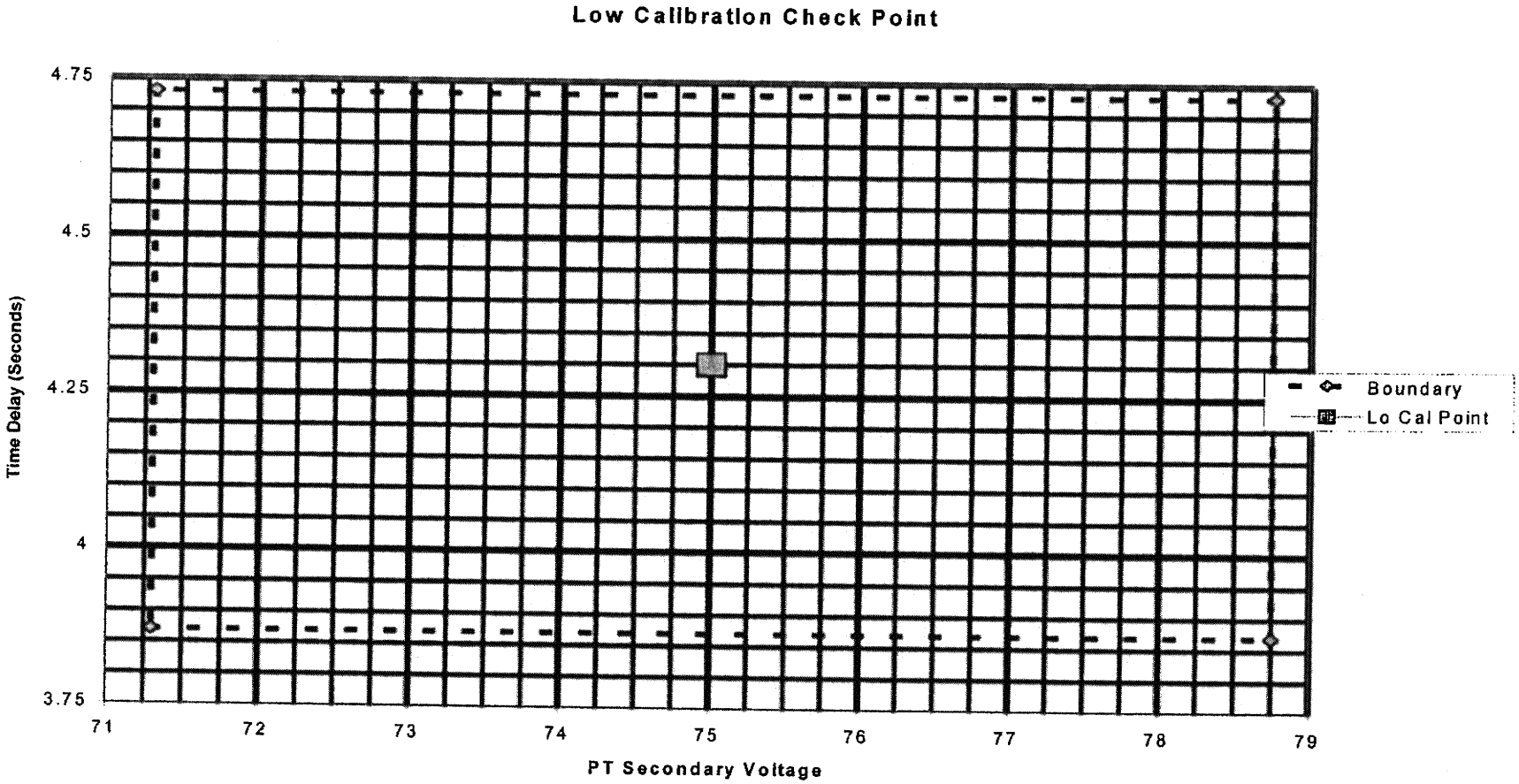
CALCULATION PAGE

CALCULATION NO. L-002588	REVISION NO. 1B	PAGE NO. 11 of 12

Attachment F: Acceptance Regions for Calibration Checkpoints for ITE-27 Relays Page F1 of F2



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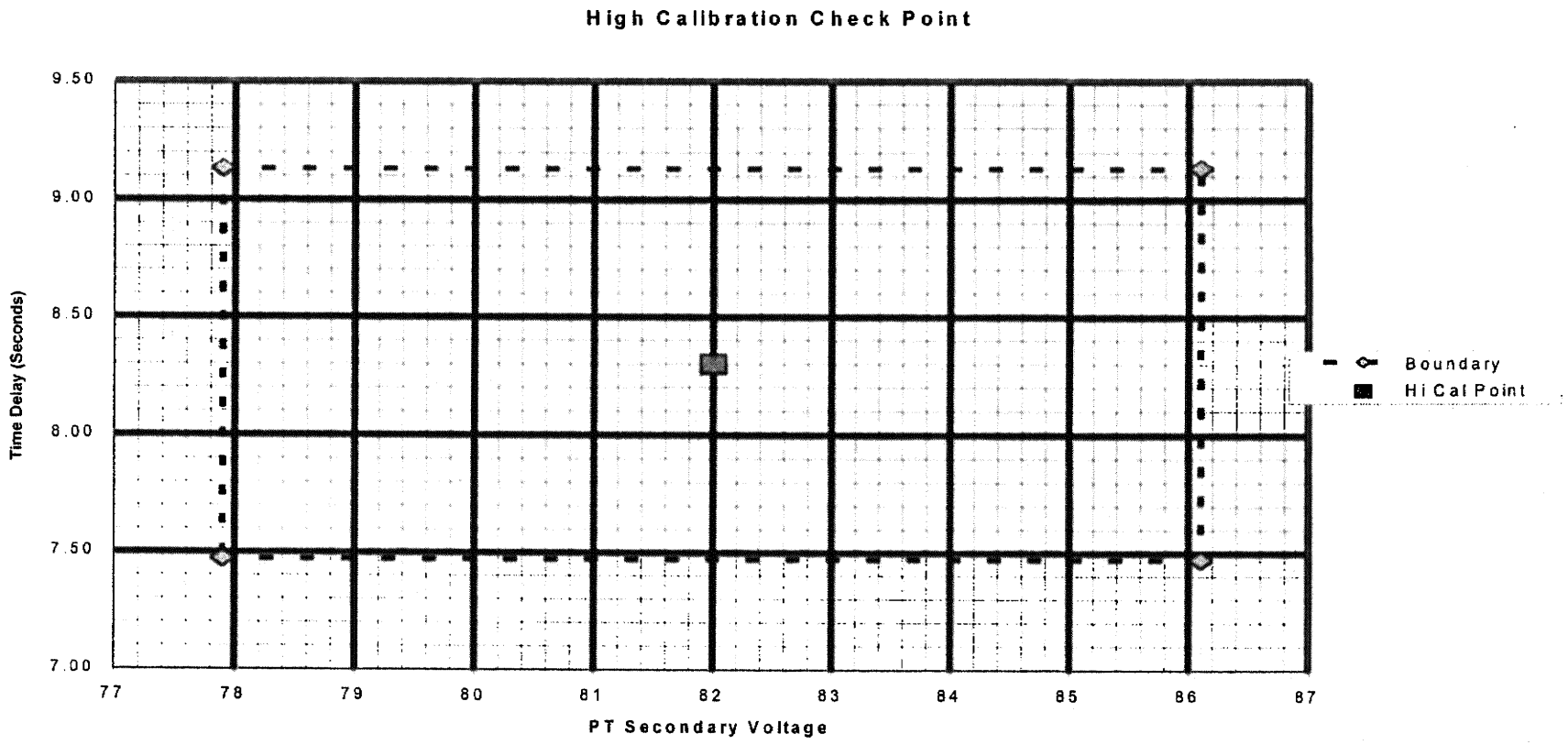
CALCULATION NO. L-002588	REVISION NO. 1B	PAGE NO. 12 of 12

Attachment F: Acceptance Regions for Calibration Checkpoints for ITE-27 Relays Page F2 of F2



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DESIGN ANALYSIS NO.: L-002588 PAGE NO. 1
Major REV Number: 001 Minor Rev Number: C

[ ] BRAIDWOOD STATION
[ ] BYRON STATION
[ ] CLINTON STATION
[ ] DRESDEN STATION
[X] LASALLE CO. STATION
[ ] QUAD CITIES STATION

Unit: [ ] 0 [X] 1 [X] 2 [ ] 3

DESCRIPTION CODE:(C018) I03

DISCIPLINE CODE: (C011) I

SYSTEM CODE: (C011) AP

TITLE: Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y and 243 - Undervoltage Function

[X] Safety Related [ ] Augmented Quality [ ] Non-Safety Related

ATTRIBUTES (C016)

TYPE	VALUE	TYPE	VALUE
Elevation			
Software			

COMPONENT EPN: (C014 Panel)

EPN	TYPE
1(2)AP037A	R19
1(2)AP037B	R19
1(2)AP040A	R19
1(2)AP040B	R19
1(2)AP041A	R19
1(2)AP041B	R19(R20)

DOCUMENT NUMBERS: (C012 Panel) (Design Analyses References)

Type/Sub	Document Number	Input (Y/N)
/		
/		
/		
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/		
/		
/		

REMARKS:

DESIGN ANALYSIS NO. L-002588 **REV:** 001C **PAGE NO.** 2

Revision Summary (including EC's incorporated): The purpose of this revision is to correct an error that was made in minor revision 1B of incorrectly identifying the Setting Tolerance of the checkpoint voltage for the undervoltage relays. The revision affects the Summary and Conclusions Table 7.2 and section 7.4.

