U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Air Traffic Organization Policy

**ORDER
JO 6950.27B**

Effective Date:
07/06/2022

SUBJ: Power System Studies

1. This order establishes the policy and procedures for power system studies, which are required to ensure that the power distribution system infrastructure that supports National Airspace System (NAS) facilities is adequate and resilient.

2. This order is intended to meet the regulations established by the Occupational Safety and Health Administration and the consensus standards established by the National Fire Protection Association (NFPA), including the National Electrical Code (NFPA 70), the Standard for Electrical Safety in the Workplace (NFPA 70E), and the Recommended Practice for Electrical Equipment Maintenance (NFPA 70B).

3. Electrical studies are an integral part of power distribution system design, operations, and maintenance. These engineering studies generally cover the following areas of power distribution system design:

a. Power load-flow analysis (PLFA)

b. Short-circuit analysis (SCA)

c. Protective device coordination analysis (PDCA)

d. Arc flash risk assessment (AFRA)

e. Harmonic analysis

f. Engineering design and maintenance-related studies required to ensure adequacy of the power distribution system.

4. The basic mission of the Federal Aviation Administration (FAA) is to provide the safest, most efficient aerospace system in the world. Power Services Group is responsible for providing electrical power of proper quality, reliability, maintainability, and availability that fully supports the operational requirements of the NAS. The underlying philosophy is to construct power distribution systems that are based upon fundamental engineering design principles and practices and will provide (1) continuity of service; (2) protection of people and equipment, and; (3) selective fault isolation where needed in the electrical distribution system. The planning, design, and operation of these power systems require engineering studies to evaluate and ensure proper adequacy, reliability, and safety for the electrical power systems.

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RECORD OF CHANGES DIRECTIVE NO. JO 6950.27B

CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE	CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE
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Chapter 1. General Information

1. Purpose of This Order. This order establishes the policy, procedures, and guidance to conduct the power system studies required to ensure adequacy and resiliency of the power distribution system infrastructure supporting National Airspace System (NAS) facilities. Federal Aviation Administration (FAA) Power Distribution Systems will provide (1) continuity of service; (2) protection of people and equipment, and; (3) selective fault isolation where needed in the electrical distribution system.

2. Audience. The audience for this order will typically consist of engineers, designers, technicians, and managers directly involved with a power system's design, construction, renovation, installation, maintenance, and operation at FAA facilities. The audience may be FAA employees, or they may be employees of a firm working under a contract with the Government. The reader is encouraged to review Order JO 3900.64 Air Traffic Organization Electrical Safety Program for additional information related to electrical hazards.

3. Where Can I Find This Order. You can find an electronic copy of this order on the Directives Management System (DMS) website at https://employees.faa.gov/tools_resources/orders_notices/. Or go to the MyFAA employee website, select "Tools & Resources" and then select "Orders and Notices". This order is also available on the Power Services Group's, Orders, Standards, and Specifications website: https://my.faa.gov/org/linebusiness/ato/operations/facilities_engineering/power_services/sys_eng_team/stand_specs.html.

4. Cancellation. This order cancels FAA Order 6950.27A, Power System Analyses: Load Flow Calculations, Short Circuit Analysis, Protective Device Coordination Studies, and Arc Flash Risk Assessment, dated April 13, 2016.

5. Explanation of Policy Changes. This revision extensively updates JO 6950.27A by enhancing requirements related to the design and engineering analysis associated with power system studies. The revisions incorporate informative guidance for how to conduct and prepare power system studies to ensure compliance with the order. Major and minor changes include the following:

a. Renaming the order from "Power System Analyses: Load Flow Calculations, Short Circuit Analysis, Protective Device Coordination Studies, and Arc Flash Risk Assessment" to "Power System Studies."

b. A documented effort must be made to reduce the arc flash incident energy to the lowest level possible. The study report should include commentary for every location with calculated incident energy above 4 cal/cm^2 for purpose of documenting the effort, such as reviewing the overcurrent protective device selection and settings, to achieve objective of reducing arc flash incident energy to the lowest possible levels with selected devices.

c. Adding informative material to standardize the implementation, submission, and approval process for power studies.

d. Making editorial revisions and updating referencing for codes and industry standards.

Chapter 2. Power Study: General Requirements

1. Overview. FAA projects, including the initial design and sustainment of equipment or infrastructure, typically involve some level of electrical power design. This chapter provides criteria for determining when and to what extent a power study is needed and the roles and responsibilities of those undertaking it.

a. Power studies include analysis covering the following areas:

(1) Power load-flow analysis (PLFA)

(2) Short-circuit analysis (SCA)

(3) Protective device coordination analysis (PDCA)

(4) Arc-flash risk assessment (AFRA)

(5) Harmonic analysis.

Note: Harmonic analysis is not required in every power study/project. When a contract document specifically calls for a harmonic study to be conducted, it shall follow the procedure described in this order.

b. Power systems analyses of alternating-current (ac) and direct-current (dc) facility power distribution systems shall be accomplished in accordance with the following:

(1) National Electric Code (NEC)

(2) FAA-STD-032, Design Standards for National Airspace System Physical Facilities

(3) Institute of Electrical and Electronic Engineers (IEEE) Standard 399, IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis.

c. These analyses shall be accomplished as part of the project design submission and deliverable process.

2. Roles and Responsibilities.

a. The FAA organization providing engineering leadership for the project (program office or project level organization responsible for the system design) shall be responsible for ensuring the power system calculations described in this order are properly performed. The analyses shall show that values in the study meet or exceed and do not compromise the FAA's performance objectives for the electrical systems. The distribution system design must provide efficient, convenient, and adequate power service, and incorporate future expansion provision (where required).

b. The FAA program office requesting the power system project (for example, AJW-221) and the lead project engineer responsible for the installation or modification will share the responsibility for performing PLFA, SCA, PDCA, AFRA studies. The FAA program office will be responsible for (1) performing electrical power analyses in accordance with this order and based upon type of project being implemented; (2) reviewing calculation submittals performed by design firms, and; (3) archiving project calculation submittals in the power calculations module of the Facility Power Panel Schedule database according to Order JO 6080.1, Facility Power Panel Schedule (FPPS).

c. The Environmental and Occupational Safety and Health (EOSH) program office, AJW-23, will provide technical guidance on implementing the electrical safety requirements and oversight responsibilities for compliance with the National Electrical Safety Program.

d. Qualified engineers shall prepare the power studies required by this order. Qualified engineers are registered or certified professional electrical engineers or FAA electrical engineers. The qualified engineer shall have at least 5 years of experience independently conducting and interpreting the power system analyses covered in this order.

e. The power systems analyses, and studies shall be used as the basis for specifying the rating and selecting the type of protective devices. To ensure that this requirement is met, Statements of Work (SOW) shall include requirements for power system analyses as described in this order, IEEE Std 399, IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis, and other IEEE color book series.

f. The appropriate NAS equipment program office in coordination with the power distribution system Resident Engineer will coordinate NAS electronic systems and equipment. This order addresses protection and overcurrent protective device (OCPD) coordination requirements for the power distribution system from power source to the end-of-line branch circuit panelboard circuit breaker devices that supply power to the electronic equipment. FAA-G-2100 addresses the OCPD requirements within the electronic equipment and subsystems. This order intends for the equipment interface connection point at facility branch panelboard OCPD to be coordinated.

3. Analysis Decision Process.

a. The FAA organization providing electrical engineering leadership for the project, in consultation with Engineering Services, the District/System Support Center (SSC) manager, EOSH, and other Program managers as appropriate, will determine whether there is a need to conduct a full analysis and calculations. The assessment process can take place in the planning or in design phase and shall be determined as follows:

b. In general, modifications such as changes to short-circuit current, protective device ratings or adjustment settings, or calculated incident energy levels, or any equipment modification that invalidates existing AFRA warning labels, requires a power study.

c. If the site, district, service area, or program office cannot agree upon the level of study required, the issue will be elevated to the Power Services Group, AJW-22, for resolution.

4. Engineering Assessment Guidelines. The engineer shall assess the project and consider factors that will influence parameters associated with power load-flow and short-circuit calculations, protective device coordination analysis, and arc-flash hazard analysis. Refer to the following:

a. Table 2-1 for project type related to the assessment and decision process for determining when to conduct a study.

b. Figure 2-1, Process Sequence of Steps for Implementation of JO 6950.27, for a description of end-state deliverable framework.

c. Figure 8-1, Delivery Process Flow Chart, for guidance related to typical compliance paths based on the project type and assessment determination criteria.

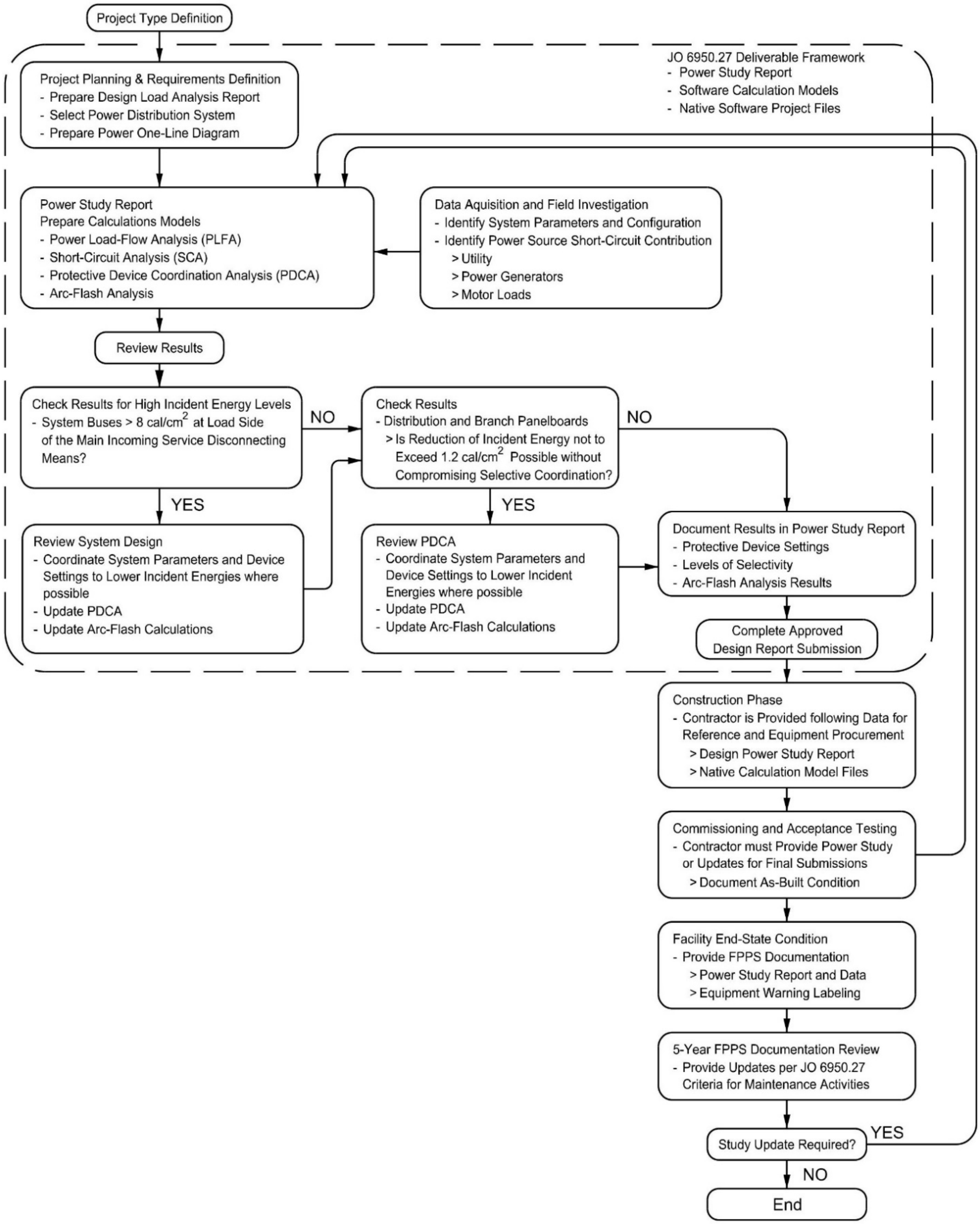
Table 2-1: Determining the Need for a Study and Extent of Analyses per Project Type

Project Category	Load Analysis	PLFA	SCA	PDCA	AFRA	Remarks
New building design and construction	1	1	1	1	1	—
Building renovation of power distribution system	2	1	1	1	1	3
Equipment modification	8	4	4	4	4	—
Equipment replacement	8	4	4	4	4	—
Equipment form/fit/function replacement	8	5	5	5	5	6
Addition of alternative energy power sources	2	7	7	7	7	—
Facility 5-year assessment update	8	7	7	7	7	—
Existing facility power study documentation unavailable	8	7	7	7	7	—

Notes:

1. Provide complete power study submission in accordance with the project design deliverable process.
2. Develop Load Analysis summary table during initial design submission in accordance with the project or program planning requirements document.
3. Existing Facility Power Panel Schedule (FPPS) data may be used to establish the Load Analysis information.
4. Refer to Appendix D for assessment conditions. Update analysis as applicable.
5. Refer to Appendix D for form/fit/function assessment conditions. Update analysis as applicable.
6. Analysis is not required for equipment replacement of same type, model, and specification.
7. Update FPPS data and power study documentation per JO 6950.27B.
8. Analysis is not required.

Figure 2-1. Process Sequence of Steps for Implementation of JO 6950.27



5. Deliverables. The power studies shall be incorporated into the project design data handbook in accordance with FAA-STD-032 deliverable requirements. A copy of the power studies should be provided to the installation contractor. The installation contractor shall be responsible to maintain the power study documentation through the project commissioning process. If changes or deviations from the approved design study are made, the installation contractor shall revise affected portions of the studies to reflect those changes or deviations. The installation contractor's scope of work specifications shall require the contractor to prepare and submit those revised portions of the studies as part of final system acceptance and record documentation submissions. Additionally, the contract specifications shall require the contractor to submit, as a minimum, one hard copy and one computer-readable media copy (soft copy) of each study. The study documentation and submission process shall include the following information:

a. Provide a report prepared in accordance with each chapter's submission requirements. The report shall provide the calculation performed for the analyses, including computer analysis programs utilized. The name of the software package, developer, and version number shall be provided.

b. Computer Software Program: Prepare study using the latest revision of the SKM Systems Analysis Power*Tools for Windows (PTW) software program.

c. Provide copies of the report and results in electronic format, referenced to the power one-line diagram and calculation model input parameters.

d. Provide the software program's native calculation model, program data files, and data collection information used in the study. The calculation model and data files shall be in a format for use by the site to perform analysis or recreate the calculations.

e. The coordination study shall be completed and submitted to FAA within a mutually agreed time prior to completion of the approved design. The results of the study shall be incorporated into the design as applicable. A copy of the approved report shall be included as part of the Design Data Handbook in accordance with FAA-STD-032. The study shall be conducted as early as practically possible in the design phase and shall be updated with every following submission.

f. The settings of the overcurrent and ground-fault protective devices shall be verified during commissioning and modified if needed.

g. Copies of the native software program files, library files, calculations, analyses, and studies submitted and accepted final documentation shall be deposited in the FPPS database system in accordance with documentation archive process by the office responsible for the project. The native program files shall be provided to the FAA, upon request, during submission deliverable and approval process to validate and review accuracy of the model and report.

Chapter 3. Power Load-Flow Analysis (PFLA)

2. Overview. A PLFA includes the following parts:

a. Load analysis

b. Power load-flow calculations.

3. Objectives. Determination of following parameters:

a. Determination of system(es) power load requirement, (Load analysis)

b. Determination of power operating loading conditions, (PLFA)

c. Determination of power system voltage conditions, (PLFA).

4. Load Analysis. Provide a summary tabulation estimate for the power distribution system demand load requirement.

a. The load analysis is the starting point for project planning and initial design approval process.

(1) Purpose. The load analysis provides the basis for power system calculations and distribution equipment selections. The project planning and initial design requires careful collection of data, verification, and documentation of the basis of design (BOD).

(2) Load Analysis Report Submission.

(a) Provide an itemized summary of the power distribution system demand load requirement.

(b) Designer should use power system demand loading information based on metered data whenever possible, for determination of distribution equipment sizing and selection requirements. When metered data is not available, use demand and system diversity factors or established loading data from similar FAA facilities.

(c) Equipment nameplate data may be used to determine the branch distribution connected power loads.

(d) Consideration for future growth and spare device/space requirements should be addressed during the scoping of the project. The assessment for spare capacity should include input from facility/regional office leadership.

> **Note:** Design main service equipment to provide approximately 15% combination of spare devices/space to accommodate future work. Include this 15% spare capacity in the demand load calculations for future or anticipated load growth.

5. PLFA Calculations. Determine active and reactive power, voltage, current, and power factor throughout the electrical system. The analysis shall include possible system power-flow operating scenarios.

a. PLFA results provides the basis for validation of the distribution system architecture.

b. The PLFA calculation model is the starting point for short-circuit and protective device coordination analyses.

(1) Purpose. The power load-flow analysis provides the basis for determine the normal operating parameters of the power distribution system. The results of the PLFA calculations shall determine the following parameters:

(a) Commercial utility service entrance equipment peak demand load requirement

(b) Alternate power source equipment sizing requirements

(c) Power feeder conductor and conduit sizing requirements

(d) Power feeder voltage-drop calculations.

(2) PLFA Report Submission. Provide a power load-flow report containing the following items:

(a) Basis, description, purpose, and scope of the study

(b) Tabulations of the data used to model the system components and a corresponding power one-line diagram

(c) Description of power flow operating scenarios

(d) Power load-flow scenarios and voltage-drop calculation results annotated on the calculation model one-line diagram

(e) Tabulation of results consolidated into a summary report.

Chapter 4. Short-Circuit Analysis (SCA)

1. Overview. Short-circuit calculation is a fundamental part of power engineering. Perform an SCA before finalizing the distribution system layout, system voltage levels, and sizing of feeder conductors and transformers. For existing systems, fault-current analysis is necessary in cases where changes are made to power source equipment short-circuit contribution, motor loads are added, feeder system layout is modified, protection equipment is rearranged, or when conducting analyses involving determination of existing OCPDs adequacy.

2. Objectives. Determine the magnitude of short-circuit current flow throughout the distribution system at various time intervals after a fault occurs. Provide analyses of salient power-flow operating scenarios such as commercial utility, generator, and maintenance tie circuit connection power operating modes. Calculate the following fault-current conditions:

a. Three-phase bolted-fault

b. Single line-to-ground faults

c. Double-line-to-ground faults

d. Line-to-line faults.

Calculate short-circuit currents for following time frames:

a. Momentary, 1/2 cycle currents

b. Interrupting, 3 and 5 cycle currents

c. Time delayed, 30 cycle currents.

3. Purpose. The short-circuit analysis shall calculate ac and dc short-circuit currents in accordance with American National Standards Institute (ANSI)-approved standards. The results of the SCA calculations are to be used to validate the application of short-circuit momentary and interrupting duties for equipment used in the power distribution system. Application considerations shall compare SCA results against the power distribution equipment ratings. The SCA results shall include the following parts:

a. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault throughout the distribution system.

b. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

c. Protective device evaluation:

(1) Evaluate equipment and protective devices and compare to short-circuit ratings

(2) Evaluate adequacy of the distribution system equipment ratings to withstand short-circuit stresses

(3) Identify areas where circuit protective devices are improperly rated for the calculated available fault-current.

4. Procedure. The short-circuit study shall be performed in accordance with the recommended practices and procedures set forth in ANSI/IEEE Std-399, and the step-by-step procedures outlined in the short-circuit calculation chapters of IEEE Std-141, IEEE Std-551.

a. Include the utility system data as well as data for the distribution system. When accurate data does not exist, assume that maximum available fault-current contribution exists, up to a possible infinite bus on the primary side of the upstream transformer, and design the system and equipment interrupting ratings assuming such conditions. Create additional short-circuit scenarios to estimate the commercial utility maximum/minimum short-circuit contribution when determining the worst-case arc flash arcing fault conditions. For systems with power generation equipment, include a short-circuit scenario for generator power load flow condition.

Note: In absence of known utility SCA data use minimum 100MVA SCA and maximum 500MVA SCA with value of 16 for X/R ratio for utility power source contribution.

b. Calculate the available short-circuit and ground-fault currents at each equipment bus.

c. Motor load short-circuit contribution may be estimated using ANSI-approved standard applications guides, refer to IEEE Std-551, section 6.8 in the absence for detailed motor load information.

d. Coordinate the calculated short circuit current at the service entrance with the available fault-current labeling required by the NEC for the service entrance equipment. Comply with IEEE C37.06, IEEE C37.13.1, or UL 489 criteria, as applicable, for equipment interrupting capability.

e. Final design studies shall be based on utility available fault-current contribution data calculated at the facility power service demarcation point.

f. Final design studies shall use PLFA calculation model results for determination of system motor load contribution.

5. Report Submission. Results of the short-circuit study shall be summarized in a final report containing the following items:

a. Basis, description, purpose, and scope of the study.

b. Tabulations of the data used to model the system components and a corresponding one-line diagram.

c. Descriptions of the scenarios evaluated, and identification of the scenario used to evaluate equipment short-circuit current ratings.

d. Tabulations of power and current flow versus equipment ratings. The tabulation shall identify percentage of rated load and the scenario for which the percentage is based. Overloaded equipment shall be clearly noted.

e. Tabulations of equipment short-circuit current ratings versus available fault duties. The tabulation shall identify percentage of rated short circuit current and clearly note equipment with insufficient ratings.

f. Conclusions and recommendations.

Chapter 5. Protective Device Coordination Analysis (PDCA)

1. Overview. Overcurrent protection and coordination is a fundamental requirement for proper operation of the power system. A PDCA is the comparison and selection of protective device operating times that achieves the objectives of the protection system under abnormal system conditions.

