Submittal Review Response

Project Name:	***Hilo WWTP Rehabilitation and Replacement Project Phase 1***
Submittal No.:	***16305-001.0***
Date:	***9/10/2025***

Client:	County of Hawaiʻi	**Carollo Project No.:**	203975
Contractor:	Nan, Inc.		
Submittal Name:	Electrical System Studies Qualifications Quality Assurance		
Reviewed By:	Kellen Gross		

SUBMITTAL REVIEW		
Review is for general compliance with contract documents. No responsibility is assumed by Carollo for correctness of quantities, dimensions, and details. No deviation or variation is approved unless specifically addressed in these review comments. Refer to Section 01330 for additional requirements. The Contractor shall assume full responsibility for coordination with all other trades and deviations from contract requirements.		
Approved	☒	No Exceptions
	☐	Make Corrections Noted - See Comments
	☐	Make Corrections Noted - Confirm
Not Approved	☐	Correct and Resubmit
	☐	Rejected - See Remarks
Receipt Acknowledged	☐	Filed for Record
	☐	With Comments - Resubmit

Review Comments:

1. Approved.

☐ High Priority

CONTRACTOR SUBMITTAL TRANSMITTAL FORM REV. A

Owner: County of Hawaii

Contractor: Nan, Inc.

Project No.: WW-4705R

Project Name: Hilo WWTP Phase 1

Submittal Number:

Submittal Title: 16305 - Quality Assurance

☐ For Information Only

TO: County

From: Nan Inc.

Specification No. and Subject of Submittal / Equipment Supplier	
Spec: 16305	**Paragraph:** 1.05
Authored By: David Wieseler	**Date Submitted:** 8/25/2025

Submittal Certification

Check Either (A) or (B):

☑ (A) We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings with no exceptions.

☐ (B) We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings except for the deviations listed.

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

General Contractor's Reviewer's Signature: [signature]

Printed Name and Title: Mark McCarthy QC

In the event, Contractor believes the Submittal response does or will cause a change to the requirements of the Contract, Contractor shall immediately give written notice stating that Contractor considers the response to be a Change Order.

Firm: **Signature:** **Date Returned:**

PM/CM Office Use

Date Received GC to PM/CM:

Date Received PM/CM to Reviewer:

Date Received Reviewer to PM/CM:

Date Sent PM/CM to GC:

Nan, Inc

PROJECT: HILO WWTP REHABILITATION AND REPLACEMENT PROJECT - PHASE 1

JOB NO. WW-4705R

THIS SUBMITTAL HAS BEEN CHECKED BY THIS CONTRACTOR. IT IS CERTIFIED CORRECT, COMPLETE, AND IN COMPLIANCE WITH CONTRACT DRAWINGS AND SPECIFICATIONS. ALL AFFECTED CONTRACTORS AND SUPPLIERS ARE AWARE OF, AND WILL INTEGRATE THIS SUBMITTAL (UPON APPROVAL) INTO THEIR OWN WORK.

DATE RECEIVED 7/5/2025
SPECIFICATION SECTION # 16305
SPECIFICATION Quality Assurance
PARAGRAPH 1.05
DRAWING
SUBCONTRACTOR Mass Electric
SUPPLIER
MANUFACTURER

CERTIFIED BY CQCM or Designee : [signature]

Submittal

SUB Reference No : MECI-SUB-0002

Status: OUTSTANDING

For Action: Darrin Lee, MECI
David Wieseler, MECI

Project: HILO WWTP REHABILITATION AND REPLACEMENT PROJECT

Subject: **ELECTRICAL SYSTEMS STUDIES: QUALITY ASSURANCE**

Submittal on quality assurance for the qualifications of the entity responsible for completing the electrical systems studies. Information provided is derived from Specification 16305 Section 1.05.

Submitted For: Approval

Specification Reference : 16305 - ELECTRICAL SYSTEM STUDIES

Paragraph No.: 1.05

Description : Qualifications of the entity responsible for completing the electrical systems studies.

Discipline: ELEC **Area:** 00

Attachments:	HWWTP - Electrical Systems Study QA.pdf	
SUB by:	Hannah Anderson, MECI	On: 22 August 2025
Created By:	Hannah Anderson, MECI	On: 22 August 2025, 01:33:26 PM -10:00
Last Edited By:	David Wieseler, MECI	On: 22 August 2025, 01:49:39 PM -10:00

01 - QC/Project Engineer Review

No comment.