Electronic Calculation Data Files:
(Program Name, Version, File Name extension/size/date/hour/min)

Design impact review completed? [ ] Yes [x] N/A, Per EC#: 338375 / 338414
(If yes, attach impact review sheet)

Prepared by: ~~W. Kirchhoff~~ R. FREDRICKSEN / Sign / 8/19/02
Print Date

Reviewed by: E. ZACHARIAS / Sign / 8/19/02
Print Date

Method of Review: [x] Detailed [ ] Alternate [ ] Test

This Design Analysis supersedes: _____ **in its entirety.**

Supplemental Review Required? [ ] Yes [X] No

[ ] Additional Review [ ] Special Review Team

Additional Reviewer or Special Review Team Leader: _____ / _____ / _____
Print Sign Date

Special Review Team: (N/A for Additional Review)

Reviewers: 1) _____ / _____ / _____ 2) _____ / _____ / _____
Print Sign Date Print Sign Date

3) _____ / _____ / _____ 4) _____ / _____ / _____
Print Sign Date Print Sign Date

Supplemental Review Results:

Approved by: MARK MURSKY / Sign / 8/20/02
Print Date

External Design Analysis Review (Attachment 3 Attached)

Reviewed by: _____ / _____ / _____
Print Sign Date

Approved by: _____ / _____ / _____
Print Sign Date

Do any ASSUMPTIONS / ENGINEERING JUDGEMENTS require later verification? [ ] Yes [X] No
Tracked By: AT#, EC# etc.) _____

CALCULATION TABLE OF CONTENTS

CALCULATION NO. L-002588 **REV. NO.** 001C **PAGE NO.** 3

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CALCULATION PAGE

Purpose/Objective

The purpose of this revision is to correct an error that was made in minor revision 1B of incorrectly identifying the Setting Tolerance of the checkpoint voltage for the undervoltage relays.

Summary and Conclusions

Revise the Setting Tolerance of voltages in Table 7.2 and section 7.4 to a value of ± 5% to agree with section 4.8 and Design Input 4.2.

Table 7.2 changes:

Calibration Frequency, Setting Tolerances and Expanded Tolerances (Div 1,2,3):

	Surveillance Interval	Setting Tolerance	Expanded Tolerance
Channel Calibration	24 months	± 5%	N/A

7.4.C is changed to:

C. That when the relay trips with simulated bus voltages of 75 and 82 ± 5% Volts the time delays will be within expected zones as shown on Attachment F pages 1 and 2.

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ATTACHMENT 2
Design Analysis Minor Revision Cover Sheet

Design Analysis (Minor Revision)		**Last Page No.** [6] 3, Att. G Page G8	
Analysis No.: [1]	L-002588	**Revision:** [2]	001D
Title: [3]	Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243-Undervoltage Function		
EC/ECR No.: [4]	369973	**Revision:** [5]	000
Station(s): [7]	LaSalle		
Unit No.: [8]	0, 1 & 2		
Safety/QA Class: [9]	SR		
System Code(s): [10]	AP		

Is this Design Analysis Safeguards Information? [11] Yes ☐ No ☒ If yes, see SY-AA-101-106

Does this Design Analysis contain Unverified Assumptions? [12] Yes ☐ No ☒ If yes, ATI/AR#: N/A

This Design Analysis SUPERCEDES: [13] N/A **In its entirety.**

Description of Changes (list affected pages): [14] Page 1-3 & Att. G Page G1-G8

- The seismic uncertainty in Section 2.7 is clarified by adding a paragraph describing that actual test data from seismic qualification testing validated the time delay settings not affected.
- Added Acton Labs Test Report 18333-82N as Reference 5.7.3 and Attachment G.
- Added direct References for Analytical Limits (currently NDIT LS-1202 is referenced).

Disposition of Changes: [15]

All changes are clarification of existing information or deletion of unnecessary information, so there is no impact on any calculated values or conclusions.

Add Calculations L-000295 and L-001561 as cross-references in to this calculation.

Preparer: [16]	E. Zacharias (Print Name)	Elizabeth Zacharias (Sign Name)	4/14/08 (Date)
Method of Review: [17]	**Detailed Review** ☒ **Alternate Calculations** ☐ **Testing** ☐		
Reviewer: [18]	T. J. Van Wyk (Print Name)	(Sign Name)	4/15/08 (Date)
Review Notes: [19]	Independent review ☒ Peer review ☐		
(For External Analyses Only) **External Approver:** [20]	(Print Name)	(Sign Name)	(Date)
Exelon Reviewer [21]	(Print Name)	(Sign Name)	(Date)
Exelon Approver: [22]	VIKRAM SHAH (Print Name)	(Sign Name)	4/15/08 (Date)

CALCULATION TABLE OF CONTENTS

CALCULATION NO. L-002588	REV. NO. 001D	PAGE NO. 2
SECTION:	PAGE NO.	SUB-PAGE NO.
TABLE OF CONTENTS	2	NA
1.0 PURPOSE / OBJECTIVE	3	NA
2.0 METHODOLOGY AND ACCEPTANCE CRITERIA	3	NA
3.0 ASSUMPTIONS / ENGINEERING JUDGEMENTS	N/A	NA
4.0 DESIGN INPUT	3	NA
5.0 REFERENCES	3	NA
6.0 CALCULATIONS	N/A	NA
7.0 SUMMARY AND CONCLUSIONS	N/A	NA
8.0 ATTACHMENTS	3	NA
G: Acton Test Report 18333-82N (Partial – Seismic test data pages only)	G1 – G8	N/A

1.0 PURPOSE/OBJECTIVE

The purpose of this minor revision is to correct several minor discrepancies noted during review of the calculation. (These discrepancies were documented in IRs 672166)

Revise Calculation L-002588 as follows:

2.0 METHODOLOGY AND ACCEPTANCE CRITERIA

Add the following paragraph to the end of Section 2.7 Seismic:

Seismic qualification testing performed at Acton Labs validated that there was no change detected in the time delay settings of the ITE-27N relay during seismic testing. (Reference 5.7.3)

4.0 DESIGN INPUT

Revise first sentence in 4.5 Analytical Limit (AL) as follows:

"Per References 5.5.2, 5.6.5, and 5.6.6, the Analytical Limits (AL) are as follows:"

5.0 REFERENCES

Add References 5.6.5, 5.6.6, and 5.7.3 as follows:

"5.6.5 LaSalle Calculation L-000295, Rev. 2C, "Analysis of Safety Related Loads During LOCA Block Start for LaSalle Unit 2"

5.6.6 LaSalle Calculation L-001561, Rev. 4C, "Analysis of Safety Related Loads During LOCA Block Start for LaSalle Unit 1"

3 4/12/05

5.7.3 Acton Test Report 18333-8ZN (Attachment G)"

8.0 ATTACHMENTS

Add Attachment G as follows:

3 4/12/05

"G. Acton Test Report 18333-8ZN (Partial – Seismic test data pages only)"

This minor revision to L-002588 is for clarification of minor discrepancies and does not affect any calculated values.

ATTACHMENT 1
Design Analysis Cover Sheet

Design Analysis		**Last Page No.** 8, Attachment B, Page B2	
Analysis No.: [1]	L-002588	**Revision:** [2] 001E	Major ☐ Minor ☒
Title: [3]	**Loss of Voltage Relay Setpoint for 4.16 kV Buses 141Y, 142Y, 143, 241Y, 242Y, 243 – Undervoltage Function**		
EC/ECR No.: [4]	390578, 390579	**Revision:** [5]	000, 000

		Component(s): [14]	
Station(s): [7]	LaSalle		
Unit No.: [8]	01 and 02	1427-AP037A	2427-AP037A
Discipline: [9]	ELDC	1427-AP037B	2427-AP037B
Descrip. Code/Keyword: [10]	E07	1427-AP040A	2427-AP040A
Safety/QA Class: [11]	SR	1427-AP040B	2427-AP040B
System Code: [12]	AP	1427-AP041A	2427-AP041A
Structure: [13]	REACTOR BUILDING	1427-AP041B	2427-AP041B

CONTROLLED DOCUMENT REFERENCES [15]

Document No.:	From/To	Document No.:	From/To
	From		

Is this Design Analysis Safeguards Information? [16] Yes ☐ No ☒ If yes, see SY-AA-101-106

Does this Design Analysis contain Unverified Assumptions? [17] Yes ☐ No ☒ If yes, ATI/AR#:

This Design Analysis SUPERCEDES: [18] N/A **in its entirety.**

Description of Revision (list changed pages when all pages of original analysis were not changed): [19]

Calculation L-002588 is a Key calculation and approval for to use a Minor revision was obtained from Mr. Richard Meyer on June 05, 2103.