2. Objectives. Determine the characteristics, ratings, and settings of overcurrent protective devices that minimize equipment damage and interrupt short-circuits as rapidly as possible. The PDCA shall determine the following parameters:

a. OCPD ratings and settings

b. Overall system protection scheme

c. Distribution equipment to ensure adequate system protection and selectivity

d. Evaluate and coordinate the system protection scheme to mitigate arc-flash incident energy levels without compromising system protection and selectivity objectives.

3. Purpose. Selective coordination is both an art and a science. A perfectly coordinated system cannot always be accomplished. It is the responsibility of the design engineer to maximize coordination to the extent practical. The designer shall strive to achieve the following coordination objectives:

a. Protection of people and equipment

b. Continuity of power service

c. The power distribution system protective devices should coordinate to a level such that no conductor, device, or circuit not directly critical to the safety function of Air Traffic systems, should ever cause or allow an interruption in service continuity to any device or circuit necessary for NAS safety. FAA critical power distribution systems (CPDS) may contain redundant power paths for reliability and maintainability. CPDS power paths shall achieve the following coordination objectives:

(1) Coordination of redundant power systems shall coordinate to a level such that a fault on power path A, of a dual redundant distribution system, will not disrupt or interfere with the operation of power path B distribution system.

(2) Ensure selective coordination in the power path to critical loads. Total selective coordination is required to the available fault current between the load panelboard branch circuit breakers and the upstream protective devices, such as the panelboard main and upstream feeder protective devices.

(a) Exception: Total selective coordination may not be possible in existing facility power systems. The intent is to update the power system to extent possible within project funding constraints. The initial project planning process must assess system capabilities and address study requirements in the SOW. Where it is not possible to achieve total selective coordination due to lack of funding, the report must document the requirements/upgrades needed to achieve selective coordination for future project consideration. The Office of Primary Responsibility (OPR) should be contacted to obtain technical guidance on the applicability of requirements herein for modifications, upgrades, and new equipment installations in existing facilities.

d. Power system load continuity requirement may be considered in coordination selectivity analysis. The following conditions should be part of PDCA:

(1) Unmanned NAS facilities and facility power circuits that supply power to equipment that directly controls the landing of aircraft, cannot tolerate power service interruptions and require selective coordination of protective devices. When difficulty is encountered meeting this requirement, consult the OPR of this document.

(2) Facility essential subsystem power loads, such as a chiller motor connected to the essential bus, may have less stringent selective coordination requirements. Redundant power distribution feeds should be considered for these conditions to improve system reliability.

4. Procedure. The coordination study shall be performed in accordance with the recommended practices and procedures set forth in ANSI/IEEE 399, Brown Book, and ANSI/IEEE 242, Buff Book. Protective device selection and settings shall comply with the system protection requirements of the NEC.

a. The maximum available-fault current or fractions of the maximum available fault-currents shall be used for the PDCA studies. PDCA, time-current coordination shall be based on the commercial utility available short-circuit data and the power systems installed equipment short-circuit contribution data.

b. AFRA, risk mitigation shall be coordinated during the PDCA process. AFRA shall consider both maximum and minimum short-circuit contribution data for PDCA, time-current coordination.

c. Ground fault protection coordination shall be a part of the report analysis. OCPD ground fault protection settings and sensing signals shall be verified during the commissioning in accordance with NEC requirements.

5. Coordination Guidelines. The following guidelines are intended to assist the PDCA process:

a. Use the national standard designs for Critical Power Distribution System, Program Implementation Plan (P6980.00), wherever possible. Implementation of these designs or other non-standard designs should include engineering and selection of distribution OCPDs to achieve the systems coordination objectives. The following device selection considerations may be included in the design:

(1) Use electronic, solid-state, circuit breakers with adjustable trip unit functions for main and feeder OCPD locations when this option is available for distribution equipment selection. Selection of adjustable trip device types is recommended to improve coordination discrimination and mitigate arc flash incident energies.

(2) Dynamic impedance. Dynamic impedance is not reflected in the instantaneous region of published time-current curve (TCC) graphical representations. OCPDs shall be selected based

on manufacturer's published selectivity and coordination test data when such data is available. Actual time-current TCC graphical representation is still valuable in long-time and short-time regions.

(3) Use OCPDs with large frame sizes at power source equipment mains and feeder branch locations where selectivity improvement in the instantaneous region is desirable. Selection of device frame size and frame size pairing combinations must be coordinated with manufacturer’s application tables for selective coordination.

(4) Elimination of panelboard main circuit breaker devices may be considered, for purpose of minimizing the number of OCPDs along the coordination path, where the protection scheme is not compromised, however, in all cases system protection shall comply with the NEC. The CPDS standard design configuration utilize instances where multiple overlapping protective devices in series are desirable, such as feeder and main circuit breaker combinations. These instances are commonly used for isolation purposes and provide a means for secondary protection to achieve desired selectivity at other points in the distribution system where coordination is paramount.

(5) AFRA generally requires fast short-time response characteristics. Consider setting the I^2T short-time delay feature to out/off setting whenever possible.

(6) Ground-fault protection may be added to protective device trip unit functions to detect and interrupt arcing fault-currents for AFRA risk mitigation.

(7) AFRA arc energy reduction systems shall be provided in accordance with NEC requirements. Preferred method to reduce device clearing time, in absence of OCPD trip unit adjustment settings, should use an energy-reducing maintenance switching scheme with local status indicator integrated into the distribution equipment layout.

b. Fire life safety systems, such as: fire alarm, emergency exit/egress lighting, fire pump, stair pressurization system, and elevator equipment shall be coordinated in accordance with NEC requirements.

c. Obtain available short-circuit contribution data from the commercial utility during initial design process.

d. Ensure that feeder conductors are selected to coordinate with the conductor protective device. The conductors thermal damage curve should not overlap the OCPD TCC in the instantaneous region.

e. Ensure that equipment protective devices are selected to coordinate with the equipment inrush-current requirements.

6. Report Submission. Results of the coordination study shall be summarized in a report containing the following items:

a. Basis, description, purpose, methods and scope of the study, and a corresponding one-line diagram.

b. Time-current curves, selective coordination ratios of fuses, or selective coordination tables of circuit breakers demonstrating the coordination of overcurrent protective devices to the scope.

c. Tabulations of protective devices identifying circuit location, manufacturer, type, and range of adjustment, and IEEE device number, and referenced TCC.

d. Tabulation of protective devices to summarize the settings selected for each protective device. Provide the following information as applicable:

(1) Recommended settings or protective device type selection

(2) Device identification name and associated load controlled

(3) Circuit breaker sensor rating

(4) Fuse type and rating.

(5) Relay current-transformer (CT) ratios and electronic set point equivalents for relay tap, time-dial settings, and instantaneous pickup points.

(6) Ground-fault pickup and time delay settings

(7) Differential relay settings

(8) Current transformer ratios.

e. Conclusions and Recommendations.

Chapter 6. Arc-Flash Risk Assessment (AFRA)

1. General Overview. Arc-Flash analysis is a fundamental power system design requirement. The design requires an iterative process to ensure proper system protection, selective coordination, and reduction of arc flash incident energies.

2. Objectives. Determine arc-flash incident energy levels and arc-flash protection boundary distances based on the results of the short-circuit and coordination studies. The analysis must determine the worst-case arc-flash conditions for power system operating modes.

The AFRA shall be performed to calculate the arc-fault current and incident energy values for each element in the facility power system or Electrical Line Distribution (ELD) project power system. The study shall include the following:

a. The AFRA shall calculate incident energy associated with 100% available fault-current and 50% of available fault-current contribution. Utility data must be used for the 100% available fault-current level.

b. Evaluate distribution equipment to ensure adequate system protection and selectivity.

c. Evaluate and coordinate the system protection system settings to mitigate arc-flash incident energy levels without compromising system protection and selectivity objectives.

d. Documented effort must be made to reduce incident energy to the lowest levels possible.

3. Purpose. Determination of following parameters:

a. Equipment arc-flash warning label parameters.

b. Prepare equipment arc-flash warning labels in accordance with Air Traffic Organization Electrical Safety Program (JO 3900.64) requirements.

4. Procedure. Calculate the arcing fault current flowing through each branch for each fault location in accordance with NFPA 70E, IEEE 1584, and Occupational Safety and Health Administration (OSHA) 1910.269 applicable standards.

a. Collect the system and installation data and prepare a one-line diagram of the power system.

b. Determine system operating modes including tie-breaker positions, and parallel generation configurations.

c. Perform a short-circuit study in accordance with Section SCA.

d. Perform a coordination study in accordance with Section PDCA.

e. Determine the time required to clear the arcing fault current using the protective device settings and associated trip curves.

f. Determine typical gap and enclosure size based upon system voltages and equipment classification.

g. Determine the equipment electrode configuration.

h. Select the working distances based on system voltage and equipment classification.

i. Calculate the incident energy at each fault location at the prescribed working distance.

j. Determine the arc-flash hazard personal protective equipment (PPE) category for the calculated incident energy level.

k. Calculate the arc-flash protection boundary at each fault location.

l. Document the assessment in reports and one-line diagrams.

m. Fabricate and install equipment warning labels on distribution equipment in accordance with Order JO 3900.64.

5. Report Submission. Results of the arc-flash hazard study shall be summarized in a final report containing the following items:

a. Basis, method of hazard assessment, description, purpose, scope, and date of the study.

b. Tabulations of the data used to model the system components and a corresponding power one-line diagram.

c. Document selection of the equipment electrode configurations.

d. Provide annotated power one-line diagram showing input data and arc-flash results data for each equipment bus according to each study scenario.

e. Descriptions of the scenarios evaluated, and identification of the scenario used to develop incident-energy levels and arc-flash boundaries.

f. Tabulations of equipment incident energies, arc-flash hazard PPE categories, and arc-flash boundaries. The tabulation shall identify and clearly note equipment with prohibited energized work locations that exceeds 40 cal/cm^2 incident energies.

g. Conclusions and recommendations.

Chapter 7. Harmonic Analysis

1. Overview. Harmonic analysis includes the following parts:

a. Calculation of harmonic bus voltages and branch current flows in the power distribution system due to harmonic sources.

b. Performance indices that calculate the effects of harmonics on voltage or current waveform distortion.

c. Conduct calculations in accordance with IEEE Std 519 IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems, 3/27/2014.

2. Objectives. Determination of following parameters:

a. Prepare a system power one-line diagram.

b. Gather nameplate data and ratings for harmonic generating equipment.

c. Determine location of nonlinear loads and the generated harmonic currents.

d. Obtain from the power utility company the relevant data and harmonics at the PCC. Provide the following information as applicable:

(1) The short-circuit capacity and X/R ratio of the utility power system at PCC.

(2) Subtransient reactance and kVA rating of rotating machines large than 50hp.

(3) Reactance and resistance of power feeders and current limiting reactors part of the distribution system one-line diagram.

(4) Three phase power transformer kVA rating and percent impedance values.

(5) Permissible limits on harmonics including distortion factors and IT factor per.

3. Purpose. The harmonic analysis provides information to verify adequacy of power system calculations and distribution equipment selections. The project planning and initial design requires careful collection of data, verification, and documentation of the BOD.

4. Calculations. The analysis shall include system salient power-flow operating scenarios such as utility and generator power operating modes.

a. Calculate individual and total harmonic voltage and current distortion factors and applicable IT values at the point of common coupling.

5. Report Submission. Provide a report containing the following items:

a. Basis, description, purpose, and scope of the study.

b. Tabulations of the data used to model the system components and a corresponding power one-line diagram.

c. Description of power flow operating scenarios.

d. Tabulation of individual and total harmonic voltage and current distortion factors and applicable IT values at the point of common coupling.

e. Tabulation of results consolidated into a summary report.

f. Provide recommendation for harmonic mitigation approach for systems that exceed permissible distortion limits.

6. Application of Harmonic Limits. IEEE 519 provides recommended harmonic voltage and current limits applicable at the PCC. Harmonic voltage limits are characterized by total harmonic distortion percentage. Harmonic current limits are characterized by total demand distortion (TDD).

a. IEEE 519 harmonic limits apply only at the point of common coupling and should not be applied to either individual pieces of equipment or at locations within the facility.

b. The PCC is intended to be applied at the point of demarcation between the commercial electric utility distribution system and the facility's power distribution system.

(1) In general, the PCC is located at the primary side of the facility service transformer.

(2) The IEEE standard allows for the same harmonic analysis procedure to be applied at other locations of interest within a facility where it is important to ensure adequate power system operation, such as a facility's main distribution point, or the interface point for on-site power generation equipment.

(3) A facility with multiple commercial utility power feeds may have multiple PCC utility interface locations.

c. Provide harmonic analysis calculations for the facility PCC and other key distribution points.

(1) The facility main distribution point may be located on the secondary of the incoming utility service if access to the primary distribution system is not available.

(2) Sites with power generation equipment should include harmonic analysis for load flow scenarios connected to the generator system.

(a) Determine appropriate power load flow scenarios to establish a basis for the system demand load requirement. The demand load should be normal steady-state operating condition.

(b) Generator system TDD harmonic current limits must be based on IEEE 519, Table 2, note-c, exception values. The harmonic analysis must consider overall power system voltage and power factor stability requirements when implementing harmonic mitigation equipment.

(i) If TDD harmonic limits cannot be achieved without effecting the generator system performance throughout all power load flow scenarios, or in absence of abnormal operating conditions, the harmonic current distortion limits may be exceeded to ensure stability of the generator power system.

(ii) Passive harmonic filtering equipment that may alter system power factor, impedance, and harmonics as demand load scenarios change should be avoided.

(iii) Harmonic mitigation equipment must include features to disable filtering if the connected power load is not operating within the filter design specifications.

7. Harmonic Analysis Calculation Considerations. The harmonic calculation model should include the following power system components:

a. Commercial Electric Utility:

(1) The utility short-circuit data and power system demand load requirement must be obtained to establish a basis for system short-circuit ratio.

(2) Short-circuit ratio is the ratio of the available short-circuit current, in amperes, to the load current, in amperes.

b. Power Factor Capacitors:

(1) Power factor capacitors must be included in the model when power factor correction equipment is used or exists within the existing power distribution system.

c. Transformers:

(1) Model transformers using equipment nameplate percentage impedance information. The transformer’s actual X/R ratio should be used if readily available.

(2) An estimated X/R ratio of 10 may be used if actual transformer data is not available. The transformer resistance will change with frequency; however, the X/R ratio may be considered constant for harmonic modeling purposes.

(3) Transformer winding phase shift must be considered between delta and wye winding configurations.

d. Cable Impedance:

(1) Conductor impedance generally is not significant for harmonic modeling purposes. Conductor information may be used where information is known. Cables will have the effect of dampening the system response at or near a resonant frequency.

e. Motor Loads:

(1) Significant motor loads should be modeled by their subtransient reactance which can be approximated based on locked rotor current if reactance data is unknown.

(2) Large motors exceeding 50 Hp should be modeled individually. Other motor loads may be lumped together and modeled as a single impedance. Motors have the effect of raising the parallel resonant frequency of the power system.

f. Harmonic Loads:

(1) Model nonlinear loads as multiple current sources, one for each characteristic frequency.

g. Other Loads:

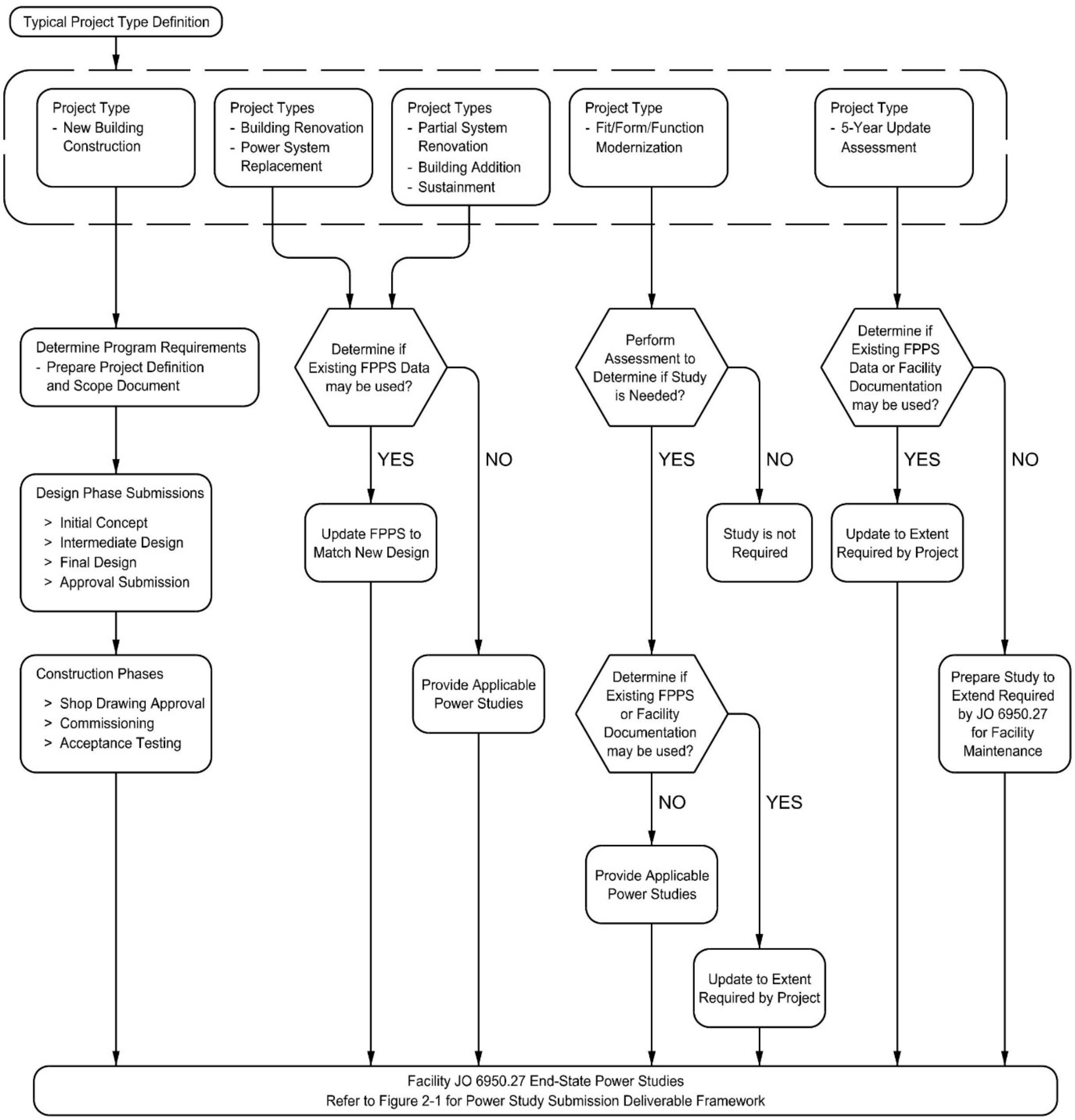
(1) System linear loads should be modeled as an inductive and resistive component. The inductive component of the load will have the effect of raising the natural frequency of the system. The resistive component will lower the peak of a resonance.

Chapter 8. Administrative Information

1. Distribution. This order will be distributed electronically.

2. Background. The following delivery process flow chart describes the fundamental compliance paths for this order.

Figure 8-1. Delivery Process Flow Chart



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Appendix A. Acronyms and Abbreviations

The following acronyms and abbreviations are essential to the application of this order. It is not intended to include commonly defined general or technical terms from related codes and standards.

	Acronym	Definition
A		
	ac	alternating current
	AFRA	arc-flash risk assessment
	ANSI	American National Standards Institute
	ATC	Air Traffic Control
	ARMS	Arc-flash Reduction Maintenance System
	ATO	Air Traffic Organization
D		
	dc	direct current
E		
	ELD	electrical line distribution
	EG	Engine-Generator
	EOSH	Environmental and Occupational Safety and Health
	ERMS	Energy Reduction Maintenance Setting Switch
F		
	FAA	Federal Aviation Administration
	FRDF	facility reference data file
	FPPS	Facility Power Schedule - FAA document archive data system database
G		
	GF	ground-fault
	GFCI	ground-fault circuit interrupter
	GFP	ground-fault protection of equipment
I		
	I^2T	Current Squared times Time
	IEEE	Institute of Electrical and Electronics Engineers
L		
	LF	load-flow
	LFA	load-flow analysis
	L-G	Line-to-Ground
	L-L	Line-to-Line
	L-N	Line-to-Neutral
N		
	NAS	National Airspace System
	NEC	National Electrical Code
	NEMA	National Electrical Manufacturers Association
	NFPA	National Fire Protection Association

O		
	OCP	overcurrent protection
	OCPD	overcurrent protective device
	OPR	Office of Primary Responsibility
	OSHA	Occupational Safety and Health Administration
P		
	PDC	protective device coordination
	PDCA	protective device coordination analysis
	PLF	power load-flow
	PLFA	power load-flow analysis
	PPE	personal protective equipment
	PV	photovoltaic - power system
R		
	RFDF	facility reference data file
	rms	root-mean-square
S		
	SC	short-circuit
	SCA	short-circuit analysis
	SDM	service disconnecting means
	SOW	statement of work
	SPD	surge protective device
	SSC	system support center (FAA Acronym)
	Std	standard
T		
	TCC	time-current curve
U		
	UPS	uninterruptible power supply

Appendix B. Key Terms and Definitions

1. Overview. The following contain only definitions essential to the application of this order. It is not intended to include commonly defined general or technical terms from related codes and standards.