QC/Project Engineer Review by:	David Wieseler, MECI	On: 22 August 2025
Created By:	David Wieseler, MECI	On: 22 August 2025, 01:49:39 PM -10:00
Last Edited By:	David Wieseler, MECI	On: 22 August 2025, 01:49:39 PM -10:00

02 - Project Manager Review

great

Project Manager	Darrin Lee, MECI	On: 22 August 2025

Review by:		
Created By:	Darrin Lee, MECI	On: 22 August 2025, 01:53:54 PM -10:00
Last Edited By:	Darrin Lee, MECI	On: 22 August 2025, 01:53:54 PM -10:00

03 - Response

Response by:	Darrin Lee, MECI	On: 22 August 2025
Created By:	Darrin Lee, MECI	On: 22 August 2025, 01:54:55 PM -10:00
Last Edited By:	Darrin Lee, MECI	On: 22 August 2025, 01:54:55 PM -10:00

04 - Project Manager/Engineer Closeout

Project Manager/Engineer Closeout by:		On:
Created By:		On: ,
Last Edited By:		On: ,

Electrical System Studies Qualifications

Quality Assurance

16305 1.05

mass. electric construction company

HILO WWTP

MASS ELECTRIC HAWAII

Personnel Resume

Steven McGovern, P.E.
Power Systems Specialist Engineer, Power Systems Engineering
Eaton Electrical Engineering Services & Systems

EDUCATION

BSc (Eng) in Electrical and Electronic Engineering, Dublin Institute of Technology, Ireland 2001.

MPhil (Elec Eng) in Electrical Engineering, Dublin Institute of Technology, Ireland 2004.

Jacobs Engineering – Dublin, Ireland 2004 – 2005

PROFESSIONAL ACTIVITIES

- Registered Professional Engineer
  - California (P.E. # E19912)
  - Hawaii (P.E. # E15704)
  - Nevada (P.E. # 026064)
  - Utah (P.E. # 11017282-2202)
  - Washington (P.E. # 21024183)
  - South Dakota (P.E. # 16484)
  - Wyoming (PE 20521)
- Member of the Institute of Electrical and Electronics Engineers (IEEE), Power Engineering and Industry Applications Societies
- Member of International Association of Electrical Inspectors (IAEI) Border Counties division

TRAINING QUALIFICATIONS

- Qualified electrical worker certified through the Eaton Field Certified program (Class 3).
- First-Aid and CPR certified by the American Red Cross

EXPERIENCE

Presently a Power Systems Specialist Engineer at Eaton Corporation – Electrical Engineering Services and Systems Division based in San Diego, California. He is performing power system analysis and design as well as providing technical resource support for team engineers. From 2009 to 2018 Steven worked for Schneider Electric Engineering Services (SEES) as Principal Electrical Engineer for the Southern California and Hawaii territories managing the regional team of engineers whilst performing detailed engineering analysis and engaging customer solutions. His experience includes various power system analyses; such as short circuit, protective device coordination, arc flash hazard, power quality, harmonics, load flow/voltage drop, motor starting and relay programming for commercial, industrial and institutional projects both new construction and existing facilities. Steven has also completed numerous Grounding System Assessments and Testing projects. Steven actively assists customers in evaluating their compliance with the National Fire Protection Association (NFPA) guidelines enforced by the Occupational Health and Safety Administration (OSHA). In addition, tasks involve onsite investigations of existing power systems, collecting and analyzing power data, preparing and presenting technical reports of findings and recommendations for power systems. He is a registered Professional Engineer (P.E.) in the states of California, Hawaii, Nevada and Utah.
Steven received his BSc (Eng) Bachelor's Degree in Electrical and Electronic Engineering from Trinity College Dublin (TCD) and the Dublin Institute of Technology (DIT) in 2001. He successfully obtained is Master's Degree (MPhil) in Electrical Engineering at the Dublin Institute of Technology (DIT) in 2004. Following this Steven worked as a design engineer with Jacobs International Engineering and later moved to INTEL where he was employed as the lead facilities electrical engineer with responsibilities for the management, maintenance, design and implementation of new and upgrade projects, systems analysis/tracking and overall ownership for the electrical systems at three large fabrication plant's at the Ireland facility.

As a lead engineer, Steven McGovern is also actively involved in providing proposals for power systems studies and the management of large and complex projects involving multiple engineers. Steven is active in a number of Eaton PSE standards committees.

Power System Study Project Experience

- Short-circuit, coordination, arc flash, load flow, and harmonics analysis studies for many high-profile projects.