This minor revision addresses Loss of Voltage (LOV) relay setpoint changes to address a NRC 2010 CDBI NCV.

Preparer: [20]	Anup Behera (KCI) Print Name	Sign Name	8/6/13 Date
Method of Review: [21]	**Detailed Review** ☒	**Alternate Calculations (attached)** ☐	**Testing** ☐
Reviewer: [22]	Tom VanWyk (KCI) Print Name	Sign Name	8/6/13 Date
Review Notes: [23]	Independent review ☒ Peer review ☐ Reviewed per Attachment 4 of CC-AA-309-1001.		
(For External Analyses Only) **External Approver:** [24]	Badar Hussain (KCI) Print Name	Sign Name	8/6/13 Date
Exelon Reviewer: [25]	E. L. Seckinger Print Name	Sign Name	8/30/2013 Date
Independent 3rd Party Review Reqd? [26]	Yes ☐ No ☒		
Exelon Approver: [27]	Richard A. Meyer Print Name	Sign Name	9-5-13 Date

ATTACHMENT 2
Owner's Acceptance Review Checklist for External Design Analyses

DESIGN ANALYSIS NO. L-002588 **REV.** 001E **PAGE:** 1a

No	Question	Instructions and Guidance	Yes / No / N/A
1	Do assumptions have sufficient documented rationale?	All Assumptions should be stated in clear terms with enough justification to confirm that the assumption is conservative. For example, 1) the exact value of a particular parameter may not be known or that parameter may be known to vary over the range of conditions covered by the Calculation. It is appropriate to represent or bound the parameter with an assumed value. 2) The predicted performance of a specific piece of equipment in lieu of actual test data. It is appropriate to use the documented opinion/position of a recognized expert on that equipment to represent predicted equipment performance. Consideration should also be given as to any qualification testing that may be needed to validate the Assumptions. Ask yourself, would you provide more justification if you were performing this analysis? If yes, the rationale is likely incomplete.	☐ ☐ ☒
2	Are assumptions compatible with the way the plant is operated and with the licensing basis?	Ensure the documentation for source and rationale for the assumption supports the way the plant is currently or will be operated post change and they are not in conflict with any design parameters. If the Analysis purpose is to establish a new licensing basis, this question can be answered yes, if the assumption supports that new basis.	☐ ☐ ☒
3	Do all unverified assumptions have a tracking and closure mechanism in place?	If there are unverified assumptions without a tracking mechanism indicated, **then** create the tracking item either through an ATI or a work order attached to the implementing WO. Due dates for these actions need to support verification prior to the analysis becoming operational or the resultant plant change being op authorized.	☐ ☐ ☒
4	Do the design inputs have sufficient rationale?	The origin of the input, or the source should be identified and be readily retrievable within Exelon's documentation system. If not, then the source should be attached to the analysis. Ask yourself, would you provide more justification if you were performing this analysis? If yes, the rationale is likely incomplete.	☒ ☐ ☐
5	Are design inputs correct and reasonable with critical parameters identified, if appropriate?	The expectation is that an Exelon Engineer should be able to clearly understand which input parameters are critical to the outcome of the analysis. That is, what is the impact of a change in the parameter to the results of the analysis? If the impact is large, then that parameter is critical.	☒ ☐ ☐
6	Are design inputs compatible with the way the plant is operated and with the licensing basis?	Ensure the documentation for source and rationale for the inputs supports the way the plant is currently or will be operated post change and they are not in conflict with any design parameters.	☒ ☐ ☐
7	Are Engineering Judgments clearly documented and justified?	See Section 2.13 in CC-AA-309 for the attributes that are sufficient to justify Engineering Judgment. Ask yourself, would you provide more justification if you were performing this analysis? If yes, the rationale is likely incomplete.	☐ ☐ ☒
8	Are Engineering Judgments compatible with the way the plant is operated and with the licensing basis?	Ensure the justification for the engineering judgment supports the way the plant is currently or will be operated post change and is not in conflict with any design parameters. If the Analysis purpose is to establish a new licensing basis, **then** this question can be answered yes, if the judgment supports that new basis.	☐ ☐ ☒
9	Do the results and conclusions satisfy the purpose and objective of the Design Analysis?	Why was the analysis being performed? Does the stated purpose match the expectation from Exelon on the proposed application of the results? If yes, **then** the analysis meets the needs of the contract.	☒ ☐ ☐

ATTACHMENT 2
Owner's Acceptance Review Checklist for External Design Analyses

DESIGN ANALYSIS NO. L-002588 **REV.** 001E **PAGE:** 1b

No	Question	Instructions and Guidance	Yes / No / N/A
10	Are the results and conclusions compatible with the way the plant is operated and with the licensing basis?	Make sure that the results support the UFSAR defined system design and operating conditions, or they support a proposed change to those conditions. If the analysis supports a change, are all of the other changing documents included on the cover sheet as impacted documents?	☒ ☐ ☐
11	Have any limitations on the use of the results been identified and transmitted to the appropriate organizations?	Does the analysis support a temporary condition or procedure change? Make sure that any other documents needing to be updated are included and clearly delineated in the design analysis. Make sure that the cover sheet includes the other documents where the results of this analysis provide the input. See EC's 390576 and 390579	☒ ☐ ☐
12	Have margin impacts been identified and documented appropriately for any negative impacts (Reference ER-AA-2007)?	Make sure that the impacts to margin are clearly shown within the body of the analysis. If the analysis results in reduced margins ensure that this has been appropriately dispositioned in the EC being used to issue the analysis.	☒ ☐ ☐
13	Does the Design Analysis include the applicable design basis documentation?	Are there sufficient documents included to support the sources of input, and other reference material that is not readily retrievable in Exelon controlled Documents?	☒ ☐ ☐
14	Have all affected design analyses been documented on the Affected Documents List (ADL) for the associated Configuration Change?	Determine if sufficient searches have been performed to identify any related analyses that need to be revised along with the base analysis. It may be necessary to perform some basic searches to validate this.	☒ ☐ ☐
15	Do the sources of inputs **and** analysis methodology used meet committed technical and regulatory requirements?	Compare any referenced codes and standards to the current design basis and ensure that any differences are reconciled. If the input sources **or** analysis methodology are based on an out-of-date methodology or code, additional reconciliation may be required if the site has since committed to a more recent code	☒ ☐ ☐
16	Have vendor supporting technical documents and references (including GE DRFs) been reviewed when necessary?	Based on the risk assessment performed during the pre-job brief for the analysis (per HU-AA-1212), ensure that sufficient reviews of any supporting documents not provided with the final analysis are performed.	☒ ☐ ☐
17	Do operational limits support assumptions and inputs?	Ensure the Tech Specs, Operating Procedures, etc. contain operational limits that support the analysis assumptions and inputs.	☒ ☐ ☐

Create an SFMS entry as required by CC-AA-4008. SFMS Number: 41357

DESIGN ANALYSIS TABLE OF CONTENTS

ANALYSIS NO. L-002588	**REV. NO. 001E**	**PAGE NO. 2**
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Attachment A: System Protection Department – Relay Setting Order (Nuclear) for Division 1, 2 and 3 Loss of Voltage relay 1(2)AP037A & B, 1(2)AP040A & B and 1(2)AP041A & B	A1-A9	
Attachment B: Acceptance Regions for Calibration Checkpoints for ITE-27 Relays	B1-B2	

PURPOSE/SCOPE

The purpose of this calculation is to evaluate relay setpoints so that all the safety related motors normally running from power supplied from the SAT would not trip in less than 5.7 minutes under a degraded voltage condition of the 4kV ESF bus. The degraded voltage relay timer is set to trip in 300 ± 29.9 seconds time delay following the 10.9 seconds time delay of the degraded voltage relay before transfer of all the loads to the diesel generators. The maximum time delay to trip the offsite source due to degraded bus voltage is therefore 340.8 seconds (5.7 minutes) [Reference Technical Specification Table 3.3.8.1.1]. This evaluation of the relay setpoints is done to address a NRC 2010 CDBI NCV. Specifically, the NRC concern was that adequate basis was not documented to demonstrate the ability of the permanently connected safety-related loads to continue to operate during the 5.7 minutes relay time delay without sustaining damage or tripping during a worst case, non-accident degraded voltage condition (when voltage was still above the setpoint of the loss of voltage relay setpoint).