2. Definitions. The terms used within this order are provided as follows:

A	
Ampacity	The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.
B	
Battery System	Interconnected battery subsystems consisting of one or more storage batteries and battery chargers, and can include inverters, converters, and associated electrical equipment.
Branch Circuit	The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).
C	
Circuit Breaker	A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.
	Adjustable (as applied to circuit breakers). A qualifying term indicating that the circuit breaker can be set to trip at various values of current, time, or both, within a predetermined range.
	Instantaneous Trip (as applied to circuit breakers). A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker.
	Inverse Time (as applied to circuit breakers). A qualifying term indicating that there is purposely introduced a delay in the tripping action of the circuit breaker, which delay decreases as the magnitude of the current increases.
	Nonadjustable (as applied to circuit breakers). A qualifying term indicating that the circuit breaker does not have any adjustment to alter the value of the current at which it will trip or the time required for its operation.
	Setting (of circuit breakers). The value of current, time, or both, at which an adjustable circuit breaker is set to trip.
Continuous Load	A load where the maximum current is expected to continue for 3 hours or more.

Coordination, Selective, (Selective Coordination)	Localization of an overcurrent condition to restrict outages to the circuit or equipment affected, accomplished by the selection and installation of overcurrent protective devices and their ratings or settings for the full range of available overcurrents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associated with those overcurrents.
D	
Demand Factor	The ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration.
Disconnecting Means	A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.
Duty, Continuous	Operation at a substantially constant load for an indefinitely long time.
Duty, Intermittent	Operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load, and rest.
Duty, Periodic	Intermittent operation in which the load conditions are regularly recurrent.
Duty, Short-Time	Operation at a substantially constant load for a short and definite, specified time.
Duty, Varying	Operation at loads, and for intervals of time, both of which may be subject to wide variation.
Equipment Grounding Conductor (EGC)	The conductive path installed to connect normally non-current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode conductor, or both. For FAA purposes, the EGC is to be green-insulated, solid or stranded, copper wire.
F	
Fuse	An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it.
Form/Fit/Function, Equipment Replacement	Replacement of existing equipment with new equipment that has the same characteristics, such as the following categories: a. *Form (of the equipment).* Describes physical and electrical parameters. b. *Fit (of the equipment).* The ability to interface with, be connected to, or become an integral part of another item c. *Function (of the equipment).* The action(s) that the equipment is designed to perform.
G	
Ground	A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to a conducting body that serves in place of the earth.
Grounded	Connected to earth via a path of sufficiently low impedance and having sufficient current carrying capacity, such that fault current cannot build up voltage potentials that are hazardous to personnel.

Grounded, Solidly	Connected to ground without inserting any resistor or impedance device.
Grounded Conductor	A system or circuit conductor that is intentionally grounded at the SDM or at the source of a separately derived system. This grounded conductor is the neutral conductor for the power system.
Grounding Conductor	A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.
Grounding Electrode	Copper rod, plate, or wire embedded in the ground for the specific purpose of dissipating electric energy to the earth. Also referred to as the Grounding Electrode System.
Grounding Electrode Conductor	A conductor used to connect the system grounded conductor or the equipment to a grounding electrode or to a point on the grounding electrode system.
Ground Fault	An unintentional, electrically conductive connection between an ungrounded conductor of an electrical circuit and the normally non-current-carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth.
Ground Fault Circuit Interrupter	A device intended for the protection of personnel that functions to denergize a circuit or portion thereof within an established period of time when a current to ground exceeds 6 mA.
Ground Fault Protection of Equipment	A system intended to provide protection of equipment from damaging line-to ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device.
L	
Labeled	Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
Listed	Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.
O	
Office of Primary Responsibility (OPR)	The authority assigned to maintain and interpret this order.

Overcurrent	Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault.
Overcurrent Protective Device	A device capable of providing protection for service, feeder, and branch circuits and equipment over the full range of overcurrents between its rated current and its interrupting rating. Such devices are provided with interrupting ratings appropriate for the intended use but no less than 5000 amperes.
Overcurrent Protective Device, Supplementary	A device intended to provide limited overcurrent protection for specific applications and utilization equipment such as luminaires and appliances. This limited protection is in addition to the protection provided in the required branch circuit by the branch circuit overcurrent protective device.
P	
Premises Wiring (System)	Interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all their associated hardware, fittings, and wiring devices, both permanently and temporarily installed. This includes (a) wiring from the service point or power source to the outlets or (b) wiring from and including the power source to the outlets where there is no service point (Refer to NEC).
S	
Separately Derived System	An electrical source, other than a service, having no direct connection(s) to circuit conductors of any other electrical source other than those established by grounding and bonding connections.
Service	The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
Service Conductors	The conductors from the service point to the service disconnecting means.
Service Equipment	The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.
Service Point	The point of connection between the facilities of the serving utility and the premises wiring (Refer to NEC).
Short-Circuit Current Rating	The prospective symmetrical fault current at a nominal voltage to which an apparatus or system is able to be connected without sustaining damage exceeding defined acceptance criteria.
Surge Protective Device (SPD)	A device intended to limit surge voltages on equipment by diverting or limiting surge current and is capable of repeating these functions as specified. SPDs are also commonly referred to as Transient Voltage Surge Suppressors or secondary surge arresters.
V	
Voltage (of a circuit)	The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned.

Voltage (Nominal)	A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts).

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Appendix C. Applicable Codes and Standards

1. Overview. The latest editions of the following publications are the primary reference documents for this order. Use latest versions of the documents.

a. Documents listed in this section are government and non-government reference documents that form a part of this order and are applicable to the extent specified herein. While every effort has been made to ensure the completeness of this list, document users are cautioned that they shall meet specified requirements of documents cited in Chapters of this order, and national safety standards, whether or not they are listed.

b. In the event of a conflict between the text of this standard and the references cited herein, the text of this standard takes precedence. Nothing in this standard shall supersede applicable laws and regulations unless a specific exemption has been obtained.

2. Government Documents.

FAA-G-2100	Electronic Equipment, General Requirements
FAA-STD-032	Design Standards for National Airspace System Facilities
FAA - JO 3900.64	Air Traffic Organization Electrical Safety Program
FAA - JO 6080.1	Facility Power Panel Schedule (FPPS)
FAA-Order-3900.19B	Occupational Safety and Health Program
FAA-P6980.00	Critical Power Distribution System, Program Implementation Plan

3. Non-Government Documents.

Due to periodic updating of non-government documents, the Contracting Officer and/or the Implementation Engineer must specify the current version for project design or at contract award unless a specific version is identified in this standard. These documents form a part of this standard and are applicable to the extent specified herein. While this standard may exceed the requirements of the following documents, building codes and industry standards always shall be performed as a minimum.

4. National Fire Protection Association (NFPA).

NFPA 70	National Electrical Code (NEC)
NFPA 70B	Recommended Practice for Electrical Equipment Maintenance
NFPA 70E	Standard for Electrical Safety in the Workplace

5. Institute of Electrical and Electronic Engineers (IEEE).

IEEE Std 141	Recommended Practice for Electric Power Distribution for Industrial Plants
IEEE Std 242	Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

IEEE Std 551	Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems
IEEE Std 399	Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 3000	IEEE Standards Collection: Protection and Coordination
IEEE Std 1584	Guide for Performing Arc Flash Hazard Calculations

Appendix D. Power Study Decision Process Assessment Guidelines

1. Overview. This section provides informative guidance related to equipment evaluation and factors that may affect the level of analysis, assessment, and the need for calculations. These conditions are typically related to design, renovation, refurbishment, or modification of existing power distribution systems.

2. Assessment Considerations. The following list includes equipment categories that are part of the assessment and decision process:

a. Distribution Transformer

b. ELD, Power Cables and Conductors

c. Commercial Utility Transformer or Service Entrance Conductors

d. Service Entrance Equipment

e. Engine-Generator (EG)

f. Power Panels

g. UPS Equipment (excluding rack-mounted equipment)

h. Power Feeder, Circuit Breaker Protective Devices with adjustment set points.

i. Addition of Alternative Energy Power Sources

j. Motor Loads

k. Equipment Serviced by Form/Fit/Function Replacement.

Update or provide new power study report if the assessment determines existing FPPS database calculations models or documentation are invalidated by the conditions described below.

3. Distribution Transformer.

a. Conditions:

(1) Addition of new equipment

(2) Change in load capacity or system impedance ratings

(3) Form/Fit/Function replacement.

4. ELD, Power Cables, and Conductors.

a. Conditions:

(1) Addition of new equipment

(2) Change in load capacity or system impedance ratings

(3) Form/Fit/Function replacement.

5. Commercial Utility, Transformer, or Service Entrance Conductors.

a. Conditions:

(1) Addition of new equipment

(2) Change in load capacity or system impedance ratings

(3) Form/Fit/Function replacement.

6. Service Entrance Equipment.

a. Conditions:

(1) Addition of new equipment

(2) Changes to protective device settings

(3) Fuse replacement, if identical fuse type and ratings are not used

(4) Form/Fit/Function replacement.

7. Engine-Generator, EG.

a. Conditions:

(1) Addition of new equipment - Notes Applicable for New Equipment Installation:.

(a) Worst case scenarios of impedances shall always be considered.

(b) Generator sub-transient direct axis reactance X”d, negative sequence reactance X2, and zero sequence reactance Xo shall be considered.

(c) If the value of X”d is specified by the generator manufacturer as a range, use the minimum value of X”d. For example, if the data sheet lists the subtransient reactance as 0.2 ohm ± 15% then the worst-case value of X”d should be calculated as 0.2 * ((100 - 15)/100) = 0.17 ohm.

(d) Addition of a new engine generator to an electrical power distribution system to operate as a stand-alone prime power source, or stand-by alternative power source, or operate in a parallel configuration, generally increases the resultant value of arc flash incident energy. It is imperative that calculation scenarios are evaluated in order to capture the worst-case operating conditions for arc flash incident energy analysis.

(e) If the generator is solidly-grounded then ground-fault current can exceed the value of the three-phase fault current. Short-Circuit calculations shall include both 3-phase fault {Isc, 3-phase = EL-G / X”d}, and single-phase to ground-fault current {Isc, 1-phase to GF = 3 * EL-G / (X”d+ X2+ Xo)} conditions. Where, EL-G is the Line-to-Ground Generator voltage, typically 277 Volts or 120 Volts.

(f) Changing the location of the Generator installation with respect to the power system distribution equipment can affect the resultant short-circuit and arc-flash incident energy calculations.

(g) Close proximity of the power system distribution equipment and the Generator equipment generally results in higher short-circuit current values. The power feeder conductor reactance X and the resistance R may be are considered negligible when the EG is located within close proximity, less than 25-feet) of the generator output distribution equipment.

(2) Form/Fit/Function replacement - Notes Applicable for Equipment Replacement:

(a) Replacement of EG with an identical unit generally does not result in a change of incident energy; however, during the assessment process the qualified engineer shall evaluate the following parameters that affect the fault current calculation:

(i) Generator volt-ampere (VA) rating

(ii) Power-Factor, (PF) rating

(iii) System Voltage configuration

(iv) Subtransient, direct-axis reactance value

(v) Negative sequence reactance value

(vi) Zero sequence reactance value.

(b) Replacement of an EG with a unit manufactured by a different manufacturer may not require calculation updates. The qualified engineer shall compare the parameters of the proposed and existing EG units to determine if there is a need to perform new calculations.

8. Power Panels.

a. Conditions:

(1) Addition of new equipment.

(2) Form/Fit/Function replacement. A power study is not be required if a panel replacement does not change the feeder power conductors or OCPD ratings:

Note: There are special considerations for panels that are remotely located at large distance from the upstream protective device. The following considerations are applicable for panels remotely located from its upstream feeder circuit breaker protective device:

(a) Feeder circuit breakers protecting long distance feeders may not be able to sense a fault condition due to the attenuation of the short circuit current at the load panel resulting from higher feeder impedances. The qualified registered engineer shall provide recommendations to resolve the following design considerations:

(i) Inability of the feeder circuit breaker to sense and automatically open the circuit in case of a low-level fault current conditions.

(ii) The elevated amount of incident energy due to an elongated upstream feeder circuit breaker tripping time to open the circuit and clear the fault-current condition.

(b) Panels mounted remotely from power distribution source equipment, such as panels mounted in the cab of an Air Traffic Control Tower or a panel mounted outdoor in a security guard house and fed from the base building distribution system, shall be identified and evaluated separately.

9. Uninterruptible Power Supply (UPS) Equipment (excluding rack-mounted equipment).

a. Conditions:

(1) Addition of new equipment.

(2) Form/Fit/Function replacement:

Note: The UPS manufacturer data must be considered carefully. The level of arcing fault current in relation to the overload rating of the UPS can affect the calculations for the following case scenario conditions:

(a) Case 1: Arcing fault currents significantly higher than the overload rating of the UPS may immediately cause the UPS to switch power flow to the bypass circuit. This is the typical default short-circuit power-flow scenario to be modeled in short-circuit calculations.

(b) Case 2: Arcing fault currents from a UPS that are lower than overload rating of the UPS and may not result in the UPS switching power-flow to the bypass circuit.

(c) Case 3: Arcing fault currents slightly higher than the overload rating of the UPS may result in a parallel operation of the UPS and the bypass circuit for an approximately 40 milliseconds.

Note: Cases 2 and 3 are to be included in advanced studies where more investigation is required to establish the proper arcing-fault current values.

10. Power Feeder, Circuit Breaker Protective Devices.

a. Conditions:

(1) Addition of new equipment

(2) Changes to circuit breaker settings

(3) Form/Fit/Function replacement.

11. Addition of Alternative Energy Power Sources.

a. Conditions:

(1) Addition of new equipment

(2) Form/Fit/Function replacement.

Note: Refer to FAA-E-99001, Photovoltaic Specification for Arc Flash analysis requirements.

12. Motor Loads.

a. Conditions:

(1) Addition of new equipment

(2) Form/Fit/Function replacement:

Note: Motor loads greater than or equal to 50 hp require consideration for the following parameters that may affect calculations. Modifications of the following parameters may affect the calculations.

(a) Addition of motor loads greater than or equal to 50 hp. Multiple motor loads may be grouped in to combined loads totaling 50 hp or greater and modeled as a single motor load.

(b) Modification of motor controller or starter type for motor loads greater than or equal 50 HP. When equipped with a bypass circuit, the default power-flow scenario to be modeled in short-circuit calculations should utilize the bypass circuit. The following are common motor starter types:

(i) Direct-on-line or across-the-line motor starters

(ii) Reduced voltage starters

(iii) Variable Frequency Drive (VFD) units

(iv) Electronic, Solid-State, Soft Starters

(v) Smart motor controllers, equipped with a bypass circuit.

13. Equipment Serviced by Form/Fit/Function Replacement.

Update study as applicable.

14. Data Acquisition Template Forms.

The following tables indicate data that shall be documented when conducting Power Studies.

a. The power study shall include a Power One-Line Diagram showing configuration of the calculation model.

b. Provide itemized table listings for all elements included in the calculation model.

The following are illustrative examples for data table templates. Contractor shall add equipment serial numbers to tables when the information is available.

Table D-1. Power Source Equipment, Data Collection Tables

Commercial Utility Short-Circuit Contribution Data								
Item No.	Utility Name	3-Phase Short-Circuit Contribution MVA		Line to Ground Short-Circuit Contribution MVA		X/R (3phase)	X/R (Line to ground)	Rated Voltage
		Max.	Min	Max.	Min.			
1.								

Table D-2. Generator Equipment, Data Collection Table

Engine-Generator Nameplate and Short-Circuit Contribution Data												
Item No.	Gen. Name, or Location	Manufacturer	Rated kVA	PF	Rated Voltage	Serial Number/ Catalog	ANSI CONTRIBUTION			Transient and Steady State Parameter		
1.							Seq.	X”	X/R	Xd'	Xd	Ra
							+					
							-			Td”	Td'	Tdc
							0					

Table D-3. Power Transformer Equipment, Data Collection Table

Transformer Nameplate Data										
Item No.	XFMR name or Location	#of Phases	Rated kVA	PF	Rated Primary Voltage	Z%	Rated Secondary Voltage	Type of Connection e.g. (Li-Y)	Type of XFMR (Dry, oil)	In-rush current
1										

Table D-4. Conductor and Cable, Data Collection Table

Conductor and Cable Data						
Item No.	Cable Identification or Number	Number of Parallel Conductors /Phase	Size (AWG, kCMIL)	Insulation Class	Conductor Description e.g. (4- 1/C+G)	Length (ft)
1.						
Note: Itemize all conductors and cables used in the system one-line diagram.						

Table D-5. Power Fuse, Data Collection Table

Power Fuse Device Data							
Item No.	**Location& Identification**	**Type**	**Rated V**	**Trip Current**	**Manufacturer**	**Interrupting Rating**	**TCC No.**
1.							

Table D-6. Electronic Circuit Breaker, Data Collection Table

Circuit Breaker (Electronic, Solid-State, Trip Unit) Device Data									
Item No.	**Location & Identification**	**Type, Frame (letters), Interrupting Rating Trip Unit #,**	**Manufacturer**	**Rated Voltage**	**Frame Rating (A)**	**Plug (A)**	**Sensor (A)**	**Trip Current, Device Settings: LTPU LTD STPU INST GFPU GFD Equipment Options: ERMS ARMS**	**Description, TCC No.**
1.									

Table D-7. Thermal Magnetic Circuit Breaker, Data Collection Table

Circuit Breaker (Thermal Magnetic Trip Unit) Device Data								
Item No.	**Location & Identification**	**Type, Frame (letters)**	**Manufacturer**	**Rated Voltage**	**Frame Rating (A)**	**Interrupting Rating**	**Trip Current**	**Description, TCC No.**
1.								

Table D-8. Equipment Power Loads, Nameplate Data Collection Table

Equipment Power Load Data							
No.	**Load Location & Identification**	**kVA or kW**	**PF**	**Rated Voltage**	**Rated current**		
1.							

Table D-9. Motor Equipment, Nameplate Data Collection Table

Motor Equipment Data							
No.	Motor Location & Identification	Rated HP or kVA, kW	PF	Rated Voltage	Rated current	Locked-Rotor kVA/HP	
1.							

Table D-10. Automatic Transfer Switch (ATS), Nameplate Data Collection Table

Automatic Transfer Switch (ATS) Equipment Data							
No.	Location & Identification	Model No.	Poles	Rated Voltage	Rated current	Serial No.	Options
1.							

Table D-11. Static Transfer Switch (STS), Nameplate Data Collection Table

Static Transfer Switch (STS) Equipment Data							
No.	Location & Identification	Model No.	Poles	Rated Voltage	Rated current	Serial No.	Options
1.							

Appendix E. Load Analysis Report – Illustrative Example

1. Overview. This section provides guidance material for the preparation of a load analysis report and it is intended to illustrate means, but not necessarily the only means, of complying with requirements in this document.

2. Objectives. The project type definition will establish the type and extent of study required. This section is tailored to suite a new design project with an initial design submission and follow-on design submissions extending to the final design and construction phases. In general, the studies required for a new design project includes:

a. Initial Concept Design Submission – Load Analysis Report

b. Intermediate Design and Follow-on Submissions – Power Study Report.

The power study report example is shown in Appendix D, and includes the following parts:

a. Power load-flow analysis

b. Short-circuit analysis

c. Protective device coordination analysis

d. Arc-flash risk assessment.

The studies may be tailored to suite other project definition types in accordance with Chapter 2 requirements.

3. Purpose. The illustrative example provides criteria and methods to prepare a report. The project scope definition must be determined during initial project planning process to ensure the proper application of requirements. The report format must be in accordance with Chapter 2 deliverable and archival storage requirements.

4. Load Analysis Report. The basic principle of an electrical power load analysis requires a listing of system power loads categorized by system and load type. The initial preliminary load analysis is intended to determine the total aggregate steady-state power load requirement for proper selection of characteristics and capacity of power source equipment.

The load analysis is the initial starting point for implementing electrical power design projects. The results of the load analysis are intended to inform the reader of criteria and material necessary to establish the basis for the project's follow-on electrical design phases. The load data should be updated where appropriate for follow-on design submissions to ensure accuracy of data and document initial design assumptions.

The load analysis report content should be organized into following parts:

a. Section 1 – Executive Summary

(1) Provide a brief introduction and project definition summary. Include assumptions and criteria references.

(2) Provide a listing of design standards and references used for the design.

b. Section 2 – Design Analysis

(1) Provide a design analysis narrative with project description. List any special features and alternative considerations.

(2) Provide a summary of the distribution system operating characteristics and capacity requirements such as, system voltage classification, power sources kVA/kW capacity, and distribution branch power operating modes.

(3) Provide an elemental power connection diagram illustrating configuration and distribution system topology.

c. Section 3 – AC and/or DC Load Analysis – Tabulation of Connected Loads

(1) Provide a listing of system loads categorized by type:

(a) Life safety equipment

(b) Lighting

(c) General purpose power and receptacle plug loads

(d) Critical/UPS electronic equipment loads

(e) Mechanical - air ventilation equipment

(f) Mechanical - air conditioning equipment

(g) Mechanical - humidification equipment

(h) Mechanical - electric heating equipment

(i) Mechanical - chiller equipment

(j) Mechanical - chilled water pumping system

(k) Mechanical - pumping equipment

(l) Fire protection - pumping system.

d. Section 4 – Power Source Equipment – Load Capacity Tabulation

(1) Provide a listing of applicable power source equipment:

(a) Commercial utility electric service entrance equipment

(b) Generator power source equipment

(c) Uninterruptible power source (UPS) equipment

(d) DC power source equipment.

e. Section 5 – Conclusion

(1) Provide a brief summary of follow-on project design phase activities. The load analysis results are intended to provide necessary input data for project follow-on design phase power study submissions.

(2) The conclusion should include statements that document design decisions reached throughout the design process.