- Selective coordination for many health care facilities including new construction and existing facility renovations.
- Harmonic analysis and harmonic filter design studies for several large industrial customers.
- Industrial plant & utility generation plant relay protection (generator, transformer, & motor protection).
- Grounding systems evaluations and investigations
- Active expert in SKM PowerTools for Windows, ETAP and EasyPower electrical analyses softwares

SOFTWARE TO BE USED
FOR THIS PROJECT

Other Project Experience
- Medium and high voltage protection relays
- Arc Flash mitigation solutions
- IEEE 519 harmonic analysis
- Power Factor Correction
- Harmonic Filter Sizing

Field Experience
- Field data collection for power system studies.
- Power quality investigations.
- Troubleshooting of system failures and equipment malfunctions.
- Power system grounding investigations.

SOUNDS GOOD

SECTION 16305

ELECTRICAL SYSTEM STUDIES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Short-circuit fault analysis study.
   2. Protective device coordination study.
   3. Arc-flash hazard study.

1.02 REFERENCES

A. Definitions:
   1. Modified: Equipment with load additions or with loads being removed that affect fault current, include new overcurrent protective devices that require settings and device coordination, or require additional/removal/replacement of arc flash labels.

B. Standards:
   1. American National Standards Institute (ANSI).
   2. Institute of Electrical and Electronics Engineers (IEEE):
      a. 1584 - IEEE Guide for Specification of Scope and Deliverable Requirements for an Arc-Flash Hazard Calculations Study in Accordance with IEEE Std 1584(TM).
   3. National Fire Protection Association (NFPA):
      a. 70E - Standard for Electrical Safety in the Workplace.

1.03 DELEGATED DESIGN

A. As specified in Section 01357 - Delegated Design Procedures.

B. Signed and Sealed electrical system study reports.

1.04 SUBMITTALS

A. Furnish submittals as specified in Section 01330 - Submittal Procedures.

B. Initial studies and reports:
   1. Include the following in the initial short-circuit current report:
      a. List of all devices included in the studies.
      b. A description of all operating scenarios.
      c. Form and format of arc-flash labels.

C. Delegated Design final studies and reports:
   1. Format and quantity:
      a. Provide 3 bound copies of all final reports.

b. Provide 3 complete sets of electronic files on CD or DVD media, including the electrical system model(s), configuration files, custom libraries, and any other files used to perform the studies and produce the reports. Also provide an electronic version of the bound reports in PDF format.

2. Include the sections below in the final report:
   a. Copies of correspondence and data obtained from the electric utility company.
   b. Letter certifying the inspection and verification of existing equipment and incorporation of applicable RFI's and change orders.
   c. One-line diagrams:
      1) The following information shall be included at a minimum:
         a) Motor horsepower.
         b) Transformer data:
            (1) kVA.
            (2) Configuration.
         c) Cable data:
            (1) Insulation.
            (2) Size.
            (3) Length.
      2) One-line diagrams shall be fully legible at 11-inch by 17-inch size.
   d. Include in the short-circuit fault analysis study:
      1) Descriptions, purpose, basis, assumptions, recommendations, and scope of the study.
      2) Normal system connections and those that result in maximum fault conditions.
      3) Tabulation of circuit breaker, fuse, and other protective device ratings compared to maximum calculated short-circuit duties.
      4) Fault current calculations for the cases run including a definition of terms and guide for interpretation of computer software printouts.
   e. Protective device coordination study shall include:
      1) Descriptions, purpose, basis, assumptions, recommendations, and scope of the study.
      2) List all requirements used in the selection and setting criteria for any protective devices.
      3) TCCs graphically indicating the coordination proposed for the system on log-log graphs:
         a) All TCCs shall be in color.
      4) Tabulation of relay, fuse, circuit breaker, and other protective devices in graphical form with a one-line diagram to display area coordination.
      5) Where coordination could not be achieved, an explanation shall be included in the report to support the statement along with recommendations to improve coordination. Recommended equipment modifications or settings shall be in a tabulated form.
      6) All protective device settings in a tabulated format.
   f. Include in the arc-flash hazard study:
      1) Descriptions, purpose, basis, assumptions, recommendations, and scope of the study.
      2) Normal system connections and those that result in maximum arc-flash conditions.
      3) Arc-flash raw data, calculations, and assumptions.

4) Arc-flash label data:
   a) Identifying the content of each label.
   b) Identifying the location of each label.

D. Submit the credentials of the individual(s) performing the study and the individual in responsible charge of the study.