This calculation is applicable for the following undervoltage relays that perform the Loss of Voltage identification function and initiate load shedding at Emergency Safe Shutdown (ESS) buses 141Y, 142Y, 241Y, 242Y, 143, and 243:

Relay	Bus	Relay Type
1(2)427AP037A & B	141Y(241Y)	Inverse Time UV Relay
1(2)427AP040A & B	142Y(242Y)	Inverse Time UV Relay
1(2)427AP041A & B	143(243)	Undervoltage Relay

DESIGN INPUTS

Revise the first two rows of the table in Section 4.4 Calibration Procedure Data for Divisions 1 & 2 as follows:

Per the most recent Relay Setting Order [Ref. 5.8.1] (included as Attachment A to this minor revision), the present settings for the Division 1 & 2 Loss of Voltage relays are as follows. The ratio for the Potential Transformer (PT) supplying these relays is 35:1.

Relay Tap and Time Dial	80V, TD = 3
Relay Setting	≤ 86.49 Dropout (3027V on primary)

Revise Section 4.5 Analytical Limit (AL) as follows:

Per Reference 5.5.2, the Division 1 and 2 Loss of Voltage relay Analytical Limit (AL) is 2363 Volts ≤ AL ≤ 3150 Volts at the relay bus and the Division 3 Loss of Voltage relay Analytical Limit (AL) is 2583 Volts ≤ AL ≤ 3150 Volts at the relay bus. These voltages are transformed to a control voltage using a PT with a turns ratio of 35:1 (Ref. 5.8.1).

Control Voltage = Bus Voltage / 35

Thus, the transformed control voltage AL bands are as shown below:

Control Voltage AL	Division
67.52 V ≤ AL ≤ 90.00 V	1 & 2
73.80 V ≤ AL ≤ 90.00 V	3

The above upper limit of AL for Division 1, 2 and 3 bus voltage was chosen to ensure that the minimum expected voltage during LOCA Block Start of all safety related loads is above this

value. This would ensure that the Loss of Voltage relays do not trip the SAT feeder breaker when the SAT voltage is adequate to supply the power to the safety related loads. Reference 5.6.6 analyzed the 4160 SWGR degraded voltage relays [1(2)427-AP270A(B), 1(2)427-AP271A(B) and 1(2)427–AP272A(B)] during a LOCA Block Start with a minimum switchyard voltage. The minimum voltage at 4160 SWGR busses for Division 1, 2 and 3 is more than 3190 Volts (Reference 5.6.6, Attachments F and AL), when the all the safety related loads were started at the same time (i.e., T = 0.0). This voltage improves to a higher value in 2.5 seconds as the motors accelerate. Therefore, the upper limit of AL is less than 3190 and therefore can be chosen to be 3185 Volts. This is equivalent to 91 Volts on the PT secondary side.

There is no technical basis for the existing lower limit of the AL for Division 1, 2 and 3 bus voltages. The lower limit of AL for Division 1, 2 and 3 bus voltages should be such that none of the safety related normally running motors stalls at this voltage. The minimum bus voltage that ensures none of the safety related motors running in Division 1 and 2 will stall is 65.5% of 4160 Volts or 2725 Volts (Reference 5.6.6, Attachment AN) and for Division 3 will stall is 65% of 4160 Volts or 2704 Volts (Reference 5.6.6, Attachment AN). Therefore, the lower limit of AL for Division 1 and 2 is chosen as 2812 Volts to provide margin. This is equivalent to 80.34 Volts on the PT secondary side. Similarly, the lower limit of AL for Division 3 is chosen as 2712 Volts to provide margin. This is equivalent to 77.48 Volts on the PT secondary side. Note that tripping the SAT at higher bus voltage is desirable since the motors will be protected against overloading as would be in a lower terminal voltage condition.

Therefore, the revised transformed control voltage AL bands are as follows:

Control Voltage AL	Division
80.34 Volts ≤ AL ≤ 91.00 Volts	1 & 2
77.48 Volts ≤ AL ≤ 91.00 Volts	3

Replace Section 4.8 with the following:

Calibration checkpoints will be at or near the high and low technical specification range when setting tolerance is included. The setting tolerance for voltage is ± 5.0 % (Design Input 4.2). The low checkpoint is approximately 75 Volts computed from the value in section 6.4 of 71.314 Volts adjusted up by 5% tolerance. The high checkpoint is approximately 83 volts computed from the value in Section 6.4 of 87.49 V when adjusted down by 5% tolerance. These two voltages, 75 Volts and 83 Volts, will be used for calibration checkpoints. These adjusted calibration points will provide some additional conservatism in that the inverse voltage curve that will fit them will meet tighter constraints.

REFERENCES

Add the following reference:

5.6.6 L-003364, Auxiliary Power Analysis, Revision 002.

Update the following references:

5.6.5 L-002589, Instrument Setpoint Analysis For 4.16 kV Undervoltage (Loss of Voltage) Relay – Time Delay Function, Rev. 001D

CALCULATION

Replace Section 6.4 with the following:

6.4 Nominal Calculated Setpoint

The values calculated for the parameters associated with the calculated setpoint are

$AL_{DIV1\&2}$	$\leq$ 91.00 Volts	$AL_{DIV1\&2}$	$\geq$ 80.34 Volts	[Section 4.5]
AL_{DIV3}	$\leq$ 91.00 Volts	AL_{DIV3}	$\geq$ 77.48 Volts	[Section 4.5]
$Z_{DIV1\&2}$	= +3.841 Volts /	-3.51 Volts		[Section 6.3]
Z_{DIV3}	= +4.158 Volts /	-3.968 Volts		[Section 6.3]

Per References 5.6.1 and 5.6.2, the DTI1c is calculated based on a sufficiently large historical data, and per Reference 5.1.2, additional margin may be omitted in calculating the setpoint. Thus, MAR = 0 V.

Therefore, in accordance with Section 2.8, the calculated setpoints for upper and lower limits are:

SPc(UL)	$\leq AL(UL) - \lvert Z^{-} \rvert$ - MAR	[upper limit]
$SPc(UL)_{DIV1\&2}$	$\leq$ 91.00 Volts - 3.51 V - 0 Volts	
$SPc(UL)_{DIV1\&2}$	$\leq$ 87.49 Volts	
$SPc(UL)_{DIV3}$	$\leq$ 91.00 Volts - 3.968 V - 0 Volts	
$SPc(UL)_{DIV3}$	$\leq$ 87.032 Volts $\approx$ 87.03 Volts	
SPc(LL)	$\geq AL(LL) + Z^{+}$ + MAR	[lower limit]
$SPc(LL)_{DIV1\&2}$	$\geq$ 80.34 Volts + 3.841 Volts + 0 Volts	
$SPc(LL)_{DIV1\&2}$	$\geq$ 84.181 Volts $\approx$ 84.18 Volts	
$SPc(LL)_{DIV3}$	$\geq$ 77.48 Volts + 4.158 Volts + 0 Volts	
$SPc(LL)_{DIV3}$	$\geq$ 81.638 Volts $\approx$ 81.64 Volts	

Division 1 & 2: The upper setpoint, $SPc(UL)_{DIV1\&2} \leq$ 87.49 Volts, is the maximum value that the pickup voltage of the relay can be set at. This is the maximum voltage that accounts for the uncertainty of the relay voltage setting.

The lower setpoint, $SPc(LL)_{DIV1\&2} \geq$ 84.181 Volts $\approx$ 84.18 Volts, is representative of the voltage value that will be above the lower analytical limit. In order to meet the calibration requirements at the lower end of the voltage range, (See Section 7.4, Item B), a 60% of normal bus voltage (71.314 Volts) will be used to check for compliance with the expected values near the low end of the voltage range.

Division 3: Per Section 4.4, the field calibration setpoint (SPf) for this loop is 82 Volts. The field calibration setpoint value is within the calculated setpoint limits of $\geq$ 81.64 Volts and $\leq$ 87.03 Volts. Although the field calibration setpoint is bounded by the calculated setpoint limits, field calibration setpoint (SPf) is recommended to be at 84 Volts.

Replace Section 6.5 with the following:

6.5 Allowable Value

The values calculated for the parameters associated with the allowable value are

$SPc(UL)_{DIV1\&2} \leq 87.49$ Volts $SPc(LL)_{DIV1\&2} \geq 84.18$ Volts [Section 6.4]

$Zav_{DIV1\&2} = +2.181$ Volts / -1.85 Volts [Section 6.3]

$SPc(UL)_{DIV3} \leq 87.03$ Volts $SPc(LL)_{DIV3} \geq 81.64$ Volts [Section 6.4]

$Zav_{DIV3} = +3.798$ Volts / -3.608 Volts [Section 6.3]

Therefore, in accordance with Section 2.9, the calculated allowable value is

$AV(UL) \leq SPc(UL) + |Zav^-|$ [upper limit]

$AV(UL)_{DIV1\&2} \leq 87.49$ Volts + 1.85 Volts

$AV(UL)_{DIV1\&2} \leq 89.34$ Volts

$AV(UL)_{DIV3} \leq 87.03$ Volts + 3.608 Volts

$AV(UL)_{DIV3} \leq 90.638$ Volts ≈ 90.64 Volts

$AV(LL) \geq SPc(LL) - Zav^+$ [lower limit]

$AV(LL)_{DIV1\&2} \geq 84.18$ Volts - 2.181 Volts

$AV(LL)_{DIV1\&2} \geq 81.999$ Volts ≈ 82.0 Volts

$AV(LL)_{DIV3} \geq 81.64$ Volts – 3.798 Volts

$AV(LL)_{DIV3} \geq 77.842$ Volts ≈ 77.84 Volts

Replace Section 6.7 with the following:

6.7 Minimum / Maximum Calculated Values

Deleted.