5. Load Analysis Report – Illustrative Example. This section contains an example load analysis report.

Note: Provide a brief design narrative describing the objectives and purpose for the report. This example report document should not be read as a template or used as a form to fill in. The user is responsible for the final content and report format. The example calculations provided are intentionally over-simplified to clarify the process involved. They do not provide definitive numbers or values and are for guidance only.

a. Section 1 – Executive Summary. This document describes the basic electrical distribution system architecture and provides preliminary electrical load analysis for development of the project program requirements. The load analysis is intended to define preliminary capacity requirements for power source equipment needed to support the facility's expected electrical loads.

b. Section 2 – Design Analysis

(1) Project facility type definition:

(a) Air Traffic Control Tower (ATCT) and Base Building: 10,000 gross sq-ft

(b) ATC Activity Level: Low

(c) ATCT Cab Size: 550 sq-ft, 4 controller positions

(d) ATCT Height: Number of shaft floor levels, six, (86'-0" height from grade to cab floor)

(e) Site Area: 62,000 sq-ft

(f) Site Parking: 10 parking positions

(g) Security Perimeter Fencing: 450 lf.

(2) Power distribution system characteristics:

(a) Simple Radial Distribution Configuration

(b) Service Voltage Classification: 208Y/120V, 3-phase, 4-wire, 60 Hz

(c) Power Source: commercial utility

(d) Alternate Power Source: standby diesel-engine generator

(e) Distribution Branches: Normal, Essential, Fire Life Safety, and Critical.

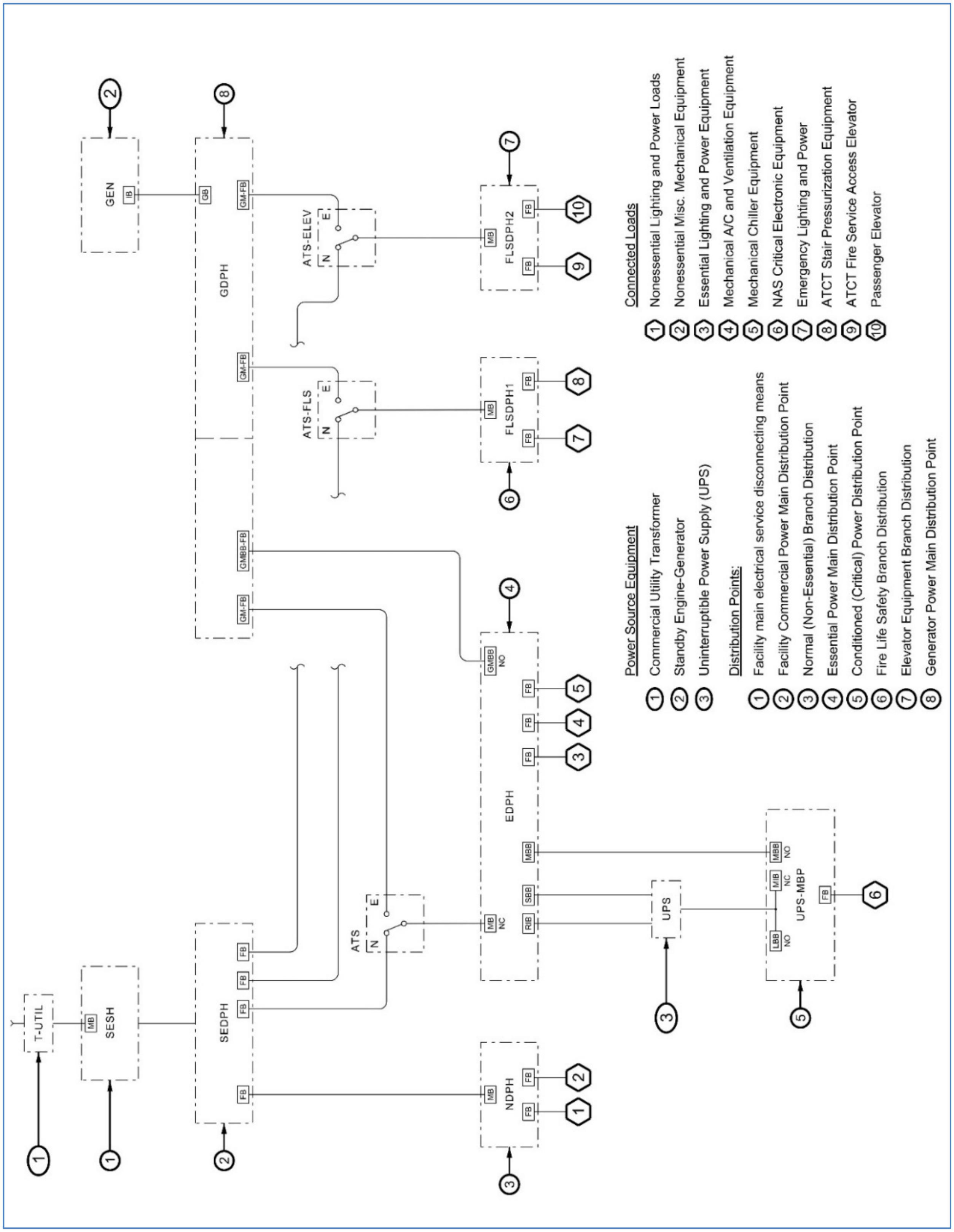
(3) Mechanical system characteristics:

(a) Chilled water system with redundant air-cooled chillers and electric heating equipment.

(b) Air handling units will provide facility ventilation air. The air handlers include chilled water and electric heating coils.

(c) Computer room air conditioning (CRAC) units will serve electronic equipment areas. The CRAC units include chilled water and electric heating coils.

Diagram 1. Simplified Power Distribution System Configuration



c. Section 3 – Facility AC Loads Analysis

Tabulation 1. Air Traffic Control and Telecommunication Equipment Connected Loads

No.	Equipment No.	Location	Room No.	kVA	Voltage
1	ETVS Cabinet 1	Level 1	Electronic Equipment Rm	1.5	120V-1PH
2	ETVS Cabinet 2	Level 1	Electronic Equipment Rm	1.5	120V-1PH
3	VIDS Cabinet	Level 1	Electronic Equipment Rm	1.5	120V-1PH
4	STARS Cabinet	Level 1	Electronic Equipment Rm	1.5	120V-1PH
5	DALR Cabinent	Level 1	Electronic Equipment Rm	1.5	120V-1PH
6	Swing/Expansion Cabinet	Level 1	Electronic Equipment Rm	1.5	120V-1PH
7	Telco Equipment Cabinets	Level 1	Telco Room	4.0	120V-1PH
8	ASOS Cabinet	ATCT Level 4	ATCT Electronic Equipment Rm	1.5	120V-1PH
9	Comm/Radio Cabinet 1	ATCT Level 5	ATCT Electronic Equipment Rm	1.5	120V-1PH
10	Comm/Radio Cabinet 2	ATCT Level 6	ATCT Electronic Equipment Rm	1.5	120V-1PH
11	Comm/Radio Cabinet 3	ATCT Level 7	ATCT Electronic Equipment Rm	1.5	120V-1PH
12	Swing/Expansion Cabinet	ATCT Level 8	ATCT Electronic Equipment Rm	1.5	120V-1PH
13	ATCT Cab Supervisor Position	ATCT Cab	-	2.0	120V-1PH
14	ATCT Cab Controller Position 1	ATCT Cab	-	2.0	120V-1PH
15	ATCT Cab Controller Position 2	ATCT Cab	-	2.0	120V-1PH
16	ATCT Cab Controller Position 3	ATCT Cab	-	2.0	120V-1PH
17	ATCT Cab Controller Position 4	ATCT Cab	-	2.0	120V-1PH
			Sub Total:	**30.5**	

Tabulation 2. Fire Life Safety Equipment Connected Loads

	ATS-FLS Connected Loads								
		Area	**Load**	**Unit**			**Load**		
No.	**Room Space Types:**	**Sq-Ft**	**Type**	**VA/Sq-Ft**	**HP**	**FLA**	**Factor**	**kVA**	**Voltage**
1	Fire Life Safety Systems	7142	Egress Ltg	0.25			1.00	1.8	120V-1PH
			Security/Fire Alarm	0.50			1.00	3.6	120V-1PH
			Stair Pressurization	-	2.00	7.50	1.00	2.7	208V-3PH
							Sub Total:	**8.1**	
	ATS-ELEV Connected Loads								
		Area	**Load**	**Unit**			**Load**		
No.	**Room Space Types:**	**Sq-Ft**	**Type**	**VA/Sq-Ft**	**HP**	**FLA**	**Factor**	**kVA**	**Voltage**
1	Elevator Machine Rm	-	ATCT Fire Service Elevator	-	75.00	211.00	1.00	76.0	208V-3PH
							Sub Total:	**76.0**	

Tabulation 3. Essential Mechanical Equipment Connected Loads

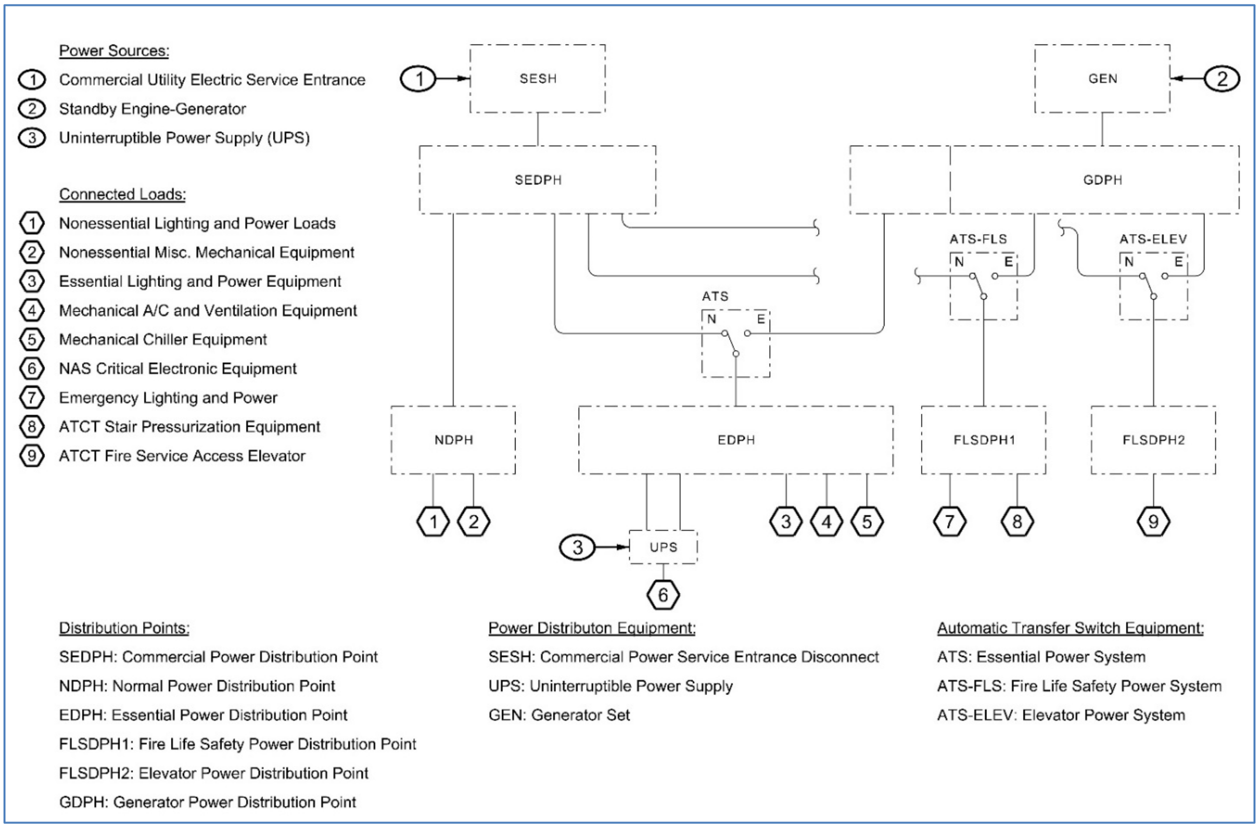
No.	Equipment No.	Location	Room No.	HP	FLA	kVA	Voltage	Remarks
	Mechanical Computer Room A/C Units							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	CRAH-1	Level 1	Electronic Eq Rm		44.8	16.1	208V-3PH	
2	CRAH-2	Level 1	Electronic Eq Rm		44.8	16.1	208V-3PH	Redundant Unit
3	CRAH-3	Level 1	Telco Room		30	6.2	208V-1PH	
4	CRAH-4	Level 1	Telco Room		30	6.2	208V-1PH	Redundant Unit
			Sub Total:			22.4		
			Load Factor (x 0.80):			17.9		
	Mechanical Air Handling Units with Electric Heat							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	AHU-1	ATCT Cab	-	4	50	10.4	208V-3PH	
2	AHU-2	ATCT Cab	-	4	50	10.4	208V-3PH	Redundant Unit
3	AHU-3	ATCT Level 4	ATCT Electronic Eq Rm	1.5	19	4.0	208V-3PH	
4	AHU-4	ATCT Level 4	ATCT Electronic Eq Rm	1.5	19	4.0	208V-3PH	Redundant Unit
5	DOAS-1	Level 1	Mechanical Room	1.5	34	7.1	208V-3PH	
			Sub Total:			21.4		
			Load Factor (x 0.80):			17.1		
	Mechanical Air Cooled Chiller							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	CH-1	Building Exterior	-		96.7	34.8	208V-3PH	
2	CH-2	Building Exterior	-		96.7	34.8	208V-3PH	Redundant Unit
			Sub Total:			34.8		
			Load Factor (x 1.0):			34.8		
	Mechanical Electric Humidifier Units							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	H-1	ATCT Level 2	Mechanical Room		18.0	6.5	208V-3PH	
2	H-2	ATCT Level 2	Mechanical Room		18.0	6.5	208V-3PH	Redundant Unit
			Sub Total:			6.5		
			Load Factor (x 0.75):			4.9		
	Mechanical Pumps							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	CHWP-1, Chilled Wtr Pmp	Level 1	Mechanical Room	5.0	16.7	6.0	208V-3PH	
2	CHWP-2, Chilled Wtr Pmp	Level 1	Mechanical Room	5.0	16.7	6.0	208V-3PH	
3	CHWP-3, Chilled Wtr Pmp	Level 2	Mechanical Room	5.0	16.7	6.0	208V-3PH	Redundant Unit
4	CHWP-3, Chilled Wtr Pmp	Level 3	Mechanical Room	5.0	16.7	6.0	208V-3PH	Redundant Unit
5	Site Sanitary Pump Station	Building Exterior	-	7.5	24.2	8.7	208V-3PH	
			Sub Total:			20.8		
			Load Factor (x 0.75):			15.6		
			System Total Connected Load (CL):			105.9		
			Est. System Max. Demand Load (DL):			90.3		
			Est. System Demand Factor (DL/CL):			0.85		

Tabulation 4. Non-essential Mechanical Equipment Connected Loads

	Mechanical Exhaust Fans							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	EF-1	Level 1	Mechanical Room	0.25	5.8	0.7	120V-1PH	
2	EF-2	Level 1	Sprinkler Room	0.25	5.8	0.7	120V-1PH	
3	EF-3	Level 1	Electrical Room	0.25	5.8	0.7	120V-1PH	
4	EF-4	Level 1	Restroom	0.25	5.8	0.7	120V-1PH	
5	EF-5	ATCT Level 2	Mechanical Room	0.25	5.8	0.7	120V-1PH	
6	EF-6	ATCT Level 3	Mechanical Room	0.25	5.8	0.7	120V-1PH	
7	EF-7	ATCT Level 6	Restroom	0.25	5.8	0.7	120V-1PH	
8	EF-8	Level 1	Electronic Eq Rm	0.25	5.8	0.7	120V-1PH	
9	EF-9	ATCT Level 4	Electronic Eq Rm	0.25	5.8	0.7	120V-1PH	
10	EF-10	ATCT Level 5	Break Room	0.25	5.8	0.7	120V-1PH	
11	EF-11	ATCT Cab Roof	-	0.5	2.4	0.9	208V-3PH	
			Sub Total:			7.5		
			Load Factor (x 0.50):			3.8		
	Mechanical Fan Coil Units							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	FC-1	Level 1	Fire Control Room		12.4	2.6	208V-1PH	
2	FC-2	Level 1	Corridor		12.4	2.6	208V-1PH	
3	FC-3	Level 1	Elevator Machine Rm		12.4	2.6	208V-1PH	
4	FC-4	ATCT Level 5	Break Room		12.4	2.6	208V-1PH	
5	FC-5	ATCT Level 6	Hall		12.4	2.6	208V-1PH	
			Sub Total:			12.8		
			Load Factor (x 0.60):			7.7		
	Mechanical Electric Unit Heaters							
No.	**Equipment No.**	**Location**	**Room No.**	**HP**	**FLA**	**kVA**	**Voltage**	**Remarks**
1	CUH-1	Level 1	Stairs		8	1.7	208V-3PH	
2	CUH-2	Level 1	Restroom		12.5	2.6	208V-3PH	
3	CUH-3	Level 1	Vestibule		12.5	2.6	208V-3PH	
4	CUH-4	ATCT Level 6	Restroom		12.5	2.6	208V-3PH	
5	UH-1	Level 1	Mechanical Room		27	5.6	208V-3PH	
6	UH-2	Level 1	Sprinkler Riser Room		27	5.6	208V-3PH	
7	UH-3	Level 1	Electrical Room		27	5.6	208V-3PH	
8	UH-4	ATCT Level 2	Mechnical Room		27	5.6	208V-3PH	
9	UH-5	ATCT Level 3	Mechanical Room		27	5.6	208V-3PH	
			Sub Total:			37.5		
			Load Factor (x 0.7):			26.3		
			System Total Connected Load (CL):			57.9		
			Est. System Max. Demand Load (DL):			37.8		
			Est. System Demand Factor (DL/CL):			0.65		

d. Section 4 – Power Source Equipment Load Analysis

Diagram 2. Elemental Power System Connection Diagram



Tabulation 5. Facility UPS - Load Capacity

Facility UPS Power Loads (Estimate)					
Line Item No.	Load Type Description	Voltage	Load kVA	Load Factor	Sub Total kVA
1	Level 1 Electronic Equipment Room	208V-3PH	9.00	0.8	7.2
2	Level 1 Telco Equipment Room	208V-3PH	4.00	0.8	3.2
2	ATCT Level 4 Electronic Equipment Rm	208V-3PH	7.50	0.8	6.0
3	ATCT Cab Electronic Equipment	208V-3PH	10.00	0.6	6.0

Subtotal:	22.4
Growth Provision (20%):	4.5
Total:	26.9

Mininum UPS size selection: 30 kVA

Tabulation 6. Commercial Utility Electric Service Entrance - Load Capacity

SESH Power Loads (Estimate)						
Line Item No.	Distribution Point	Load Type Description	Voltage	Load kVA	Demand Factor	Sub Total kVA
1	NDPH	Nonessential Lighting and Power	208V-3PH	15.1	0.50	7.5
2	NDPH	Nonessential Mechanical Equipment	208V-3PH	57.9	0.65	37.6
3	EDPH	Essential Lighting	208V-3PH	5.8	1.00	5.8
4	EDPH	Mechanical A/C and Ventilation Equipment	208V-3PH	105.9	0.77	81.5
5	EDPH	NAS Critical Electronic Equipment	208V-3PH	26.9	1.00	26.9
6	FLSDPH1	Emergency Lighting and Power Equipment	208V-3PH	5.4	1.00	5.4
7	FLSDPH1	ATCT Stair Pressurization Equipment	208V-3PH	2.7	1.00	2.7
8	FLSDPH2	ATCT Fire Service Access Elevator	208V-3PH	76.0	1.00	76.0

Subtotal:	243.5
Growth Provision (15%):	36.5
Total:	280.0

Est. Electric Service Entrance Capacity: 300 kVA

Tabulation 7. Power Generation Equipment - Load Capacity

Generator Power Loads (Estimate)						
Line Item No.	Distribution Point	Load Type Description	Voltage	Load kVA	Demand Factor	Sub Total kVA
1	EDPH	Essential Lighting	208V-3PH	5.8	1.00	5.8
2	EDPH	Mechanical A/C and Ventilation Equipment	208V-3PH	105.9	0.77	81.5
3	EDPH	NAS Critical Electronic Equipment	208V-3PH	26.9	1.00	26.9
4	FLSDPH1	Emergency Lighting and Power Equipment	208V-3PH	5.4	1.00	5.4
5	FLSDPH1	ATCT Stair Pressurization Equipment	208V-3PH	2.7	1.00	2.7
6	FLSDPH2	ATCT Fire Service Access Elevator	208V-3PH	76.0	1.00	76.0

Subtotal:	198.3
Growth Provision (10%):	19.8
Total:	218.1

Est. E/G size selection: 180 kW / 225 kVA

Note: The generator capacity tabulation is a generic estimate and does not consider other application and environmental criteria associated with generator sizing. The power load capacity and system design must be validated by using the generator manufacturer's proprietary sizing and load calculation software application tools.

e. Section 5 – Conclusion. This report provides basis of design criteria for development of the electrical power distribution system. This information will be used for follow-on design phases and power study report submissions.

The findings include:

(1) Power distribution system will be based on a simple radial topology with following distribution branches:

(a) Normal power bus

(b) Essential power bus

(c) Standby generator power bus

(d) Fire life safety power bus

(e) Critical power bus.

(2) Preliminary load estimates are based on a combination of individual and area based connected load calculation method for determination of system demand load requirements.

(3) System distribution branch demand load calculations include growth provision of 15% spare capacity.

(4) Power source equipment sizing includes following spare capacity provisions:

(a) Service Entrance Equipment: 15% spare capacity

(b) Generator Equipment: 10% spare capacity

(c) UPS Equipment: 20% spare capacity.

Appendix F. Power Study Report – Illustrative Example

1. Overview. This section provides guidance material for the preparation of a power study report and it is intended to illustrate means, but not necessarily the only means, of complying with requirements in this document.

2. Objectives. The project type definition will establish the type and extent of study required. This section is tailored to suite a new design project with an initial design submission and follow-on design submissions extending to the final design and construction phases.