E. Submit course outline for Owner's training.

1.05 QUALITY ASSURANCE

A. Qualifications of the entity responsible for electrical system studies:
   1. A minimum of 5 years of experience in power system analysis is required for the individual in responsible charge of the studies.
   2. The short-circuit fault analysis, protective device coordination, and arc-flash hazard studies shall be performed with the aid of a digital computer program:
      a. Point-to-point calculations are not acceptable.

B. The study shall be performed by an independent firm or the equipment manufacturer of the Switchboard addition.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. The individual performing the studies shall visit the site and collect all necessary field data in order to perform and complete comprehensive electrical system studies.
   2. Obtain, for all equipment, the required data for preparation of the study including, but not limited to:
      a. Transformer kilovolt-ampere (kVA), nameplate data, and impedances.
      b. Generator impedances, kilovolt-ampere (kVA), and voltage.
      c. Generator decrement curves.
      d. Bus withstand ratings.
      e. Cable and bus data.
      f. Protective device taps, time dials, instantaneous pickups, and time-delay settings.
      g. As-built lengths for all new wire and cable installations covered by the studies.
      h. Grounding schemes (solidly grounded or resistive grounded).
   3. Obtain the Electric Utility information on the minimum and maximum available fault current, minimum and maximum utility impedances, utility protective device settings including manufacturer and model number, interrupting ratings, X/R ratios, and model information one level above the point of connection:
      a. Utility tolerances and voltage variations.
   4. Obtain equipment layouts and configurations from the manufacturer's final submittal requirements and project layout drawings as required.
   5. Bus and conductor data:
      a. Use impedances of the actual installed or specified conductors, unless otherwise indicated.
      b. Use cable and bus impedances calculated at 25 degrees Celsius, unless otherwise indicated.

c. Use 600-volt cable reactance based on typical dimensions of actual installed or specified conductors, unless otherwise indicated.
d. Use bus withstand values for all equipment having buses.

B. Use medium-voltage cable reactance based on typical dimensions of shielded cables with 133 percent insulation levels, unless otherwise indicated.

C. Certification:
1. Submit written certification signed by the professional engineer conducting the study, equipment supplier, and electrical subcontractor stating that the data used in the study is correct and captures all RFI's, as-builts, and change orders affecting the study.

D. Meetings:
1. Electrical system study meetings:
a. The individual conducting the electrical system studies leads the meeting.
b. Meet with the Owner and Engineer 3 times.
c. The purpose of the 3 meetings is as follows:
1) Initial meeting:
a) Timing:
(1) After delegated design qualifications have been submitted and approved.
(2) Prior to producing any electrical equipment submittals.
b) Meet with the Owner and Engineer to discuss the scope of the studies.
(1) Confirm assumptions to be used in the electrical system study with the Owner including but not limited to:
(a) Maximum protective device fault clearing time.
c) Discuss the Owner's operational requirements for both normal operation and maintenance.
2) Preliminary results meeting:
a) Timing":
(1) After the studies have been completed, reviewed, and accepted by the Engineer.
b) The purpose of this meeting is to inform the Owner of the results of the study and impacts on normal operation and maintenance including:
(1) Protective device coordination problems and recommended solutions.
(2) Explanation of the arc-flash hazard study results and its potential impact on operations.
(3) Recommendations for reduction of arc-flash category levels including reduction of protective device settings or changes in operational practices.
3) Final meeting:
a) Timing:
(1) Prior to substantial completion.
b) Discuss changes to the studies based on the previous meeting.
c) Discuss with the Owner how changes to the electrical system may change the arc-flash hazard category.