Replace Section 6.8 with the following:

6.8 Acceptance Criteria for Calibration Testing

The acceptance points that should be tested are for PT Secondary voltages for Division 1 and 2 as specified in Design Input 4.8.

For the 83 Volt check point the upper time delay limit from design input 4.7 will be used. Thus for a simulated bus voltage that generates 83, within the range of the 5% setting tolerance of ± 4.15 Volts, at the PT secondary, the time delay should be 8.3 ± 0.83 seconds.

For the 75 Volt check point the lower time delay limit from design input 4.7 will be used. Thus for a simulated bus voltage that generates 75, within the range of the 5% setting tolerance of ± 3.75 Volts, at the PT secondary, the time delay should be 4.3 ± 0.43 seconds.

RESULTS/CONCLUSION

Replace Section 7.0 with the following:

7 SUMMARY AND CONCLUSIONS

The results summarized below are applicable for normal and accident operating conditions.

7.1 Calculated Values Summary

Calculated Setpoint:	84.18Volts ≤ $SPc_{DIV1\&2}$ ≤ 87.49Volts
	81.64Volts ≤ SPc_{DIV3} ≤ 87.03Volts
Allowable Value:	82.00Volts ≤ $AV_{DIV1\&2}$ ≤ 89.34Volts
	77.84Volts ≤ AV_{DIV3} ≤ 90.64Volts
Analytical Limit	80.34Volts ≤ $AL_{DIV1\&2}$ ≤ 91.00Volts
	77.48Volts ≤ AL_{DIV3} ≤ 91.00Volts

7.2 Calibration Summary

The calibration information used to support the results of this calculation is defined below.

Calibration Setpoint / Allowable Value:

EPN	Parameter	Process Units
Div 1 & 2 1AP037A & B 1AP040A & B 2AP037A & B 2AP040A & B	Field Calibration Checkpoints	75 Volts 83 Volts
	Allowable Value	≥ 82.00 Volts and ≤ 89.34 Volts
	Analytical Limit	≥ 80.34 Volts and ≤ 91.00Volts
Div 3 1AP041A & B 2AP041A & B	Field Calibration Setpoint	84 Volts
	Allowable Value	≥ 77.84 Volts and ≤ 90.64 Volts
	Analytical Limit	≥ 77.48 Volts and ≤ 91.00Volts

Calibration Frequency, Setting Tolerances and Expanded Tolerances (Div 1,2,3):

	Surveillance Interval	Setting Tolerance	Expanded Tolerance
Channel Calibration	24 months	± 2%	N/A

7.3 Acceptance Criteria for Division 3

The acceptance criteria (Section 2.10) associated with the setpoints for Division 3 are met since the field calibration setpoint (SPf) is within the enveloping calculated setpoints (SPc) and therefore ensures that the analytical limits will not be exceeded.

There are no acceptance criteria for the allowable value determination.

7.4 Calibration Checkpoint Acceptance Criteria for Division 1 and 2

The verification that the ITE-27 inverse voltage curve will meet the requirements of this calculation for Division 1 and 2 is to test the relay to ensure that:

A. The pickup voltage is not set higher than 87.49 Volts or lower than 84.18 volts.

B. That, when the relay trips with a simulated bus voltage that equals 60% of the normal bus voltage that the time delay is greater than the minimum allowable value of 3.1 seconds.

C. That when the relay trips with simulated bus voltages of 75 Volts and 83 ± 5% Volts the time delays will be within expected zones as shown on Attachment F pages 1 and 2.

ATTACHMENTS

Replace Attachment C with the contents of Attachment A of this minor revision.

Replace Attachment F with the contents of Attachment B of this minor revision.

System Protection Department – Relay Setting Order (Nuclear) for Division 1, 2 and 3 Loss of Voltage relay 1(2)AP037A & B, 1(2)AP040A & B and 1(2)AP041A & B

System Protection Department - Relay Setting Order (Nuclear)

STATION: 01, LaSalle Co. UNIT: 1 KV: 4.16 RELAY TYPE: ITE-27

EQUIPMENT: Bus 141Y Cubicle No.: 2 SAFETY-RELATED?: Yes

RELAY NO: 1427-AP037A(B) APPLICATION: Bus Loss of Voltage AP CODE: 27

A: ☒ B: ☒ C: ☒ N: ☐ RES: ☐

INSTALL: ☐ CHANGE: ☒

REPLACE: ☐ DEACTIVATE: ☐

POTENTIAL TRANSFORMER RATIO: 35 :1

TARGET TAPS: N/A

PICKUP (UV RESET) TAPS RANGE: 50-110V

DROPOUT (UV TRIP) RANGE: Approx. 97% Of Pickup

TIME DELAY RANGE: Tap 1 to 6 (0.4-12 seconds)

EXISTING:		NEW:	
PRIMARY RELAY DROPOUT (UV TRIP):	2625 V	PRIMARY RELAY DROPOUT (UV TRIP):	Less than or equal to 3027.15 V V
SECONDARY RELAY DROPOUT (UV TRIP):	75 V	SECONDARY RELAY DROPOUT (UV TRIP):	Less than or equal to 86.49 V V
TIME DIAL/TAP:	3	TIME DELAY:	TIME DELAY GREATER THAN 3.1 SEC @ 71.3 V (80% of normal) Calibration Checkpoints: 8.3 sec +/- 10% @ 82 V +/- 5% 4.3 sec +/- 10% @ 75 V +/- 5%
TIME DELAY:	120-0V @ 1.5 seconds	TIME DIAL/TAP:	FIELD IS TO DETERMINE AND RECORD BELOW
PICKUP TAP (UV RESET):	70 V	RECOMMENDED TIME TAP: 3	ACTUAL TIME TAP: 3
RELAY PICKUP (UV RESET):	N/A	PICKUP VOLTS TAP (UV RESET):	FIELD IS TO DETERMINE AND RECORD BELOW
		RECOMMENDED VOLT TAP: 80	ACTUAL VOLT TAP: 80
		RELAY PICKUP (UV RESET):	N/A

TOLERANCES:

DROPOUT (UV TRIP) TOLERANCE: Checkpoint voltages tolerances are +/- 5%. The relay dropout (UV TRIP) setpoint tolerance is also +/- 5% with the added restriction that the UV TRIP setpoint must be less than or equal to 86.49 Volts.

SOURCE: Calc Nos. L-002588, Rev 1C and L-002589, Rev 1A. DCP EC 338375

TIMING TOLERANCE: +/- 10% SOURCE: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A

PICKUP (UV RESET) TOLERANCE N/A SOURCE: N/A

COMMENTS: DCP No. EC 338375

SUPERSEDES RSO DATED: 5/31/01 W.R. 00474712-01

ISSUED BY: T.J. Meno COMPLETED BY: BAm RETURNED TO:

ISSUE DATE: 8/23/02 COMPL DATE: 9/3/02 RETURN DATE:

FOR SAFETY-RELATED RELAYS ONLY, THE FOLLOWING INFORMATION MUST BE INCLUDED:

INDICATE THE BASIS FOR THE PROTECTIVE RELAY SETTINGS CONTAINED IN THIS RELAY SETTING ORDER:

☐ CONCURRENCE WITH A/E RECOMMENDATIONS

☐ SETTINGS PER SYSTEM PROTECTION SETTINGS GUIDE SPD-RPS-TG3 REV # ☐ DATED: ☐

☒ OTHER BASIS EXPLAIN: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A and DCP No. EC 338375.