The power study report includes the following parts:

- **a.** Power load-flow analysis
- **b.** Short-circuit analysis
- **c.** Protective device coordination analysis
- **d.** Arc-flash risk assessment.

The studies may be tailored to suite other project definition types in accordance with Chapter 2 requirements.

3. Purpose. The illustrative examples provide criteria and methods to prepare a report. The project scope definition must be determined during initial project planning process to ensure the proper application of requirements. The report format must be in accordance with Chapter 2 deliverable and archival storage requirements.

4. Power Study Report – General. A load analysis must be conducted to establish the basic electrical characteristics of the power distribution system. An example load analysis report is contained in Appendix E.

The power study includes following analyses:

- **a.** Load-flow
- **b.** Short-circuit
- **c.** Protective Device Coordination
- **d.** Arc Flash Risk Assessment.

This section also outlines standard forms that shall be used to present the input data, the output results, and a template to formally document the basis, conclusions and recommendations for each study.

To meet study input requirements, a composite one-line diagram for the power distribution system is required to serve as a basis for preparation of calculations and analysis. Specific components to be addressed are as follows:

- **a.** Maximum and minimum short circuit current availability from the electric utility system.

b. Transformer ratings and typical or specified impedances. When available and for final calculations, nameplate data shall be used.

c. Distribution equipment power bus and circuit breaker ratings.

d. System conductor type, size, lengths.

e. Motor loads: model motors 50 HP or larger as a separate input load. Motor loads less than 50 HP may be grouped as a lump sum horsepower or kw input load.

f. Type and current rating of the protective devices, relays, etc., and their associated instrument transformers are required for Protective Device and Arc Flash studies.

5. Power Study Implementation Process.

a. Perform data collection process to define model input and power source data.

(1) From the Utility, obtain minimum and maximum values for 3-phase faults and phase to ground (earth) faults including R/X or X/R ratio: For Preliminary design projects, where utility information is unavailable, engineering judgement must be used to determine the minimum and maximum values of 3-phase fault current.

(2) Determine or obtain the method of grounding (earthing).

(3) Gather relevant measured data and test reports.

(4) Gather actual or typical vendor information.

(5) Gather applicable standards and literature information.

(6) Document assumptions.

b. Building the Electrical Analysis Program Calculation Model.

(1) In developing the electronic model, the level of detail will be determined by the phase of the project and the studies required for that phase per the approved scope of work. In defining the scope of work, the following should be addressed:

(a) The scenario's to be considered, such as utility, generator, maintenance, and tie-circuit power flow operating modes.

(b) The number of calculations runs for each scenario, such as at maximum available short circuit, at minimum available or other values.

(c) The level of detail for the model.

(d) The selection of motors/loads to be modeled individually.

(e) The equipment and voltage levels where arc flash studies are required.

(2) The model comprises busses and branches. Provide a logical bus/branch naming convention and use a unique designation name for each bus/branch. A logical numbering system makes the model easily to check and increases readability: Where the design or existing distribution system includes a standard naming convention, use actual equipment tags for all modelled equipment.

c. Validate the Calculation Model:

(1) Once the model has been built, it should be thoroughly checked for accuracy. Validate model calculations by performing preliminary calculations to find errors, such as, abnormal high or low short circuit currents, abnormal power flows, and voltages, etc.

(2) After validation, configure the model operating scenarios and ensure that data changes are incorporated consistently for each scenario.

d. Perform the Load Flow Study.

(1) The Load Flow Study will determine system capability to supply the connected load under steady-state operating conditions, motor starting inrush transient voltage condition, and normal running conditions for other loads.

(2) The load flow analysis results are used to verify:

(a) Bus voltage levels, amperes, and power factor parameters.

(b) Potential extent of overloading transformers, generators, cables, equipment continuous bus bar ratings, and tie circuits during alternate power operating modes. Generator ratings shall be reviewed at maximum ambient conditions.

(c) Optimum tap setting for power transformers.

(3) Perform load flow runs for system operating scenarios to confirm equipment ratings.

e. Perform the Short Circuit Study.

(1) The Short circuit study will determine the presently available fault current at strategically designated points and determine if distribution equipment is applied correctly.

(2) The maximum and minimum short circuit currents shall be calculated for each scenario. The thermal withstand current shall be calculated for each switchboard and shall be used to determine the short circuit ratings of the switchboard.

(3) For the maximum short circuit current scenario, as a minimum calculate the following:

(a) 3-Phase short circuit currents

(b) Phase-to-Ground short circuit currents

(4) For the minimum short circuit current scenario, as a minimum calculate the following:

(a) 2-Phase (Line-to-Line) short circuit currents

(b) Phase-to-Ground short circuit currents

(5) Consider negative tolerances on generator and transformer impedances, and positive tolerances on motor starting currents, as applicable.

(6) All results shall be clearly documented and presented in a report. To help understand the future available margin for short-circuit capacity, it is recommended that calculated short circuit results be summarized in a table including applicable equipment rated short circuit values.

f. Perform the Protective Device Coordination Study.

(1) The Protective Device Coordination (PDC) Study will determine appropriate selection and setting of protective devices required to ensure reliable on-line performance and optimum trip sequencing. Time-current curves will be issued along with the relay setting records. The parts of the study include:

(a) Selection/Definition of current transformers and voltage transformers.

(b) Selection of protection devices to be applied.

(c) Determine protection device settings.

(d) Documentation of results.

(2) A PDC Study starts at the definition of the power system and ends when all relevant data is known (vendor equipment data). Before a PDC study can be started, the operating conditions must be known.

(3) The PDC Study shall consider:

(a) Reliability: The ability of the protection to operate correctly. Not only the correct operation on the occurrence of a fault but also the avoidance of incorrect operation during faults.

(b) Speed: The minimum amount of time to clear a fault to minimize impact/damage to the power system.

(c) Selectivity: Maintaining continuity of supply by disconnecting the minimum section of a network necessary to isolate a fault.

(4) Develop the Protection Philosophy for the system. Provide a protection scheme one-line diagram where required to illustrate levels of device selectivity for the different power load flow scenario configurations.

g. Perform the Arc Flash Analysis.

(1) The objective of an arc flash analysis is to minimize or mitigate the hazard to electrical service personnel. Consequently, an arc flash hazard analysis must identify following parameters:

(a) System bus bolted fault currents

(b) Equipment enclosure size and bus gaps based upon system voltage and type classification

(c) Equipment electrode configuration

(d) Working distances

(e) Arcing current

(f) Arc duration

(g) Incident energy

(h) Equipment arc-flash boundary.

(2) To perform the arc flash analysis, first perform a short circuit study and protective device coordination study. These studies will provide the short circuit fault current levels and protective device (circuit breaker, fuse, protective relay) settings for the switchgear, motor control centers, panelboards, etc. Access the results of these studies.

(3) Using the results of the short circuit study and protective device coordination study, perform the arc flash incident energy analysis. The arc flash incident energy analysis will identify the following:

(a) Amount of incident energy (cal/cm2) at working distance

(b) Arc Flash hazard boundary

(c) Shock hazard parameters

(d) Limited approach boundary

(e) Restricted approach boundary

(f) Type and level of Personnel Protective Equipment (PPE) needed.

(4) Generate the Arc Flash Warning Labels.

h. Documentation of Results. The results of each study shall be clearly documented and presented in the report. The report may be an individual report of each study type, or a composite report with a section for each study type. For composite reports, the preferred grouping is Load Flow, Short Circuit, Protective Device Coordination and Arc Flash studies together in a separate report. Other reports such as Load Analysis, Harmonic Studies and Transient Analysis should be separate reports.

6. Power Study Report – Format Example. The report, at a minimum, should contain the following applicable parts breakdown.

a. Section 1 – Executive Summary. Provide a brief introduction and summary of key points. Include objectives and purpose of the report, and describe any results, conclusions, or recommendations from the report.

b. Section 2 – Technical Considerations. Provide a narrative description of the following parts:

(1) Study Scope and Objectives:

(a) Study Criteria:

(i) Computer software and version information

(ii) Applicable FAA Orders and Standards

(iii) Applicable Building Codes and Industry Standards

(iv) Technical Basis and Assumptions.

c. Section 3 – Analysis and Methodology. Provide narrative description and applicable diagrams or tables for following items:

(1) Power Distribution System Configuration:

(a) Power One-line Diagram

(b) Power System Operating Modes.

(2) Input Data for Calculation Model:

(a) Utility Data

(b) Generator Data

(c) Motor Data

(d) Transformer Data

(e) Connected Power Loads.

(3) Load-flow and Voltage Drop Analysis

(4) Short-circuit Analysis

(5) Protective Device Coordination Analysis

(6) Arc-Flash Risk Assessment.

d. Section 4 – Summary of Calculation Results. Provide narrative description of results for following items:

(1) Load Analysis Operating Modes:

(a) Load-flow

(b) Voltage Drop.

(2) Short-circuit Operating Modes:

(a) AC Short-circuit

(b) DC Short-circuit.

(3) Protective Device Coordination:

(a) Utility Power Mode

(b) Generator Power Mode

(c) Maintenance/Tie Circuit Power Modes.

(4) Arc-flash Risk Assessment:

(a) AC Arc-flash Hazard

(b) DC Arc-flash Hazard.

e. Section 5 – Appendices. Provide calculation model results and output reports, generated by the software, for the following items:

(1) Data Group 1. Computer Software Input Data Output Reports:

(a) Power Bus Data

(b) Conductor/Cable Data

(c) Protective Device Data

(d) Utility/Generator Data

(e) Transformer Data

(f) Motor Data.

(2) Data Group 2. Load-flow Reports:

(a) Computer software generated and annotated power diagram

(b) Load-flow and voltage drop reports for operating modes.

(3) Data Group 3. Short-circuit Reports:

(a) Computer software generated and annotated power diagram

(b) Short-circuit reports for operating modes

(c) Equipment bus evaluation report

(d) Protective device evaluation report.

(4) Data Group 4. PDCA Reports:

(a) TCC plots

(b) Protective device settings report.

(5) Data Group 5. AFRA Reports:

(a) Arc-flash analysis data report

(b) Arc-flash warning label sample format.

7. Power Study Report Appendices – Illustrative Results Example. This section contains example results for a generic power study report. The report uses the basic power system configuration from Appendix E, Load Analysis report example.

The illustrative results are organized by following data groups:

a. Data Group 1: Computer software model input/output data reports.

b. Data Group 2: Load-flow calculation results.

c. Data Group 3: Short-circuit calculation results.

d. Data Group 4: Protective device coordination analysis TCC plots and protective device settings report.

e. Data Group 5: Arc-flash risk assessment results tabulation, equipment enclosure size and electrode configuration table, and arc-flash hazard warning label sample format.

Note: This example should not be read as a template or used as a form to fill in. The user is responsible for the final content and report format. The example calculations provided are intentionally over-simplified to clarify the process involved and illustrate the results. They do not provide definitive numbers or values and are for guidance only.

Data Group 1. Calculation Model - Bus Data

System Parameters			Bus Data
Line #	**Component**	**Field Parameter**	**Base Project**
1	CPL1	System Nominal Voltage (V)	208
2		Equipment Category	LV Panelboard
3		Manufacturer	SQUARE D
4		Bus Lib Type	NQOD CLASS 1630
5		Description	225A
6		Rating Description	225A 240V 225.0A 10.0kA 1.732
7	EDPH	System Nominal Voltage (V)	208
8		Equipment Category	LV Panelboard
9		Manufacturer	SQUARE D
10		Bus Lib Type	I-LINE CLASS 2110
11		Description	800A
12		Rating Description	800A 240V 800.0A 25.0kA 4.899
13	EPH1	System Nominal Voltage (V)	208
14		Equipment Category	LV Panelboard
15		Manufacturer	SQUARE D
16		Bus Lib Type	NQOD CLASS 1630
17		Description	225A
18		Rating Description	225A 240V 225.0A 10.0kA 1.732
19	EPH2	System Nominal Voltage (V)	208
20		Equipment Category	LV Panelboard
21		Manufacturer	SQUARE D
22		Bus Lib Type	NQOD CLASS 1630
23		Description	225A
24		Rating Description	225A 240V 225.0A 10.0kA 1.732
25	FLS-ELEV	System Nominal Voltage (V)	208
26		Equipment Category	LV Panelboard
27		Manufacturer	SQUARE D
28		Bus Lib Type	I-LINE CLASS 2110
29		Description	400A
30		Rating Description	400A 240V 400.0A 25.0kA 4.899
31	FLSDPH1	System Nominal Voltage (V)	208
32		Equipment Category	LV Panelboard
33		Manufacturer	SQUARE D
34		Bus Lib Type	NQOD CLASS 1630
35		Description	225A
36		Rating Description	225A 240V 225.0A 10.0kA 1.732
37	GDPH	System Nominal Voltage (V)	208
38		Equipment Category	LV Panelboard
39		Manufacturer	SQUARE D
40		Bus Lib Type	I-LINE CLASS 2110
41		Description	800A
42		Rating Description	800A 240V 800.0A 25.0kA 4.899

Data Group 1. Calculation Model - Bus Data (continued)

System Parameters			Bus Data
Line #	**Component**	**Field Parameter**	**Base Project**
43	NDPH	System Nominal Voltage (V)	208
44		Equipment Category	LV Panelboard
45		Manufacturer	SQUARE D
46		Bus Lib Type	I-LINE CLASS 2110
47		Description	400A
48		Rating Description	400A 240V 400.0A 25.0kA 4.899
49	NPH	System Nominal Voltage (V)	208
50		Equipment Category	LV Panelboard
51		Manufacturer	SQUARE D
52		Bus Lib Type	NQOD CLASS 1630
53		Description	225A
54		Rating Description	225A 240V 225.0A 10.0kA 1.732
55	SEDPH	System Nominal Voltage (V)	208
56		Equipment Category	LV Switchboard
57		Manufacturer	SQUARE D
58		Bus Lib Type	SPEED-D CLASS 2710
59		Description	1200A
60		Rating Description	1200A 240V 1200.0A 25.0kA 4.899
61	SESH	System Nominal Voltage (V)	208
62		Equipment Category	LV Switchboard
63		Manufacturer	SQUARE D
64		Bus Lib Type	SPEED-D CLASS 2710
65		Description	1200A
66		Rating Description	1200A 240V 1200.0A 25.0kA 4.899
67	UPS-MBP	System Nominal Voltage (V)	208
68		Equipment Category	LV Panelboard
69		Manufacturer	SQUARE D
70		Bus Lib Type	I-LINE CLASS 2110
71		Description	225A
72		Rating Description	225A 240V 225.0A 25.0kA 4.899

Data Group 1. Calculation Model - Cable Data

System Parameters			Cable Data
Line #	Component	Field Parameter	Base Project
1	ATS-ELEV-F	ComponentName	ATS-ELEV-F
2		ConnectedBus	SEDPH
3		ConductorType	Copper
4		Conductor Desc	3-(1/C)
5		CableSize (AWG)	4/0
6		QtyPerPhase	2
7		Length (ft)	50
8	ATS-ELEV-GM-F	ComponentName	ATS-ELEV-GM-F
9		ConnectedBus	GDPH
10		ConductorType	Copper
11		Conductor Desc	3-(1/C)
12		CableSize (AWG)	4/0
13		QtyPerPhase	2
14		Length (ft)	50
15	ATS-F	ComponentName	ATS-F
16		ConnectedBus	SEDPH
17		ConductorType	Copper
18		Conductor Desc	3-(1/C)
19		CableSize (kcmil)	350
20		QtyPerPhase	2
21		Length (ft)	25
22	ATS-FLS-F	ComponentName	ATS-FLS-F
23		ConnectedBus	SEDPH
24		ConductorType	Copper
25		Conductor Desc	3-(1/C)
26		CableSize (AWG)	1/0
27		QtyPerPhase	1
28		Length (ft)	50
29	ATS-FLS-GM-F	ComponentName	ATS-FLS-GM-F
30		ConnectedBus	GDPH
31		ConductorType	Copper
32		Conductor Desc	3-(1/C)
33		CableSize (AWG)	1/0
34		QtyPerPhase	1
35		Length (ft)	50
36	ATS-GM-F	ComponentName	ATS-GM-F
37		ConnectedBus	GDPH
38		ConductorType	Copper
39		Conductor Desc	3-(1/C)
40		CableSize (kcmil)	350
41		QtyPerPhase	2
42		Length (ft)	25

Data Group 1. Calculation Model - Cable Data (continued)

System Parameters			Cable Data
Line #	**Component**	**Field Parameter**	**Base Project**
43	CH1-F	ComponentName	CH1-F
44		ConnectedBus	EDPH
45		ConductorType	Copper
46		Conductor Desc	3-(1/C)
47		CableSize (AWG)	1/0
48		QtyPerPhase	1
49		Length (ft)	100
50	CH1-MTR-F	ComponentName	CH1-MTR-F
51		ConnectedBus	BUS-0041
52		ConductorType	Copper
53		Conductor Desc	3-(1/C)
54		CableSize (AWG)	1/0
55		QtyPerPhase	1
56		Length (ft)	10
57	CH2-F	ComponentName	CH2-F
58		ConnectedBus	EDPH
59		ConductorType	Copper
60		Conductor Desc	3-(1/C)
61		CableSize (AWG)	1/0
62		QtyPerPhase	1
63		Length (ft)	100
64	CH2-MTR-F	ComponentName	CH2-MTR-F
65		ConnectedBus	BUS-0044
66		ConductorType	Copper
67		Conductor Desc	3-(1/C)
68		CableSize (AWG)	1/0
69		QtyPerPhase	1
70		Length (ft)	10
71	CPL1-F	ComponentName	CPL1-F
72		ConnectedBus	UPS-MBP
73		ConductorType	Copper
74		Conductor Desc	3-(1/C)
75		CableSize (AWG)	1/0
76		QtyPerPhase	1
77		Length (ft)	75
78	EDPH-F	ComponentName	EDPH-F
79		ConnectedBus	BUS-0028
80		ConductorType	Copper
81		Conductor Desc	3-(1/C)
82		CableSize (kcmil)	350
83		QtyPerPhase	2
84		Length (ft)	50

Data Group 1. Calculation Model - Cable Data (continued)

System Parameters			Cable Data
Line #	**Component**	**Field Parameter**	**Base Project**
85	ELEV-F	ComponentName	ELEV-F
86		ConnectedBus	FLS-ELEV
87		ConductorType	Copper
88		Conductor Desc	3-(1/C)
89		CableSize (AWG)	1/0
90		QtyPerPhase	2
91		Length (ft)	75
92	ELEV-MTR-F	ComponentName	ELEV-MTR-F
93		ConnectedBus	BUS-0036
94		ConductorType	Copper
95		Conductor Desc	3-(1/C)
96		CableSize (AWG)	1/0
97		QtyPerPhase	2
98		Length (ft)	15
99	EPH1-F	ComponentName	EPH1-F
100		ConnectedBus	EDPH
101		ConductorType	Copper
102		Conductor Desc	3-(1/C)
103		CableSize (AWG)	1/0
104		QtyPerPhase	1
105		Length (ft)	75
106	EPH2-F	ComponentName	EPH2-F
107		ConnectedBus	EDPH
108		ConductorType	Copper
109		Conductor Desc	3-(1/C)
110		CableSize (AWG)	1/0
111		QtyPerPhase	1
112		Length (ft)	75
113	FLSDPH1-F	ComponentName	FLSDPH1-F
114		ConnectedBus	BUS-0031
115		ConductorType	Copper
116		Conductor Desc	3-(1/C)
117		CableSize (AWG)	1/0
118		QtyPerPhase	1
119		Length (ft)	25
120	FLSDPH2-F	ComponentName	FLSDPH2-F
121		ConnectedBus	BUS-0033
122		ConductorType	Copper
123		Conductor Desc	3-(1/C)
124		CableSize (AWG)	4/0
125		QtyPerPhase	2
126		Length (ft)	75

Data Group 1. Calculation Model - Cable Data (continued)

System Parameters			Cable Data
Line #	**Component**	**Field Parameter**	**Base Project**
127	GDPH-F	ComponentName	GDPH-F
128		ConnectedBus	BUS-0016
129		ConductorType	Copper
130		Conductor Desc	3-(1/C)
131		CableSize (kcmil)	600
132		QtyPerPhase	2
133		Length (ft)	75
134	NDPH-F	ComponentName	NDPH-F
135		ConnectedBus	SEDPH
136		ConductorType	Copper
137		Conductor Desc	3-(1/C)
138		CableSize (kcmil)	250
139		QtyPerPhase	1
140		Length (ft)	25
141	NPH-F	ComponentName	NPH-F
142		ConnectedBus	NDPH
143		ConductorType	Copper
144		Conductor Desc	3-(1/C)
145		CableSize (AWG)	1/0
146		QtyPerPhase	1
147		Length (ft)	75
148	SEDPH-F	ComponentName	SEDPH-F
149		ConnectedBus	SESH
150		ConductorType	Copper
151		Conductor Desc	3-(1/C)
152		CableSize (kcmil)	600
153		QtyPerPhase	3
154		Length (ft)	25
155	SESH-F	ComponentName	SESH-F
156		ConnectedBus	BUS-0012
157		ConductorType	Copper
158		Conductor Desc	3-(1/C)
159		CableSize (kcmil)	600
160		QtyPerPhase	3
161		Length (ft)	125
162	UPS-MBP-F	ComponentName	UPS-MBP-F
163		ConnectedBus	BUS-0039
164		ConductorType	Copper
165		Conductor Desc	3-(1/C)
166		CableSize (AWG)	1/0
167		QtyPerPhase	1
168		Length (ft)	50

Data Group 1. Calculation Model - Cable Data (continued)