E. Sequencing:
   1. Below is an outline of the typical work sequence. Proposed changes to the work sequence may be reviewed and approved by the Engineer.
      a. Site visit to gather data on the existing facility systems for all studies:
         1) Make multiple trips as required to obtain all data for the short-circuit fault analysis, protection device coordination, and arc flash hazard studies.
      b. Initial electrical system study meeting.
      c. Submit the initial short-circuit fault analysis study before submittal of any electrical equipment.
         1) Only the initial short-circuit results will be reviewed.
      d. Submit the preliminary short-circuit fault analysis, protective device coordination, and arc-flash hazard studies after the approval of all electrical equipment.
      e. Second electrical system study meeting for preliminary results.
      f. Update the model with all changes to the electrical system made during start-up and commissioning.
      g. Final arc-flash meeting and final short-circuit fault analysis, protective device coordination, and arc-flash hazard studies.
      h. Submit the final electrical system studies.
      i. Label equipment with approved arc-flash labels.
      j. Owner's training.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. General study requirements:
   1. Scope:
      a. The short-circuit fault analysis, protective device coordination, and arc-flash hazard studies shall include all equipment in the power distribution system including, but not limited to:
         1) Service entrance equipment (service entrance transformer and primary protective device).
         2) Available utility fault contribution current.
         3) All electrical equipment including:
            a) Dry-type transformers.
            b) 240- and 208-volt panelboards.
         4) Generators.
         5) Motors.
         6) Vendor control panels.
         7) HVAC equipment.
      b. Study scenarios:
         1) The studies shall include all possible electrical system configurations, for example:
            a) Operation on normal (utility) source.
            b) Operation on generator source.
            c) Operating on single utility source – One source out of service and both ties closed.

2. Motors:
   a. Each motor shall be individually modeled:
      1) Grouping of motors for fault contribution current is not acceptable.
   b. Motors with variable frequency drives (VFDs) may be assumed to have no contribution to fault current, unless VFDs are equipped with Bypass Contactors.
      1) If VFDs are equipped with bypass contactors, perform the fault current and arc flash study assuming all of bypass contactors are in the closed position.
3. Use the equipment, bus, and device designations as indicated on the Drawings for all studies.

B. Short-circuit fault analysis study additional requirements:
1. The short-circuit fault analysis shall be performed and submitted in 2 phases:
   a. Initial short-circuit fault analysis:
      1) Based on the Contract Documents and Electric Utility information.
      2) The initial short-circuit fault analysis study shall indicate the estimated available short-circuit current at the line side terminals of each piece of equipment covered by the scope of the study.
         a) Measure conductor lengths from the Drawings. Use of arbitrary short conductor lengths is not allowed.
      3) Provide a list of assumptions used in the initial study.
   b. Final short-circuit fault analysis:
      1) The final short-circuit fault analysis shall modify the initial analysis as follows:
         a) Utilize the actual equipment provided on the project.
         b) Utilize conductor lengths based on installation.
2. Calculate 3-phase bolted fault, line-to-line fault, line-to-ground fault, double line-to-ground fault, short-circuit 1/2 cycle momentary symmetrical and asymmetrical RMS, 1-1/2 to 4 cycle interrupting symmetrical RMS, and 30-cycle steady-state short-circuit current values at each piece of equipment in the distribution system.
3. Evaluate bus bracing, short-circuit ratings, fuse interrupting capacity and circuit-breaker-adjusted interrupting capacities against the fault currents, and calculate X/R values:
   a. Identify and document all devices and equipment as either inadequate or acceptable.
4. Calculate line-to-ground and double line-to-ground momentary short-circuit values at all buses having ground-fault devices.
5. Provide calculation methods, assumptions, one-line diagrams, and source impedance data, including utility X/R ratios, typical values, recommendations, and areas of concern.

C. Protective device coordination study additional requirements:
1. Furnish protective device settings for all functions indicated on the Drawings including, but not limited to:
   a. Current.
   b. Voltage:
      1) Provide settings for all voltage relays based upon actual utility and generator tolerances and specifications.

c. Frequency:
   1) Provide settings for all frequency relays based upon actual utility and generator tolerances and specifications.
d. Negative sequence.
e. Reverse power.
f. Machine protection functions:
   1) Provide settings for all motor and generator protective relays based on the manufacturer's recommended protection requirements.

2. Provide log-log form time-current curves (TCCs) graphically indicating the coordination proposed for the system:
   a. Include with each TCC a complete title and one-line diagram with legend identifying the specific portion of the system covered by the particular TCC:
      1) Typical TCCs for identical portions of the system, such as motor circuits, are acceptable as allowed by the Engineer.
   b. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics:
      1) These details can be included on the TCC.
   c. Include a detailed description of each protective device tap, time dial, pickup, instantaneous, and time delay settings:
      1) These details can be included on the TCC.
3. TCCs shall include all equipment in the power distribution system where required to demonstrate coordination. Include utility relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, transformer characteristics, motor and generator characteristics, and characteristics of other system load protective devices:
   a. Include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, main breaker in branch panelboards, and fused disconnect switches.
   b. Provide ground fault TCCs with all adjustable settings for ground fault protective devices.
   c. Include manufacturing tolerances and damage bands in plotted fuse and circuit breaker characteristics.
   d. On the TCCs, show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and transformer damage curves.
   e. Cable damage curves.
   f. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed based on the short-circuit fault analysis study.
   g. Coordinate time interval medium-voltage relay characteristics with upstream and downstream devices to avoid nuisance tripping.
4. Site generation: When site generation (including cogeneration, standby, and emergency generators) is part of the electrical system, include phase and ground coordination of the generator protective devices:
   a. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices.
5. Suggest modifications or additions to equipment rating or settings in a tabulated form.