REVIEWED BY: T. Chow INITIAL: TC DATE: 8/23/02

APPROVED BY: W. J. Miller INITIAL: [signature] DATE: 8-23-02

System Protection Department - Relay Setting Order (Nuclear)

STATION: 01, LaSalle Co. UNIT: 1 KV: 4.16 RELAY TYPE: ITE-27

EQUIPMENT: Bus 142Y Cubicle No.: 2 SAFETY-RELATED?: Yes

RELAY NO: 1427-AP040A(B) APPLICATION: Bus Loss of Voltage AP CODE: 27

A: ☒ B: ☒ C: ☒ N: ☐ RES: ☐

INSTALL: ☐ CHANGE: ☒

REPLACE: ☐ DEACTIVATE: ☐

POTENTIAL TRANSFORMER RATIO: 35 :1

TARGET TAPS: N/A

PICKUP (UV RESET) TAPS RANGE: 60-110V

DROPOUT (UV TRIP) RANGE: Approx. 97% Of Pickup

TIME DELAY RANGE: Tap 1 to 6 (0.4-12 seconds)

EXISTING:

PRIMARY RELAY DROPOUT (UV TRIP): 2625 V

SECONDARY RELAY DROPOUT (UV TRIP): 75 V

TIME DIAL/TAP: 3

TIME DELAY: 120-0V @ 1.5 seconds

PICKUP TAP (UV RESET): 70 V

RELAY PICKUP (UV RESET): N/A

NEW:

PRIMARY RELAY DROPOUT (UV TRIP): Less than or equal to 3027.15 V V

SECONDARY RELAY DROPOUT (UV TRIP): Less than or equal to 86.49 V V

TIME DELAY: TIME DELAY GREATER THAN 3.1 SEC @ 71.3 V (60% of normal)
Calibration Checkpoints: 8.3 sec +/- 10% @ 82 V +/-5%
4.3 sec +/- 10% @ 75 V +/- 5%

TIME DIAL/TAP: FIELD IS TO DETERMINE AND RECORD BELOW

RECOMMENDED TIME TAP: 3 ACTUAL TIME TAP: 3

PICKUP VOLTS TAP (UV RESET): FIELD IS TO DETERMINE AND RECORD BELOW

RECOMMENDED VOLT TAP: 80 ACTUAL VOLT TAP: 80

RELAY PICKUP (UV RESET): N/A

TOLERANCES:

DROPOUT (UV TRIP) TOLERANCE: Checkpoint voltages tolerances are +/- 5%. The relay dropout (UV TRIP) setpoint tolerance is also +/- 5% with the added restriction that the UV TRIP setpoint must be less than or equal to 86.49 Volts.

SOURCE: Calc Nos. L-002588, Rev 1C and L-002589, Rev 1A. DCP EC 338375

TIMING TOLERANCE: +/- 10% SOURCE: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A

PICKUP (UV RESET) TOLERANCE N/A SOURCE: N/A

COMMENTS: DCP No. EC 338375

SUPERSEDES RSO DATED: 5/31/01

ISSUED BY: T.J. Meno COMPLETED BY: BAM RETURNED TO:

ISSUE DATE: 8/23/02 COMPL DATE: 10/24/02 RETURN DATE:

FOR SAFETY-RELATED RELAYS ONLY, THE FOLLOWING INFORMATION MUST BE INCLUDED:

INDICATE THE BASIS FOR THE PROTECTIVE RELAY SETTINGS CONTAINED IN THIS RELAY SETTING ORDER:

☐ CONCURRENCE WITH A/E RECOMMENDATIONS

☐ SETTINGS PER SYSTEM PROTECTION SETTINGS GUIDE SPD-RPS-TG3 REV # ☐ DATED: ☐

☒ OTHER BASIS .EXPLAIN: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A and DCP No. EC 338375.

REVIEWED BY: T. Chow INITIAL: TC DATE: 8/23/02

APPROVED BY: W. J. Miller INITIAL: WJM DATE: 8-23-02

RELAY SETTING ORDER

C.E.CO. 26-4286 1-68

FROM DIST. ENG. / SYST. PLAN. ☐ OR _____ DIV. ENG

STATION 1 LASALLE Co. (AUX. POWER) KV 4.16 RELAY TYPE NGV (2) SAM (1)

A ☐ B ☐ C ☐ ☐ ☐ ± ☐ NO. ☐ INSTALL ☒ REPL. ☐ CHG. ☐ DEACTIVATE ☐

* 4160V. BUS UNDERVOLTAGE 143 (CUBICLE 102)

ZONE OR DISCHARGE	NGV13A		SAM IIK (TIMER)	
P.T. (P.R.) RATIO	35/1			
C.T. TURN RATIOS				
RANGE (RATING)	70-100V.		.05-3SEC.	SUPERSEDED BY DSO ISSUE DATE 3/29/01 REF. DIT NO. SPD-01-01-003
PRIMARY SETTING	2870V.			
SEC. SETTG (OR, VALUE)	DT 82V.			
COMPUTED TAPS				
TEST A-V CUR. LAG DEG				
TIMING	*		2.0 SEC.	

* NGV TRIPS THRU SAM TIMER

(UNIT 1)

ISSUE DATE 5-3-78 BY VEM COMPLETED 6/29/78 BY LRT

*DESIGNATIONS NOT COVERED ABOVE OR BELOW, SUCH AS LINE NO., NEW OR OLD SETTING, ETC.

DIT No SPD-01-01-003
Attachment B Pg. 2 of 2
By: _____

stem Protection Department - Relay Setting Order (Nuclear)

I: 01, LaSalle County — RELAY TYPE: SAM11A

1 — EQUIPMENT: Bus 143 Loss Of Voltage Timer — KV: 4.16 — CB #: 102

AP CODE: 62 — RELAY NO: 1427-AP041A(B)X — SAFETY-RELATED?: Yes

REASON FOR RSO: INSTALL: ☐ CHANGE: ☑ REPLACE: ☐ DEACTIVATE: ☐

EXISTING:		TO BE:	
TIME DELAY RANGE:	0.05 - 3.0 sec.	TIME DELAY RANGE:	0.05 - 3.0 sec.
TIME DIAL:	2	TIME DIAL:	2
TIME DELAY:	2.0 sec.	TIME DELAY:	2.0 SEC

RELAY TIMING TOLERANCE: see comments

TARGET TAPS: N/A

COMMENTS: Revised to document settings basis and to show tolerance of +/- 3% (+/-0.06 sec.) per Calc. No. L-002589, Rev. 1. SAM11A Relay is timer for NGV Relay

SUPERSEDES RSO DATED: N/A

PREPARED BY: L. R. Cabrera — COMPLETED BY: 4/24/01 — RETURN TO: L. Cabrera

ISSUE DATE: 3/29/01 — COMPL DATE: 4/2/01 — RETURN DATE: 4/24/01

* VERIFIED 3% TOLERANCE IN LAST CAL APPROVED 4/2/01, SAH

FOR SAFETY-RELATED RELAYS ONLY, THE FOLLOWING INFORMATION MUST BE INCLUDED: SHEETS REFLECT 3%

INDICATE THE BASIS FOR THE PROTECTIVE RELAY SETTINGS CONTAINED IN THIS RELAY SETTING ORDER:

☐ CONCURRENCE WITH A/E RECOMMENDATION

☐ PER SPD RPS TG3 SETTING GUIDE REV #: DATED:

☑ OTHER BASIS EXPLAIN: Calc. No. L-002589, Rev. 1

REVIEWED BY: T. J. Meno — INITIAL: TJM — DATE: 4/2/01

APPROVED BY: W. J. Miller — INITIAL: WJM — DATE: 4-3-1

Form revised 3/5/01 to include a section for specifying relay indicating target taps position.

DIT No. SPD-01-01-003
Attachment A, Pg. 5 of 6
By:

System Protection Department - Relay Setting Order (Nuclear)

STATION: 01, LaSalle Co. | UNIT: 2 | KV: 4.16 | RELAY TYPE: ITE-27

EQUIPMENT: Bus 241Y | Cubicle No.: 11 | SAFETY-RELATED?: Yes

RELAY NO: 2427-AP037A(B) | APPLICATION: Bus Loss of Voltage | AP CODE: 27

A: ☒ B: ☒ C: ☒ N: ☐ RES: ☐

INSTALL: ☐ CHANGE: ☒

REPLACE: ☐ DEACTIVATE: ☐

POTENTIAL TRANSFORMER RATIO: 35 :1

TARGET TAPS: N/A

PICKUP (UV RESET) TAPS RANGE: 60-110V

DROPOUT (UV TRIP) RANGE: Approx. 97% Of Pickup

TIME DELAY RANGE: Tap 1 to 6 (0.4-12 seconds)

EXISTING:

PRIMARY RELAY DROPOUT (UV TRIP): 2625 V

SECONDARY RELAY DROPOUT (UV TRIP): 75 V

TIME DIAL/TAP: 3

TIME DELAY: 120-0V @ 1.5 seconds

PICKUP TAP (UV RESET): 70 V

RELAY PICKUP (UV RESET): N/A

NEW:

PRIMARY RELAY DROPOUT (UV TRIP): Less than or equal to 3027.15 V

SECONDARY RELAY DROPOUT (UV TRIP): Less than or equal to 86.49 V

TIME DELAY: TIME DELAY GREATER THAN 3.1 SEC @ 71.3 V (60% of normal)
Calibration Checkpoints: 8.3 sec +/- 10% @ 82 V +/-5%
4.3 sec +/- 10% @ 75 V +/- 5%

TIME DIAL/TAP: FIELD IS TO DETERMINE AND RECORD BELOW

RECOMMENDED TIME TAP: 3 ACTUAL TIME TAP: 3

PICKUP VOLTS TAP (UV RESET): FIELD IS TO DETERMINE AND RECORD BELOW

RECOMMENDED VOLT TAP: 80 ACTUAL VOLT TAP: 80

RELAY PICKUP (UV RESET): N/A

TOLERANCES:

DROPOUT (UV TRIP) TOLERANCE: Checkpoint voltages tolerances are +/- 5%. The relay dropout (UV TRIP) setpoint tolerance is also +/- 5% with the added restriction that the UV TRIP setpoint must be less than or equal to 86.49 Volts.