System Parameters			Cable Data
Line #	**Component**	**Field Parameter**	**Base Project**
169	UPS-MBP-MMB-F	ComponentName	UPS-MBP-MMB-F
170		ConnectedBus	EDPH
171		ConductorType	Copper
172		Conductor Desc	3-(1/C)
173		CableSize (AWG)	1/0
174		QtyPerPhase	1
175		Length (ft)	50
176	UPS-RIB-F	ComponentName	UPS-RIB-F
177		ConnectedBus	EDPH
178		ConductorType	Copper
179		Conductor Desc	3-(1/C)
180		CableSize (AWG)	1/0
181		QtyPerPhase	1
182		Length (ft)	50
183	UTIL-F	ComponentName	UTIL-F
184		ConnectedBus	UTILITY BUS
185		ConductorType	Copper
186		Conductor Desc	3-1/C
187		CableSize (AWG)	2
188		QtyPerPhase	1
189		Length (ft)	100

Data Group 2. Calculation Model - Motor Data

System Parameters			Motor Data
Line #	**Component**	**Field Parameter**	**Base Project**
1	CH1-MTR	ComponentName	CH1-MTR
2		ConnectedBus	BUS-0042
4		Energize State	In
5		System Nominal Voltage (V)	208
6		BaseVoltage (V)	208
7		Base kVA (kVA)	28.5
8		X"d (pu)	0.150738
9		X/R	4.899
10	CH2-MTR	ComponentName	CH2-MTR
11		ConnectedBus	BUS-0045
13		Energize State	In
14		System Nominal Voltage (V)	208
15		BaseVoltage (V)	208
16		Base kVA (kVA)	28.5
17		X"d (pu)	0.150738
18		X/R	4.899

Data Group 2. Calculation Model - Motor Data (continued)

System Parameters			Motor Data
Line #	**Component**	**Field Parameter**	**Base Project**
19	ELEV-MTR	ComponentName	ELEV-MTR
20		ConnectedBus	BUS-0037
22		Energize State	In
23		System Nominal Voltage (V)	208
24		BaseVoltage (V)	208
25		Base kVA (kVA)	75.2
26		X"d (pu)	0.150738
27		X/R	4.899
28	EPH2-MTR	ComponentName	EPH2-MTR
29		ConnectedBus	EPH2
31		Energize State	In
32		System Nominal Voltage (V)	208
33		BaseVoltage (V)	208
34		Base kVA (kVA)	35
35		X"d (pu)	0.150738
36		X/R	4.899
37	Exhaust Fans	ComponentName	Exhaust Fans
38		ConnectedBus	NDPH
40		Energize State	Out
41		System Nominal Voltage (V)	208
42		BaseVoltage (V)	208
43		Base kVA (kVA)	12.8
44		X"d (pu)	0.150738
45		X/R	4.899
46	SF-1	ComponentName	SF-1
47		ConnectedBus	FLSDPH1
49		Energize State	In
50		System Nominal Voltage (V)	208
51		BaseVoltage (V)	208
52		Base kVA (kVA)	1.9
53		X"d (pu)	0.150738
54		X/R	4.899

Data Group 1. Calculation Model - Transformer Data

System Parameters			Transformer Data
Line #	**Component**	**Field Parameter**	**Base Project**
1	T-UTILITY	ComponentName	T-UTILITY
2		Manufacturer	NONE
3		Type	Oil Air/Forced Air
4		Energize State	In
5		(kVA)	300
6		FullLoad kVA (kVA)	375
7		Pri Connection	Delta
8		Pri FLA (A)	15.7
9		Sec Connection	Wye-Ground
10		Sec FLA (A)	1040.9
11		X/R	2.9176
12		Z% (%)	5.2432
13		DamageCurve	3 Phase + SLG

Data Group 1. Calculation Model - Utility Power Source Data

System Parameters			Utility Power Source Data
Line #	**Component**	**Field Parameter**	**Base Project**
1	T-UTILITY	ComponentName	T-UTILITY
2		Manufacturer	NONE
3		Type	Oil Air/Forced Air
4		Energize State	In
5		(kVA)	300.00
6		FullLoad kVA (kVA)	375.00
7		Pri Connection	Delta
8		Pri FLA (A)	15.70
9		Sec Connection	Wye-Ground
10		Sec FLA (A)	1040.9
11		X/R	2.9176
12		Z% (%)	5.2432
13		DamageCurve	3 Phase + SLG

Data Group 1. Calculation Model - Generator Data

System Parameters			Generator Power Source Data
Line #	**Component**	**Field Parameter**	**Base Project**
1	GEN	ComponentName	GEN
2		ConnectedComponent1	GEN-IB:1
3		Manufacturer	Kohler 180REOZJG, 60Hz
4		System Nominal Voltage (V)	208
5		Rated Volt (V)	208
6		ConnectionType	Wye-Ground
7		Rated kVA (kVA)	225
8		Rated kW (kW)	180
9		Rated PF (Lag)	0.8
10		RatedAmps (A)	624.54
11		Poles	4
12		BaseVoltage (V)	208
13		Base kVA (kVA)	225
14		SourceType	Volts & Angle (SB)
15		X"d (pu)	0.15
16		X"Neg (pu)	0.15
17		X"Pos (pu)	0.15
18		X"q (pu)	0.15
19		X"Zero (pu)	0.15
20		X/R Neg	13.9695
21		X/R Pos	13.9695
22		X/R Zero	13.9695
23		X0 (pu)	0.15
24		Xd (pu)	2.75
25		X'd (pu)	0.29
26		Xd Saturated (pu)	1.6
27		Xdp Saturated (pu)	0.15
28		Xdpp Saturated (pu)	0.1
29		If	3
30		Tdc (ms)	93
31		Tdp (ms)	420
32		Tdpp (ms)	26
33		R0 (pu)	0.0107

Data Group 1. Calculation Model - Protective Device Data

System Parameters			Protective Device Data
Line #	**Component**	**Field Parameter**	**Base Project**
1	ATS-ELEV-FB	ComponentName	ATS-ELEV-FB
2		Manufacturer	SQUARE D
3		Frame/Model	PG
4		Frame/Rating (A)	1200
5		FrameVoltage (V)	240
6		InterruptingRating (kA)	65
7		Poles	3 Poles
8		Sensor/Trip (A)	400
9		TCC No.	613-4, 5, 7, 10
10	ATS-ELEV-GM-FB	ComponentName	ATS-ELEV-GM-FB
11		Manufacturer	SQUARE D
12		Frame/Model	PG
13		Frame/Rating (A)	1200
14		FrameVoltage (V)	240
15		InterruptingRating (kA)	65
16		Poles	3 Poles
17		Sensor/Trip (A)	400
18		TCC No.	613-4, 5, 7, 10
19	ATS-FB	ComponentName	ATS-FB
20		Manufacturer	SQUARE D
21		Frame/Model	PG
22		Frame/Rating (A)	1200
23		FrameVoltage (V)	240
24		InterruptingRating (kA)	65
25		Poles	3 Poles
26		Sensor/Trip (A)	800
27		TCC No.	613-4, 5, 7, 10
28	ATS-FLS-FB	ComponentName	ATS-FLS-FB
29		Manufacturer	SQUARE D
30		Frame/Model	PG
31		Frame/Rating (A)	1200
32		FrameVoltage (V)	240
33		InterruptingRating (kA)	65
34		Poles	3 Poles
35		Sensor/Trip (A)	250
36		TCC No.	613-4, 5, 7, 10
37	ATS-FLS-GM-FB	ComponentName	ATS-FLS-GM-FB
38		Manufacturer	SQUARE D
39		Frame/Model	PG
40		Frame/Rating (A)	1200
41		FrameVoltage (V)	240
42		InterruptingRating (kA)	65
43		Poles	3 Poles
44		Sensor/Trip (A)	250
45		TCC No.	613-4, 5, 7, 10

Data Group 1. Calculation Model - Protective Device Data (continued)

System Parameters			Protective Device Data
Line #	Component	Field Parameter	Base Project
46	ATS-GM-FB	ComponentName	ATS-GM-FB
47		Manufacturer	SQUARE D
48		Frame/Model	PG
49		Frame/Rating (A)	1200
50		FrameVoltage (V)	240
51		InterruptingRating (kA)	65
52		Poles	3 Poles
53		Sensor/Trip (A)	800
54		TCC No.	613-4, 5, 7, 10
55	CH1-FB	ComponentName	CH1-FB
56		Manufacturer	SQUARE D
57		Frame/Model	LD
58		Frame/Rating (A)	400
59		FrameVoltage (V)	240
60		InterruptingRating (kA)	25
61		Poles	3 Poles
62		Sensor/Trip (A)	400
63		TCC No.	S1A81___00
64	CH2-FB	ComponentName	CH2-FB
65		Manufacturer	SQUARE D
66		Frame/Model	LD
67		Frame/Rating (A)	400
68		FrameVoltage (V)	240
69		InterruptingRating (kA)	25
70		Poles	3 Poles
71		Sensor/Trip (A)	400
72		TCC No.	S1A81___00
73	CPL1-BB	ComponentName	CPL1-BB
74		Manufacturer	SQUARE D
75		Frame/Model	QO
76		Frame/Rating (A)	50
77		FrameVoltage (V)	240
78		InterruptingRating (kA)	10
79		Poles	1 Pole
80		Sensor/Trip (A)	50
81		TCC No.	730-2,3,4,5,6
82	CPL1-FB	ComponentName	CPL1-FB
83		Manufacturer	SQUARE D
84		Frame/Model	JD
85		Frame/Rating (A)	250
86		FrameVoltage (V)	240
87		InterruptingRating (kA)	25
88		Poles	3 Poles
89		Sensor/Trip (A)	250
90		TCC No.	S1A814__00

Data Group 1. Calculation Model - Protective Device Data (continued)

System Parameters			Protective Device Data
Line #	**Component**	**Field Parameter**	**Base Project**
91	CPL1-MB	ComponentName	CPL1-MB
92		Manufacturer	SQUARE D
93		Frame/Model	JD
94		Frame/Rating (A)	250
95		FrameVoltage (V)	240
96		InterruptingRating (kA)	25
97		Poles	3 Poles
98		Sensor/Trip (A)	250
99		TCC No.	S1A814__00
100	EDPH-MB	ComponentName	EDPH-MB
101		Manufacturer	SQUARE D
102		Frame/Model	PG
103		Frame/Rating (A)	1200
104		FrameVoltage (V)	240
105		InterruptingRating (kA)	65
106		Poles	3 Poles
107		Sensor/Trip (A)	800
108		TCC No.	613-4, 5, 7, 10
109	EPH1-BB	ComponentName	EPH1-BB
110		Manufacturer	SQUARE D
111		Frame/Model	QO
112		Frame/Rating (A)	20
113		FrameVoltage (V)	240
114		InterruptingRating (kA)	10
115		Poles	1 Pole
116		Sensor/Trip (A)	20
117		TCC No.	730-2,3,4,5,6
118	EPH1-FB	ComponentName	EPH1-FB
119		Manufacturer	SQUARE D
120		Frame/Model	HD
121		Frame/Rating (A)	150
122		FrameVoltage (V)	240
123		InterruptingRating (kA)	25
124		Poles	3 Poles
125		Sensor/Trip (A)	150
126		TCC No.	50-1,2,3,4
127	EPH1-MB	ComponentName	EPH1-MB
128		Manufacturer	SQUARE D
129		Frame/Model	HD
130		Frame/Rating (A)	150
131		FrameVoltage (V)	240
132		InterruptingRating (kA)	25
133		Poles	3 Poles
134		Sensor/Trip (A)	150
135		TCC No.	50-1,2,3,4

Data Group 1. Calculation Model - Protective Device Data (continued)

System Parameters			Protective Device Data
Line #	Component	Field Parameter	Base Project
136	EPH2-BB	ComponentName	EPH2-BB
137		Manufacturer	SQUARE D
138		Frame/Model	QO
139		Frame/Rating (A)	20
140		FrameVoltage (V)	240
141		InterruptingRating (kA)	10
142		Poles	1 Pole
143		Sensor/Trip (A)	20
144		TCC No.	730-2,3,4,5,6
145	EPH2-FB	ComponentName	EPH2-FB
146		Manufacturer	SQUARE D
147		Frame/Model	HD
148		Frame/Rating (A)	150
149		FrameVoltage (V)	240
150		InterruptingRating (kA)	25
151		Poles	3 Poles
152		Sensor/Trip (A)	150
153		TCC No.	50-1,2,3,4
154	EPH2-MB	ComponentName	EPH2-MB
155		Manufacturer	SQUARE D
156		Frame/Model	HD
157		Frame/Rating (A)	150
158		FrameVoltage (V)	240
159		InterruptingRating (kA)	25
160		Poles	3 Poles
161		Sensor/Trip (A)	150
162		TCC No.	50-1,2,3,4
163	FLS-ELEV-MB	ComponentName	FLS-ELEV-MB
164		Manufacturer	SQUARE D
165		Frame/Model	LD
166		Frame/Rating (A)	400
167		FrameVoltage (V)	240
168		InterruptingRating (kA)	25
169		Poles	3 Poles
170		Sensor/Trip (A)	400
171		TCC No.	S1A81___00
172	FLSDPH1-BB	ComponentName	FLSDPH1-BB
173		Manufacturer	SQUARE D
174		Frame/Model	QO
175		Frame/Rating (A)	20
176		FrameVoltage (V)	240
177		InterruptingRating (kA)	10
178		Poles	1 Pole
179		Sensor/Trip (A)	20
180		TCC No.	730-2,3,4,5,6

Data Group 1. Calculation Model - Protective Device Data (continued)

System Parameters			Protective Device Data
Line #	**Component**	**Field Parameter**	**Base Project**
181	FLSDPH1-MB	ComponentName	FLSDPH1-MB
182		Manufacturer	SQUARE D
183		Frame/Model	HD
184		Frame/Rating (A)	150
185		FrameVoltage (V)	240
186		InterruptingRating (kA)	25
187		Poles	3 Poles
188		Sensor/Trip (A)	150
189		TCC No.	S1A814__00
190	GDPH-GB	ComponentName	GDPH-GB
191		Manufacturer	SQUARE D
192		Frame/Model	PG
193		Frame/Rating (A)	1200
194		FrameVoltage (V)	240
195		InterruptingRating (kA)	65
196		Poles	3 Poles
197		Sensor/Trip (A)	800
198		TCC No.	613-4, 5, 7, 10
199	GEN-IB	ComponentName	GEN-IB
200		Manufacturer	SQUARE D
201		Frame/Model	PG
202		Frame/Rating (A)	1200
203		FrameVoltage (V)	240
204		InterruptingRating (kA)	65
205		Poles	3 Poles
206		Sensor/Trip (A)	800
207		TCC No.	613-4, 5, 7, 10
208	NDPH-FB	ComponentName	NDPH-FB
209		Manufacturer	SQUARE D
210		Frame/Model	PG
211		Frame/Rating (A)	1200
212		FrameVoltage (V)	240
213		InterruptingRating (kA)	65
214		Poles	3 Poles
215		Sensor/Trip (A)	250
216		TCC No.	613-4, 5, 7, 10
217	NPH-BB	ComponentName	NPH-BB
218		Manufacturer	SQUARE D
219		Frame/Model	QO
220		Frame/Rating (A)	20
221		FrameVoltage (V)	240
222		InterruptingRating (kA)	10
223		Poles	1 Pole
224		Sensor/Trip (A)	20
225		TCC No.	730-2,3,4,5,6

Data Group 1. Calculation Model - Protective Device Data (continued)

System Parameters			Protective Device Data
Line #	**Component**	**Field Parameter**	**Base Project**
226	NPH-FB	ComponentName	NPH-FB
227		Manufacturer	SQUARE D
228		Frame/Model	HD
229		Frame/Rating (A)	150
230		FrameVoltage (V)	240
231		InterruptingRating (kA)	25
232		Poles	3 Poles
233		Sensor/Trip (A)	150
234		TCC No.	50-1,2,3,4
235	NPH-MB	ComponentName	NPH-MB
236		Manufacturer	SQUARE D
237		Frame/Model	HD
238		Frame/Rating (A)	150
239		FrameVoltage (V)	240
240		InterruptingRating (kA)	25
241		Poles	3 Poles
242		Sensor/Trip (A)	150
243		TCC No.	50-1,2,3,4
262	SESH-MB	ComponentName	SESH-MB
263		Manufacturer	SQUARE D
264		Frame/Model	PG
265		Frame/Rating (A)	1200
266		FrameVoltage (V)	240
267		InterruptingRating (kA)	65
268		Poles	3 Poles
269		Sensor/Trip (A)	800
270		TCC No.	613-4, 5, 7, 10
271	T-UTIL-F	ComponentName	T-UTIL-F
272		Manufacturer	S&C
273		Frame/Model	SM-4, 15E
274		Frame/Rating (A)	15
275		FrameVoltage (V)	7200
276		InterruptingRating (kA)	15.6
277		Poles	3 Poles
278		Sensor/Trip (A)	15
279		TCC No.	119-4, 119-4-2
280	UPS-MBB	ComponentName	UPS-MBB
281		Manufacturer	SQUARE D
282		Frame/Model	LD
283		Frame/Rating (A)	400
284		FrameVoltage (V)	240
285		InterruptingRating (kA)	25
286		Poles	3 Poles
287		Sensor/Trip (A)	400
288		TCC No.	S1A816__00

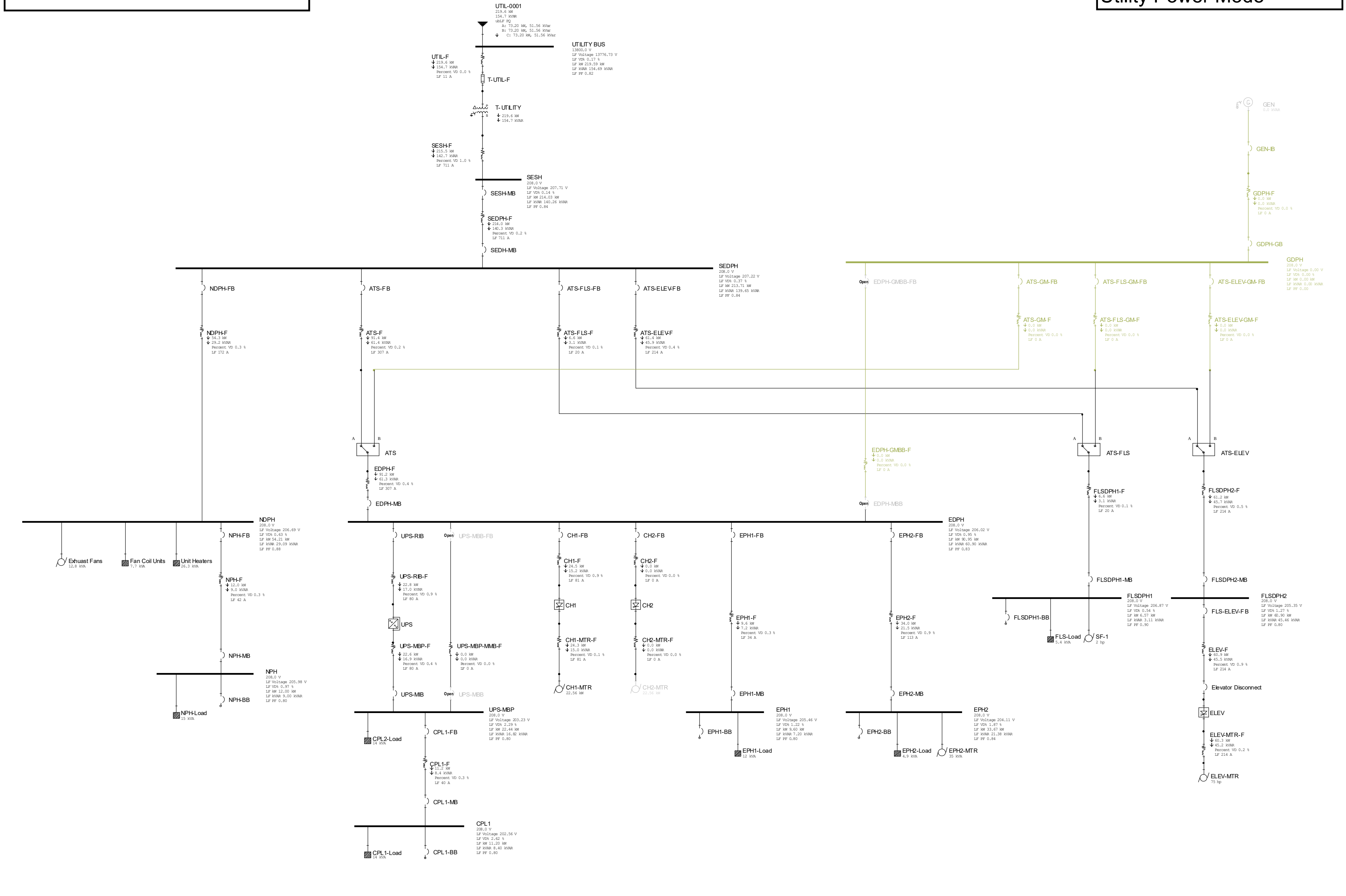
Data Group 1. Calculation Model - Protective Device Data (continued)

System Parameters			Protective Device Data
Line #	**Component**	**Field Parameter**	**Base Project**
289	UPS-MBB-FB	ComponentName	UPS-MBB-FB
290		Manufacturer	SQUARE D
291		Frame/Model	LD
292		Frame/Rating (A)	400
293		FrameVoltage (V)	240
294		InterruptingRating (kA)	25
295		Poles	3 Poles
296		Sensor/Trip (A)	400
297		TCC No.	S1A816__00
298	UPS-MIB	ComponentName	UPS-MIB
299		Manufacturer	SQUARE D
300		Frame/Model	LD
301		Frame/Rating (A)	400
302		FrameVoltage (V)	240
303		InterruptingRating (kA)	25
304		Poles	3 Poles
305		Sensor/Trip (A)	400
306		TCC No.	S1A816__00
307	UPS-RIB	ComponentName	UPS-RIB
308		Manufacturer	SQUARE D
309		Frame/Model	LD
310		Frame/Rating (A)	400
311		FrameVoltage (V)	240
312		InterruptingRating (kA)	25
313		Poles	3 Poles
314		Sensor/Trip (A)	400
315		TCC No.	S1A816__00