D. Arc-flash hazard study additional requirements:
   1. Include the calculated arc-flash boundary and incident energy (calories/square centimeter) at each piece of equipment in the distribution system:
      a. Perform study with 15 percent arcing fault variation in accordance with IEEE 1584.
      b. Perform arc-flash calculations at minimum and maximum utility and generator fault contributions.
      c. Perform arc-flash calculations for both the line side and load side of the switchgear, switchboard, motor control center, and panelboard main breakers.
      d. Perform arc-flash calculations for all short-circuit scenarios with all motors on for 3 to 5 cycles and with all motors off.
   2. Provide executive summary of the study results:
      a. Provide summary based upon worst case results.
   3. Provide a detailed written discussion and explanation of the tabulated outputs:
      a. Include all scenarios.
   4. Provide alternative device settings to allow the Owner to select the desired functionality of the system:
      a. Minimize the arc-flash energy by selective trip and time settings for equipment maintenance purposes.
      b. Identify the arc-flash energy based upon the criteria of maintaining coordination and selectivity of the protective devices.

2.02 MANUFACTURERS

A. Electrical system study software: One of the following or equal:
   1. Operation Technology, Inc., ETAP.
   2. SKM Systems Analysis, Powertools.

2.03 COMPONENTS

A. Arc-flash hazard labels:
   1. Dimensions:
      a. Minimum 5 inches by 3.5 inches.
   2. Materials:
      a. Polyester with polyvinyl polymer over-laminate.
      b. Self-adhesive.
      c. Resistant to:
         1) UV.
         2) Chemicals and common cleaning solvents.
         3) Scuffing.
         4) Wide temperature changes.
   3. Contents:
      a. Short-circuit bus identification.
      b. Calculated incident energy (calories/square centimeter) range:
         1) Based on worst-case study results.
      c. Arc-flash protection boundary.
      d. Shock hazard boundary:
         1) The Contractor may provide separate labels for indication of the shock hazard boundary.

e. Fed from:
   1) Identify the tag number of the upstream equipment providing power.

4. Color scheme:
   a. For locations above 40 calories/square centimeter:
      1) White label with red “DANGER” strip across the top.
      2) Black lettering.
   b. For locations below 40 calories/square centimeter:
      1) White label with orange “WARNING” strip across the top.
      2) Black lettering.

PART 3 EXECUTION

3.01 INSTALLATION

A. After review and acceptance of the arc-flash hazard study by the Engineer, install all arc-flash hazard labels:
   1. Install labels at all locations required by NFPA, ANSI, or IEEE standards.
   2. At a minimum, install labels in the following locations:
      a. The front of each main or incoming service compartment.
      b. The front of each low-voltage switchgear section.
      c. The front of each medium-voltage circuit breaker door.
      d. The front of each accessible auxiliary or conductor compartment.
      e. Each accessible rear or side vertical section.
      f. Each motor control center vertical section.
      g. Each panelboard covered by the study.
      h. Each control panel, individual starter or VFD, or other equipment covered by the scope of the study.

3.02 COMMISSIONING

A. As specified in Section 01756 - Commissioning.

B. Owner Training:
   1. Include, but is not limited to:
      a. Introduction and basics of NFPA 70E: 2 hours 1 sessions.
      b. Detailed review of the electrical system study 2 hours 1 session.

3.03 FIELD QUALITY CONTROL

A. The individual performing the arc-flash hazard study shall direct the installation of the arc-flash hazard labels:
   1. Remove and replace any improperly applied labels.
   2. Repair the equipment finish damaged by removal of any label.
   3. Install labels level or plumb across the entire dimension of the label.

3.04 ADJUSTING

A. After review and acceptance of the draft arc-flash hazard study and protective device coordination study by the Engineer, adjust protective device settings per final study prior to equipment energization.
   1. Devices that require power for configuration may be set during energization, but before any subfed loads are energized.
      Ensure that settings for upstream equipment are set prior to energizing downstream devices. Provide documentation that protective devices are set per the study recommendation.

END OF SECTION