SOURCE: Calc Nos. L-002588, Rev 1C and L-002589, Rev 1A. DCP No. EC 338414

TIMING TOLERANCE: +/- 10% SOURCE: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A

PICKUP (UV RESET) TOLERANCE: N/A SOURCE: N/A

COMMENTS: DCP No. EC 338414

SUPERSEDES RSO DATED: 5/31/01 W.R. # 00477418-01

ISSUED BY: T.J. Meno COMPLETED BY: BAm RETURNED TO:

ISSUE DATE: 8/23/02 COMPL DATE: 9/3/02 RETURN DATE:

FOR SAFETY-RELATED RELAYS ONLY, THE FOLLOWING INFORMATION MUST BE INCLUDED:

INDICATE THE BASIS FOR THE PROTECTIVE RELAY SETTINGS CONTAINED IN THIS RELAY SETTING ORDER:

☐ CONCURRENCE WITH A/E RECOMMENDATIONS

☐ SETTINGS PER SYSTEM PROTECTION SETTINGS GUIDE SPD-RPS-TG3 REV # ☐ DATED:

☒ OTHER BASIS .EXPLAIN: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A and DCP No. EC 338414

REVIEWED BY: T. Chow INITIAL: TC DATE: 8/23/02

APPROVED BY: W. J. Miller INITIAL: WJM DATE: 8-28-02

System Protection Department - Relay Setting Order (Nuclear)

STATION: 01, LaSalle Co. UNIT: 2 KV: 4.16 RELAY TYPE: ITE-27

EQUIPMENT: Bus 242Y Cubicle No.: 12 SAFETY-RELATED?: Yes

RELAY NO: 2427-AP040A(B) APPLICATION: Bus Loss of Voltage AP CODE: 27

A: ☒ B: ☒ C: ☒ N: ☐ RES: ☐

INSTALL: ☐ CHANGE: ☒

REPLACE: ☐ DEACTIVATE: ☐

POTENTIAL TRANSFORMER RATIO: 35 :1

TARGET TAPS: N/A

PICKUP (UV RESET) TAPS RANGE: 60-110V

DROPOUT (UV TRIP) RANGE: Approx. 97% Of Pickup

TIME DELAY RANGE: Tap 1 to 8 (0.4-12 seconds)

EXISTING:

PRIMARY RELAY DROPOUT (UV TRIP): 2625 V

SECONDARY RELAY DROPOUT (UV TRIP): 75 V

TIME DIAL/TAP: 3

TIME DELAY: 120-0V @ 1.5 seconds

PICKUP TAP (UV RESET): .70 V

RELAY PICKUP (UV RESET): N/A

NEW:

PRIMARY RELAY DROPOUT (UV TRIP): Less than or equal to 3027.15 V

SECONDARY RELAY DROPOUT (UV TRIP): Less than or equal to 86.49 V

TIME DELAY: TIME DELAY GREATER THAN 3.1 SEC @ 71.3 V (60% of normal)
Calibration Checkpoints: 8.3 sec +/- 10% @ 82 V +/-5%
4.3 sec +/- 10% @ 75 V +/- 5%

TIME DIAL/TAP: FIELD IS TO DETERMINE AND RECORD BELOW

RECOMMENDED TIME TAP: 3 ACTUAL TIME TAP: 3

PICKUP VOLTS TAP (UV RESET): FIELD IS TO DETERMINE AND RECORD BELOW

RECOMMENDED VOLT TAP: 80 ACTUAL VOLT TAP: 80

RELAY PICKUP (UV RESET): N/A

TOLERANCES:

DROPOUT (UV TRIP) TOLERANCE: Checkpoint voltages tolerances are +/- 5%. The relay dropout (UV TRIP) setpoint tolerance is also +/- 5% with the added restriction that the UV TRIP setpoint must be less than or equal to 86.49 Volts.

SOURCE: Calc Nos. L-002588, Rev 1C and L-002589, Rev 1A. DCP No. EC 338414

TIMING TOLERANCE: +/- 10% SOURCE: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A

PICKUP (UV RESET) TOLERANCE N/A SOURCE: N/A

COMMENTS: DCP No. EC 338414

SUPERSEDES RSO DATED: 5/31/01

ISSUED BY: T.J. Meno COMPLETED BY: M.A. Wiegand RETURNED TO: R. Bennetts

ISSUE DATE: 8/23/02 COMPL DATE: 03/11/03 RETURN DATE: 03/11/03

FOR SAFETY-RELATED RELAYS ONLY, THE FOLLOWING INFORMATION MUST BE INCLUDED:

INDICATE THE BASIS FOR THE PROTECTIVE RELAY SETTINGS CONTAINED IN THIS RELAY SETTING ORDER:

☐ CONCURRENCE WITH A/E RECOMMENDATIONS

☐ SETTINGS PER SYSTEM PROTECTION SETTINGS GUIDE SPD-RPS-TG3 REV # ☐ DATED: ☐

☒ OTHER BASIS EXPLAIN: Calculation Nos. L-002588, Rev 1C and L-002589, Rev 1A and DCP No. EC 338414

REVIEWED BY: T. Chow INITIAL: TC DATE: 8/23/02

APPROVED BY: W. J. Miller INITIAL: WJM DATE: 8-27-02

RELAY SETTING ORDER

C.E.CO. 58-4804 1-43

FROM ☐ DIST. ENG. ☒ BY ST. PLAN. ☐ OR _____ DIV. ENG.

STATION 1- LASALLE Co. (AUX. POW.) KV 4.16 RELAY TYPE NGV SAM

A ☐ B ☐ C ☐ REG. ☐ ÷ ☐ BL ☐ INSTALL ☒ REPL. ☐ CHG. ☐ DEACTIVATE ☐

* 4160V. SW.GR. 243 (CUB. 102) UNDERVOLTAGE

ZONE OR EL. (CHARG.)	NGV13A	SAM11A (TIMER)		
P.T. (P.R.) RATIO	35/1			
C.T. TURN RATIOS	—			
RANGE (RATING)	70-100V.	.05-3Sec.	SUPERSEDED BY RSO ISSUE DATE 3/29/01	
PRIMARY SETTING	2870 V.		REF. DIT NO SPD-01-01-003	
[illegible]	D=82V.			
COMPUTED TAPS				
TEST A-V CUR. LAG DEG				
TIMING	*	2.0 Sec.		

* NGV TRIPS THRU SAM TIMER

(UNIT 2)

ISSUE DATE 11-2-78 BY VEM COMPLETED 7MAR BY 11/20/80

* DESIGNATIONS NOT COVERED ABOVE OR BELOW, SUCH AS LINE NO., NEW OR OLD SETTING, ETC.

DIT No. SPD-01-01-003
Attachment B, Pg. 1 of 2
By [illegible]

tem Protection Department - Relay Setting Order (Nuclear)

01, LaSalle County — RELAY TYPE: SAM11A

2 EQUIPMENT: Bus 243 Loss Of Voltage Timer — KV: 4.16 — CB #: 102

E: 62 — RELAY NO: 2427-AP041A(B)X — SAFETY-RELATED?: Yes

REASON FOR RSO: INSTALL: ☐ CHANGE: ☑ REPLACE: ☐ DEACTIVATE: ☐

EXISTING:		TO BE:	
TIME DELAY RANGE:	0.05 - 3.0 sec.	TIME DELAY RANGE:	0.05 - 3.0 sec.
TIME DIAL:	2	TIME DIAL:	2
TIME DELAY:	2.0 sec.	TIME DELAY:	2.0 SEC

RELAY TIMING TOLERANCE: see comments

TARGET TAPS: N/A

COMMENTS: Revised to document settings basis and to show tolerance of +/- 3% (+/-0.06 sec.) per Calc. No. L-002589, Rev. 1. SAM11A Relay is timer for NGV Relay.

SUPERSEDES RSO DATED: N/A

PREPARED BY: L. R. Cabrera — COMPLETED BY: JRB 4/24/01 * — RETURN TO: L. CABRERA

ISSUE DATE: 3/29/01 — COMPL DATE: 2/7/01 — RETURN DATE: 4/24/01

* VERIFIED LAST CAL REFLECTED ± 3% TOLERANCE ALREADY. Data Sheets Reflect 3%.