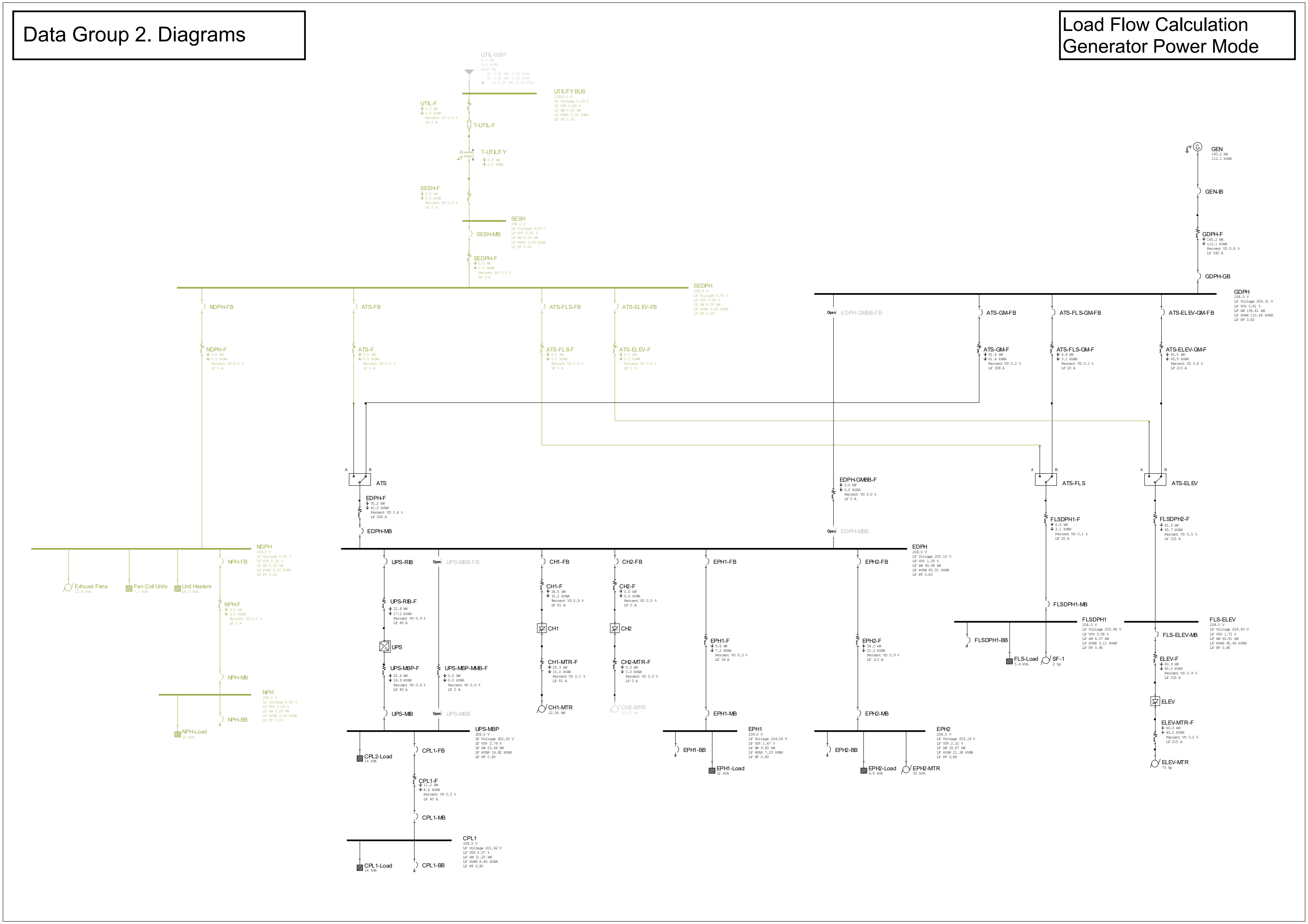
Data Group 2: Load Flow Calculation Utility Power Mode Diagram

Data Group 2. Diagrams

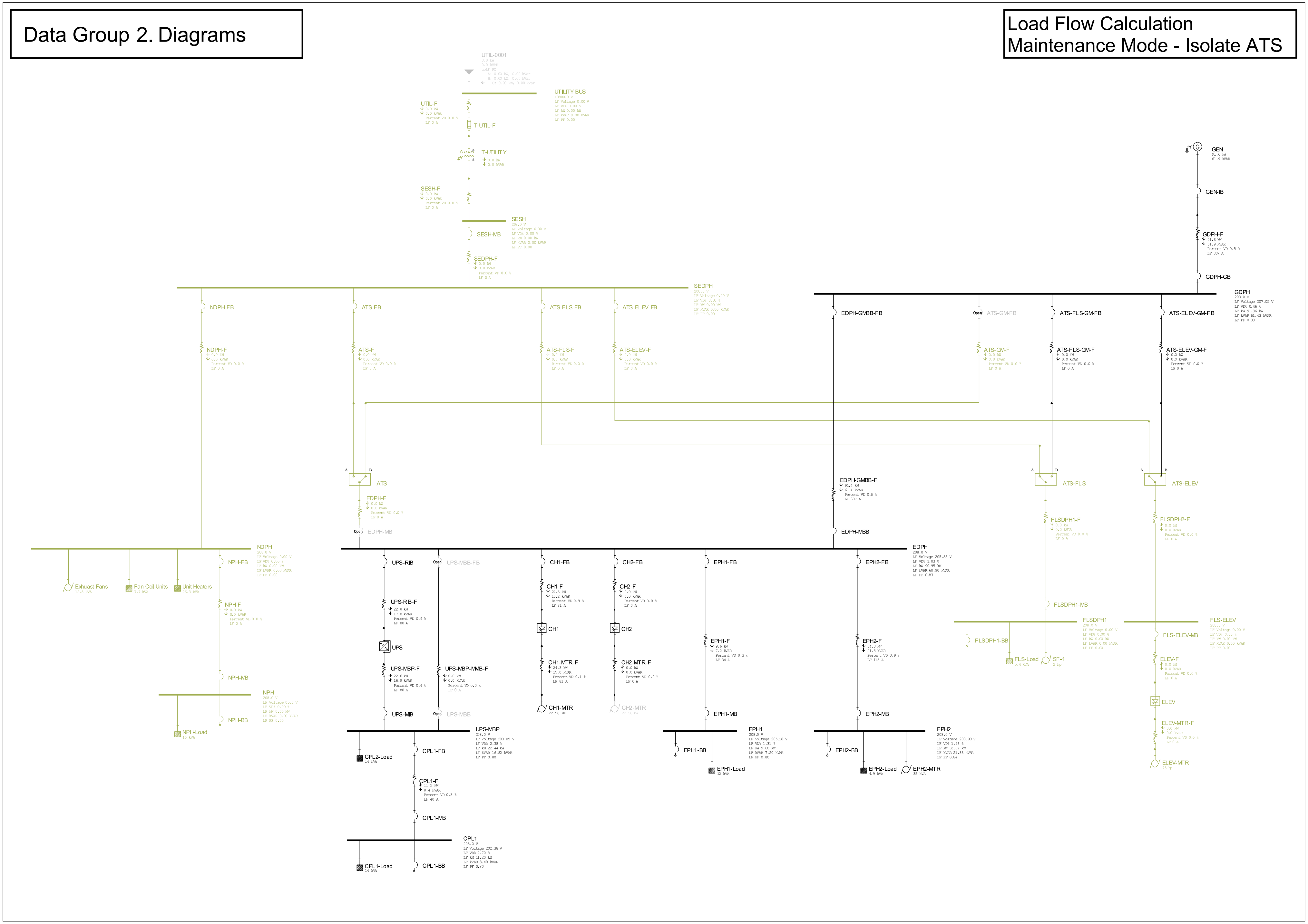
Load Flow Calculation
Utility Power Mode



Data Group 2: Load Flow Calculation Generator Power Mode Diagram



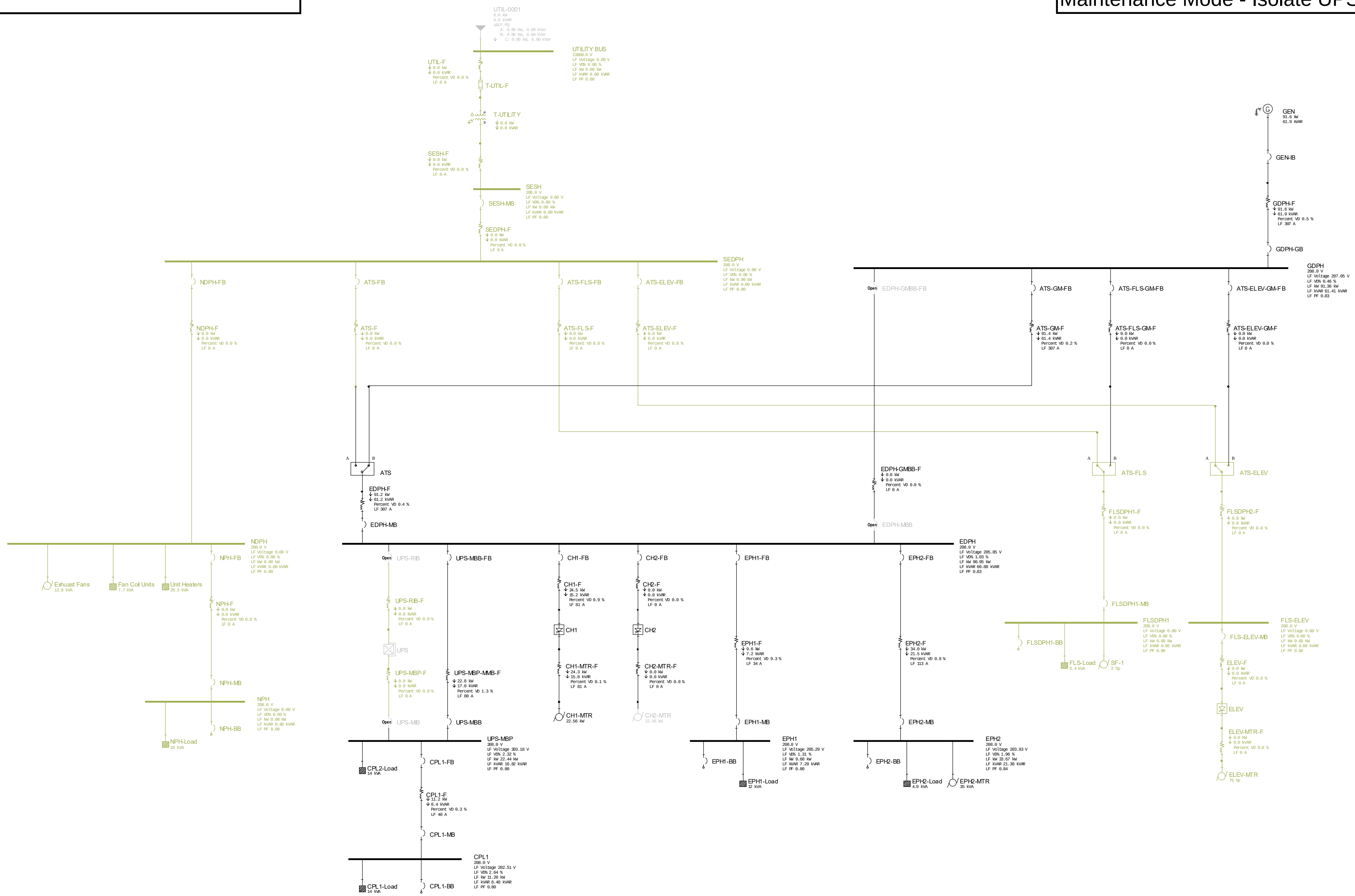
Data Group 2: Load Flow Calculation Maintenance Mode – Isolate ATS Diagram



Data Group 2: Load Flow Calculation Maintenance Mode – Isolate UPS Diagram

Data Group 2. Diagrams

Load Flow Calculation
Maintenance Mode - Isolate UPS



Data Group 2. Power Load-Flow Calculation Tabulation

System Parameters			System Configuration		Maintenance Configuration	
			Utility Power	Standby Power	Isolate ATS	Isolate UPS
			Source	Source:	GEN	GEN
			T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
Line #	Equipment Bus	Field	Mode 1A	Mode 2	Mode 3	Mode 4
1	CPL1	Nominal (V)	208.00	208.00	208	208
2		LF Voltage (V)	202.56	201.62	202.38	202.51
3		Voltage Drop (%)	2.62	3.07	2.7	2.64
4		LF kVA (kVA)	14.00	14.00	14	14
5		LF kW (kW)	11.2	11.2	11.2	11.2
6		LF PF	0.8	0.8	0.8	0.8
7		LF kVAR (kVAR)	8.4	8.4	8.4	8.4
8		LF Current (A)	39.9	40.09	39.94	39.91
9	EDPH	Nominal (V)	208	208	208	208
10		LF Voltage (V)	206.02	205.1	205.85	205.85
11		Voltage Drop (%)	0.95	1.39	1.03	1.03
12		LF kVA (kVA)	109.46	109.47	109.46	109.44
13		LF kW (kW)	90.95	90.96	90.95	90.95
14		LF PF	0.83	0.83	0.83	0.83
15		LF kVAR (kVAR)	60.9	60.91	60.9	60.88
16		LF Current (A)	306.74	308.14	307	306.95
17	EPH1	Nominal (V)	208	208	208	208
18		LF Voltage (V)	205.46	204.54	205.28	205.29
19		Voltage Drop (%)	1.22	1.67	1.31	1.31
20		LF kVA (kVA)	12	12	12	12
21		LF kW (kW)	9.6	9.6	9.6	9.6
22		LF PF	0.8	0.8	0.8	0.8
23		LF kVAR (kVAR)	7.2	7.2	7.2	7.2
24		LF Current (A)	33.72	33.87	33.75	33.75
25	EPH2	Nominal (V)	208	208	208	208
26		LF Voltage (V)	204.11	203.18	203.93	203.93
27		Voltage Drop (%)	1.87	2.32	1.96	1.96
28		LF kVA (kVA)	39.88	39.88	39.88	39.88
29		LF kW (kW)	33.67	33.67	33.67	33.67
30		LF PF	0.84	0.84	0.84	0.84
31		LF kVAR (kVAR)	21.38	21.38	21.38	21.38
32		LF Current (A)	112.82	113.33	112.91	112.91
33	FLS-ELEV	Nominal (V)	208	208	208	208
34		LF Voltage (V)	206.87	204.43	0	0
35		Voltage Drop (%)	0.54	1.72	0	0
36		LF kVA (kVA)	7.27	76	0	0

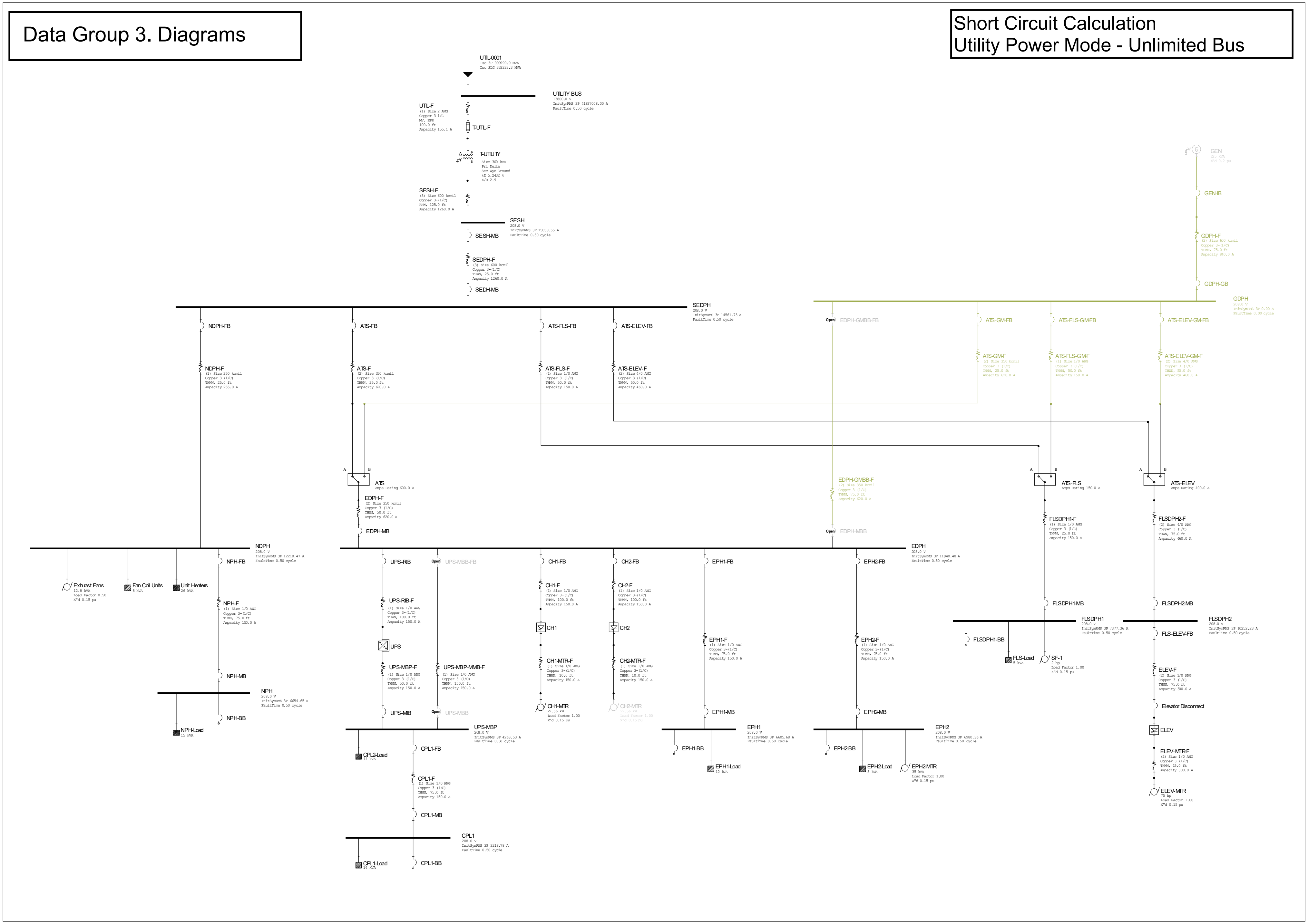
Data Group 2. Power Load-Flow Calculation Tabulation (continued)

System Parameters			System Configuration		Maintenance Configuration	
			Utility Power	Standby Power	Isolate ATS	Isolate UPS
			Source	Source:	GEN	GEN
			T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
Line #	Equipment Bus	Field	Mode 1A	Mode 2	Mode 3	Mode 4
37		LF kW (kW)	6.57	60.91	0	0
38		LF PF	0.9	0.8	0	0
39		LF kVAR (kVAR)	3.11	45.46	0	0
40		LF Current (A)	20.29	214.65	0	0
41	FLSDPH1	Nominal (V)	208	208	208	208
42		LF Voltage (V)	205.35	205.96	0	0
43		Voltage Drop (%)	1.27	0.98	0	0
44		LF kVA (kVA)	76	7.27	0	0
45		LF kW (kW)	60.9	6.57	0	0
46		LF PF	0.8	0.9	0	0
47		LF kVAR (kVAR)	45.46	3.11	0	0
48		LF Current (A)	213.67	20.38	0	0
49	GDPH	Nominal (V)	208	208	208	208
50		LF Voltage (V)	0	206.31	207.05	207.05
51		Voltage Drop (%)	0	0.81	0.46	0.46
52		LF kVA (kVA)	0	193.94	110.1	110.08
53		LF kW (kW)	0	159.41	91.36	91.36
54		LF PF	0	0.82	0.83	0.83
55		LF kVAR (kVAR)	0	110.46	61.43	61.41
56		LF Current (A)	0	542.74	307	306.95
57	NDPH	Nominal (V)	208	208	208	208
58		LF Voltage (V)	206.69	0	0	0
59		Voltage Drop (%)	0.63	0	0	0
60		LF kVA (kVA)	61.52	0	0	0
61		LF kW (kW)	54.21	0	0	0
62		LF PF	0.88	0	0	0
63		LF kVAR (kVAR)	29.09	0	0	0
64		LF Current (A)	171.85	0	0	0
65	NPH	Nominal (V)	208	208	208	208
66		LF Voltage (V)	205.98	0	0	0
67		Voltage Drop (%)	0.97	0	0	0
68		LF kVA (kVA)	15	0	0	0
69		LF kW (kW)	12	0	0	0
70		LF PF	0.8	0	0	0
71		LF kVAR (kVAR)	9	0	0	0
72		LF Current (A)	42.04	0	0	0
73	SEDPH	Nominal (V)	208	208	208	208
74		LF Voltage (V)	207.22	0	0	0
75		Voltage Drop (%)	0.37	0	0	0
76		LF kVA (kVA)	255.29	0	0	0

Data Group 2. Power Load-Flow Calculation Tabulation (continued)