FOR SAFETY-RELATED RELAYS ONLY, THE FOLLOWING INFORMATION MUST BE INCLUDED:

INDICATE THE BASIS FOR THE PROTECTIVE RELAY SETTINGS CONTAINED IN THIS RELAY SETTING ORDER:

CONCURRENCE WITH A/E RECOMMENDATION

PER SPD RPS TG3 SETTING GUIDE REV #: DATED:

✓ OTHER BASIS EXPLAIN: Calc. No. L-002589, Rev. 1

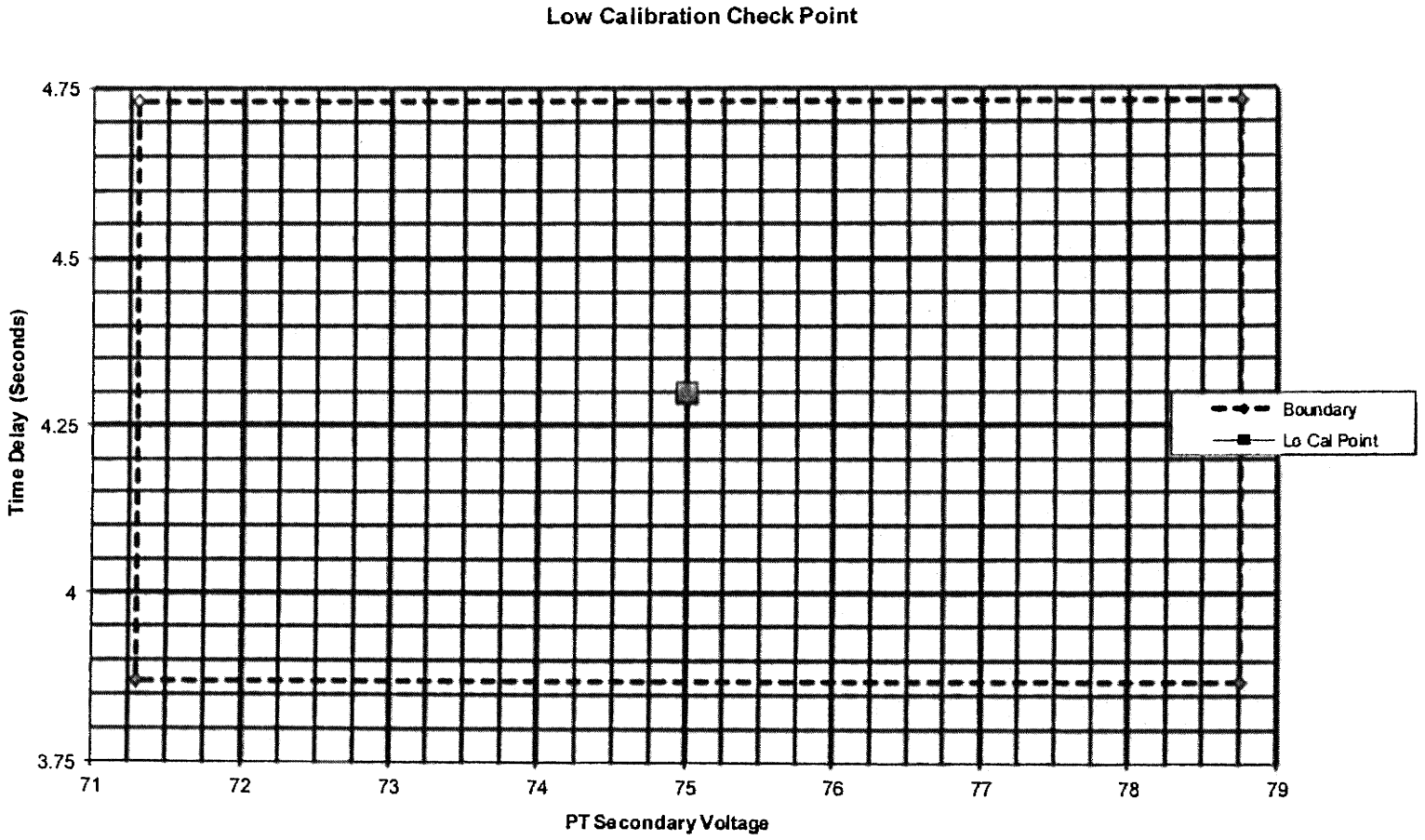
REVIEWED BY: T. J. Meno — INITIAL: TJM DATE: 4/2/01

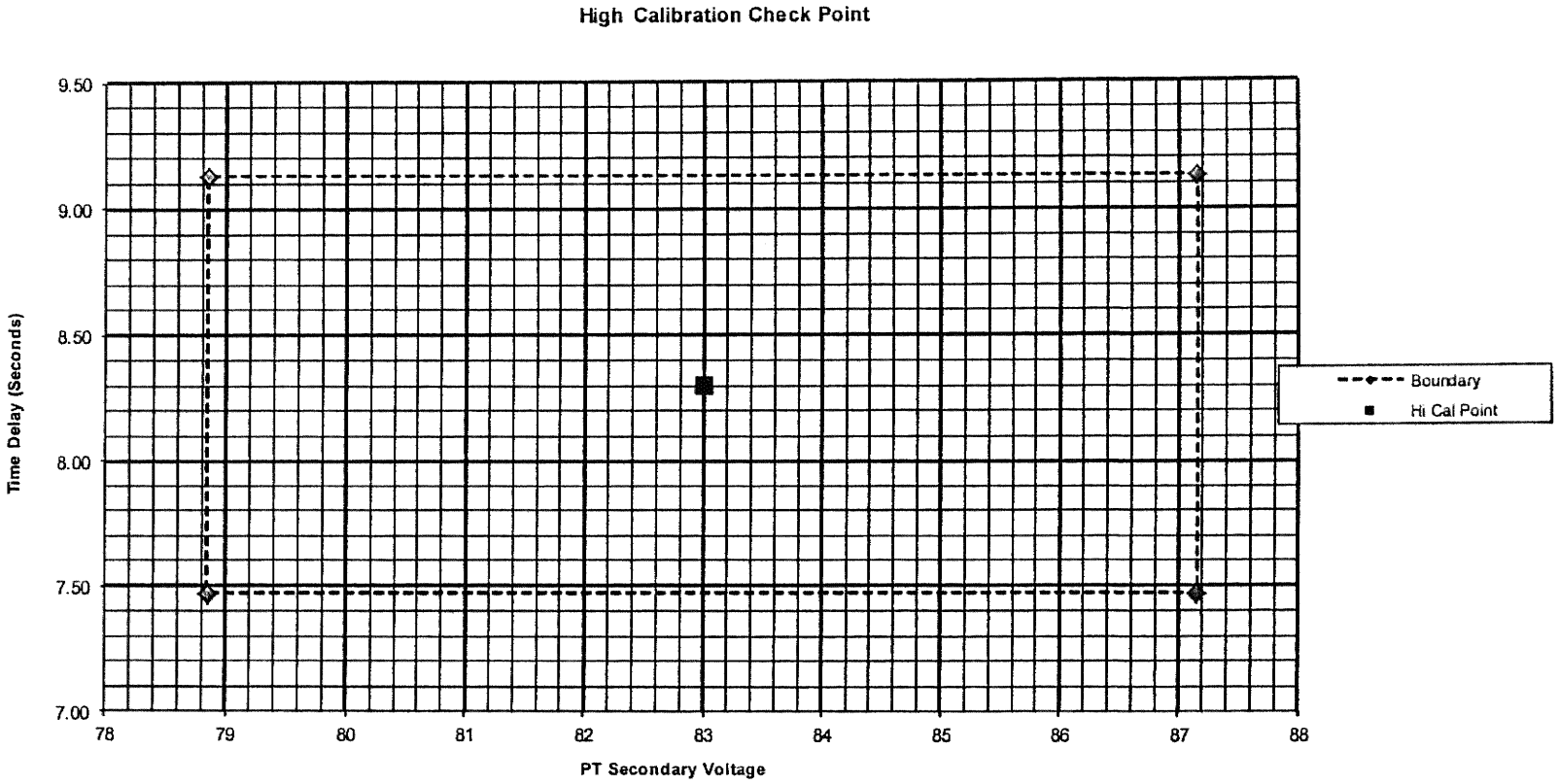
APPROVED BY: W. J. Miller — INITIAL: WJM DATE: 4-3-1

Form revised 3/5/01 to include a section for specifying relay indicating target taps position.

DIT No. SPD-01-01-003
Attachment A, Pg. 6 of 6
By:

Acceptance Regions for Calibration Checkpoints for ITE-27 Relays




High Calibration Check Point
9.50
9.00
8.50
8.00
7.50
7.00
Time Delay (Seconds)
78
79
80
81
82
83
84
85
86
87
88
PT Secondary Voltage
Boundary
Hi Cal Point