System Parameters			System Configuration		Maintenance Configuration	
			Utility Power	Standby Power	Isolate ATS	Isolate UPS
			Source	Source:	GEN	GEN
			T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
Line #	Equipment Bus	Field	Mode 1A	Mode 2	Mode 3	Mode 4
77		LF kW (kW)	213.71	0	0	0
78		LF PF	0.84	0	0	0
79		LF kVAR (kVAR)	139.65	0	0	0
80		LF Current (A)	711.28	0	0	0
81	SESH	Nominal (V)	208	208	208	208
82		LF Voltage (V)	207.71	0	0	0
83		Voltage Drop (%)	0.14	0	0	0
84		LF kVA (kVA)	255.89	0	0	0
85		LF kW (kW)	214.03	0	0	0
86		LF PF	0.84	0	0	0
87		LF kVAR (kVAR)	140.26	0	0	0
88		LF Current (A)	711.28	0	0	0
89	UPS-MBP	Nominal (V)	208	208	208	208
90		LF Voltage (V)	203.23	202.3	203.05	203.18
91		Voltage Drop (%)	2.29	2.74	2.38	2.32
92		LF kVA (kVA)	28.05	28.05	28.05	28.05
93		LF kW (kW)	22.44	22.44	22.44	22.44
94		LF PF	0.8	0.8	0.8	0.8
95		LF kVAR (kVAR)	16.82	16.82	16.82	16.82
96		LF Current (A)	79.68	80.04	79.75	79.7

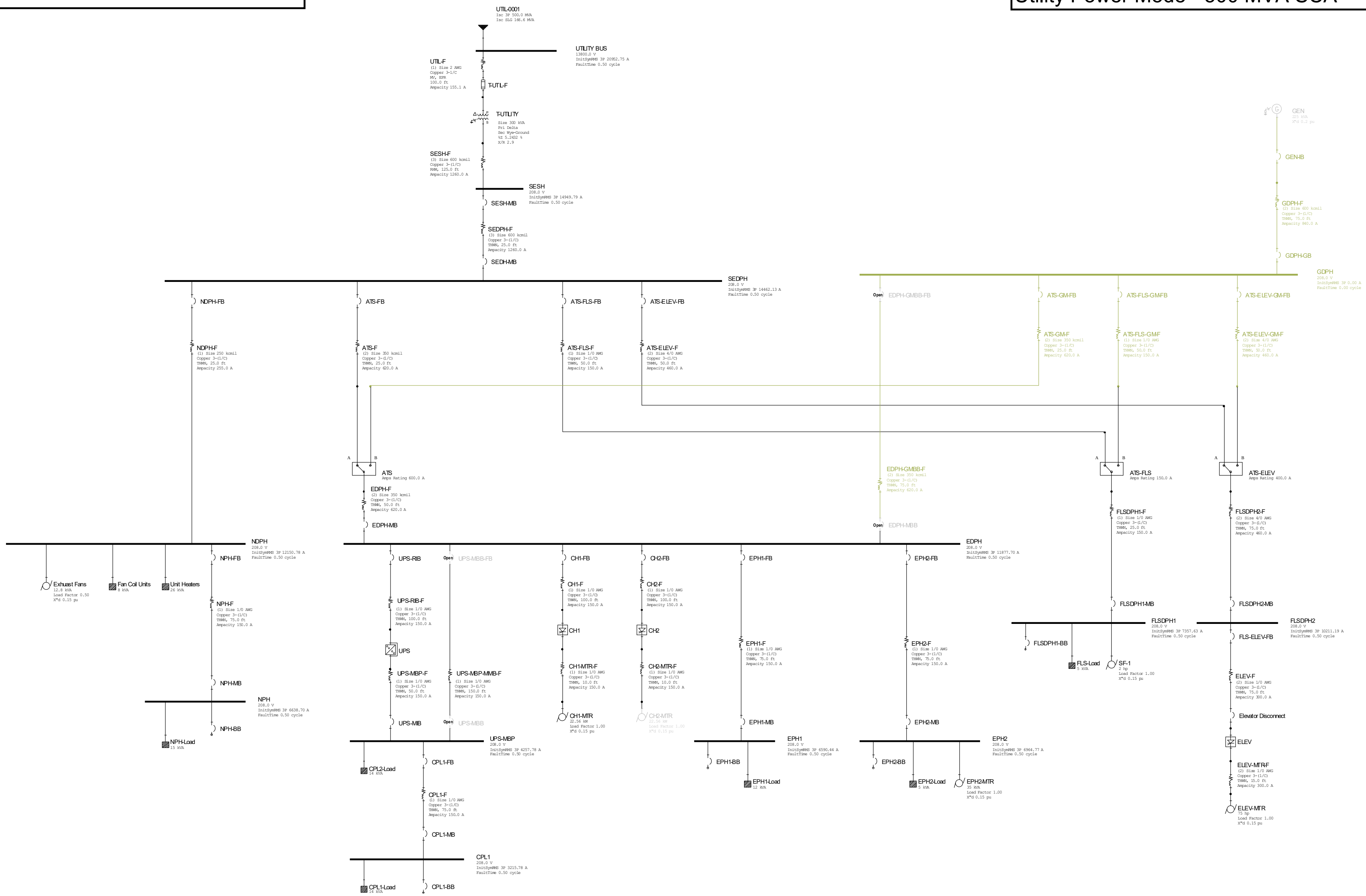
Data Group 3: Short Circuit Calculation Utility Power Mode – Unlimited Bus Diagram



Data Group 3: Short Circuit Calculation Utility Power Mode – 500 MVA SCA Diagram

Data Group 3. Diagrams

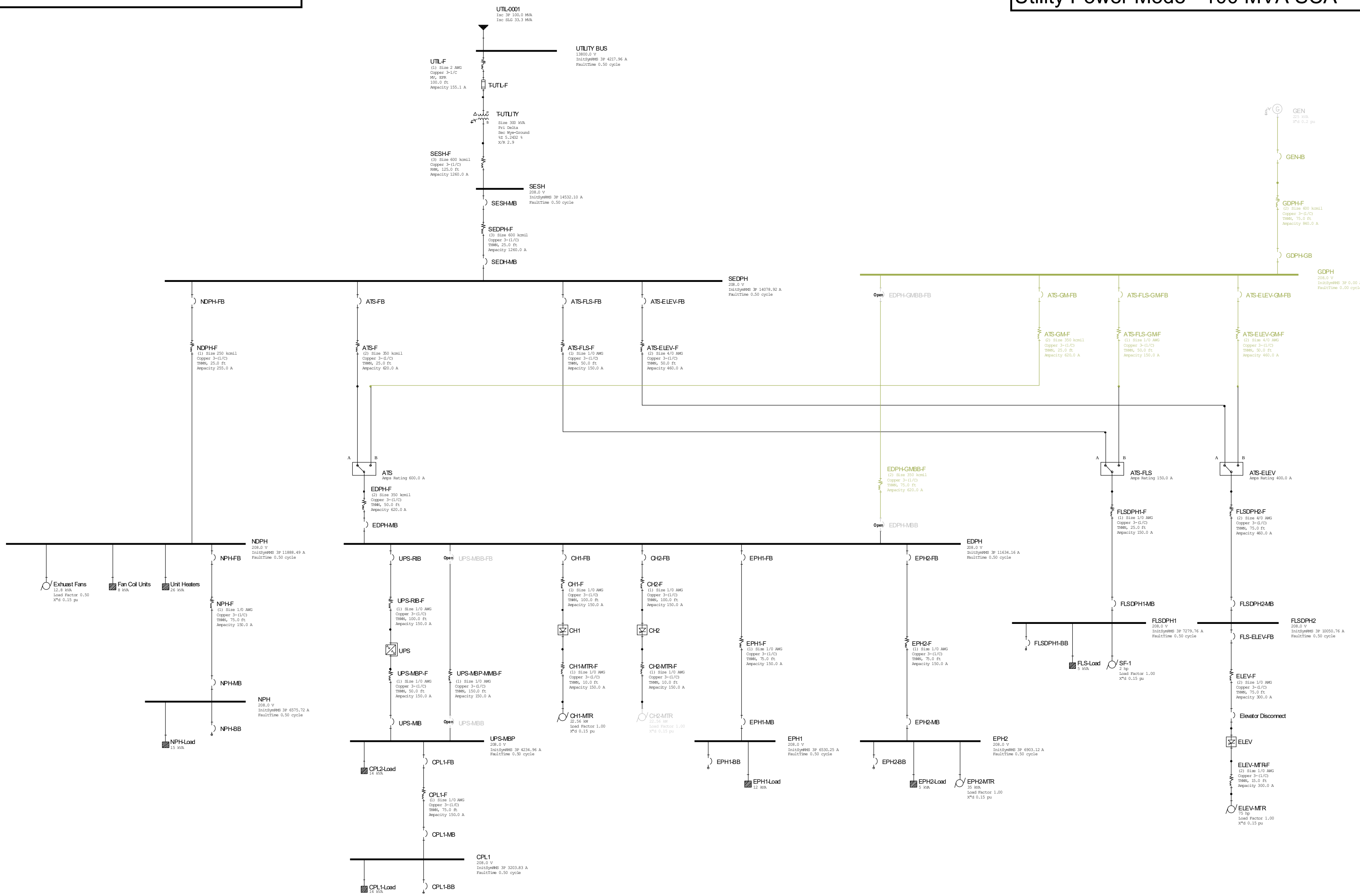
Short Circuit Calculation
Utility Power Mode - 500 MVA SCA



Data Group 3: Short Circuit Calculation Utility Power Mode – 100 MVA SCA Diagram

Data Group 3. Diagrams

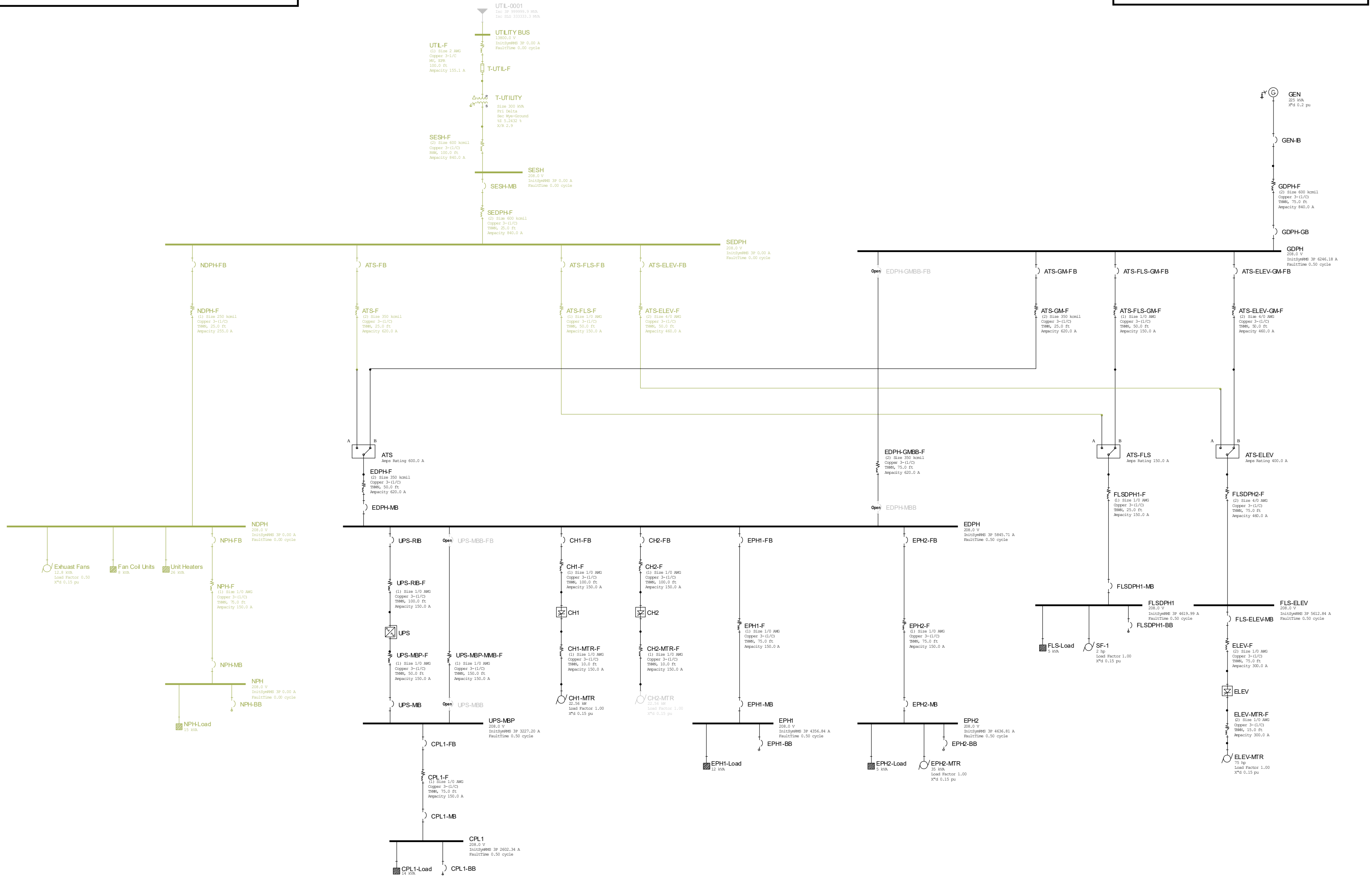
Short Circuit Calculation
Utility Power Mode - 100 MVA SCA



Data Group 3: Short Circuit Calculation Generator Power Mode Diagram

Data Group 3. Diagrams

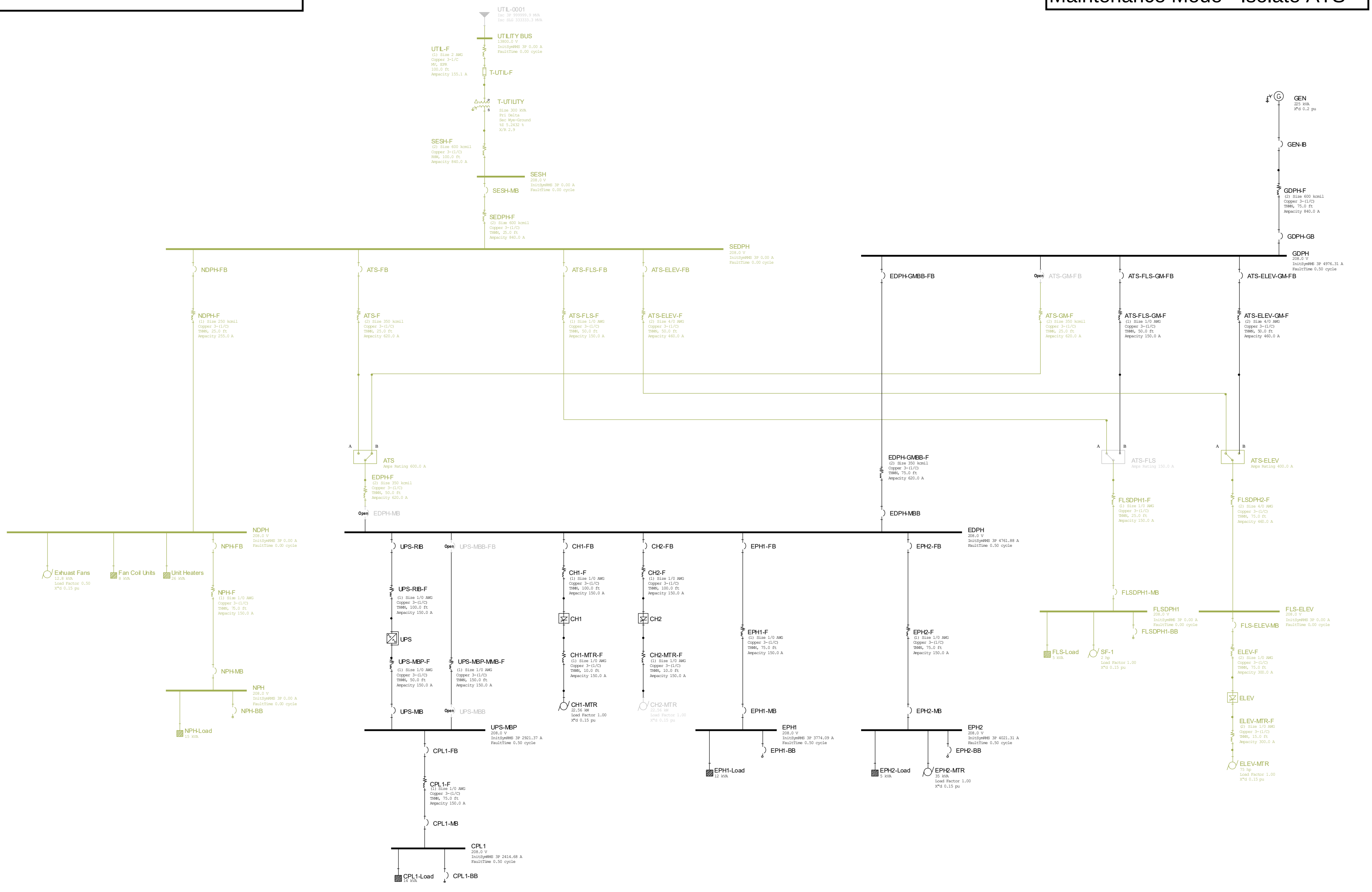
Short Circuit Calculation Generator Power Mode



Data Group 3: Short Circuit Calculation Maintenance Mode – Isolate ATS Diagram

Data Group 3. Diagrams

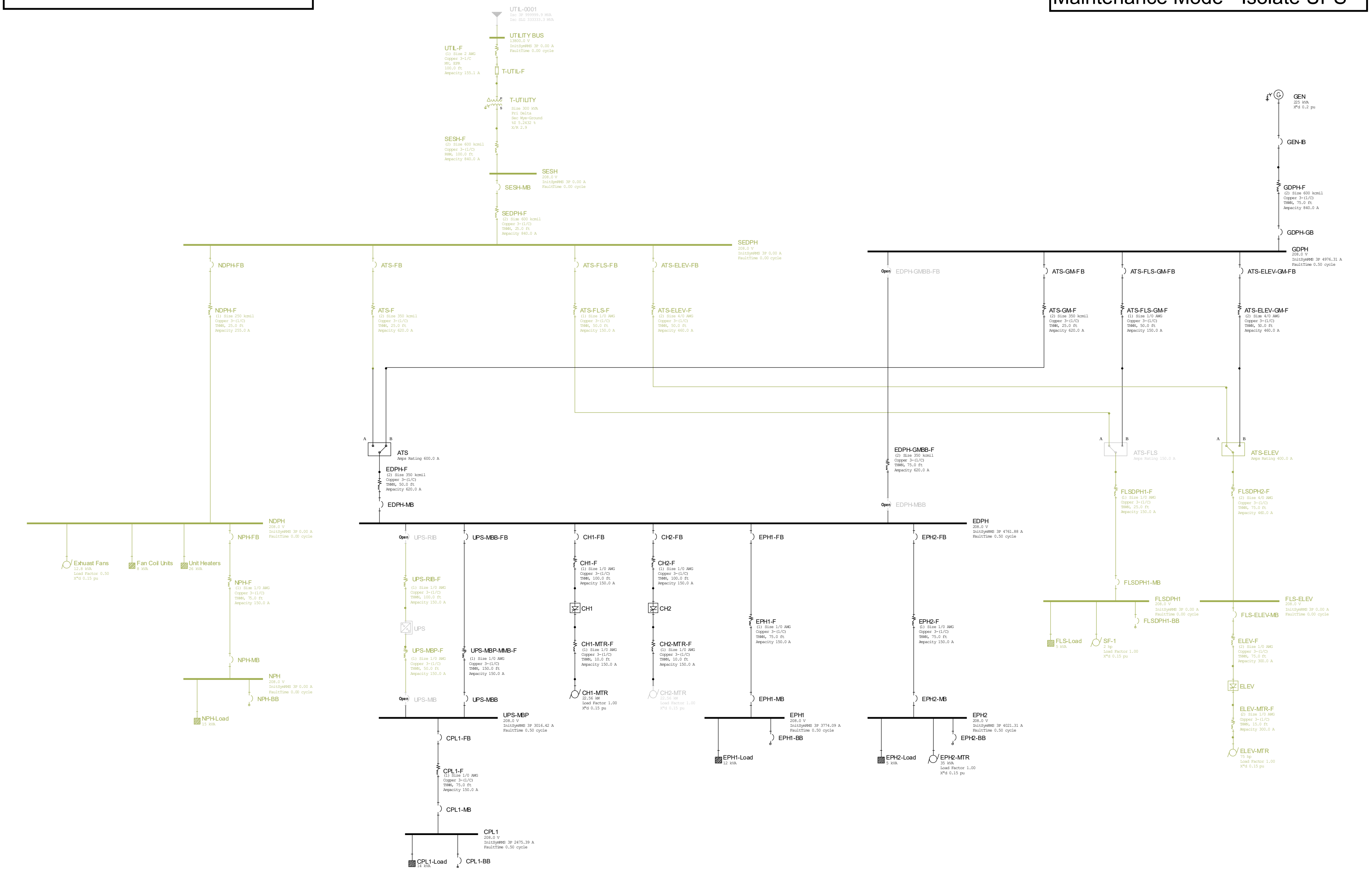
Short Circuit Calculation Maintenance Mode - Isolate ATS



Data Group 3: Short Circuit Calculation Maintenance Mode – Isolate UPS Diagram

Data Group 3. Diagrams

Short Circuit Calculation Maintenance Mode - Isolate UPS



Data Group 1. Short-circuit Calculation Tabulation

System Parameters			System Configuration				Maintenance Configuration			
			Utility Power			Standby Power	Isolate ATS	Isolate UPS		
			Unlimited Bus	500 MVA SCA	100 MVA SCA	GEN	GEN	GEN		
			Source	Source	Source	Source:	Circuit:	Circuit:		
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB		
#	Equip Bus	Field	Mode 1A	Mode 1B	Mode 1C	Mode 2	Mode 3	Mode 4	Max	Min
1	CPL1	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
2		Symm 3P (A)	3218.78	3215.78	3203.83	2602.34	2414.68	2475.39	3218.78	2414.68
3		Symm SLG (A)	2536.25	2534.89	2529.5	512.94	511.57	512.6	2536.25	511.57
4		InitSymRMS LL (A)	2787.55	2784.95	2774.6	2253.69	2091.17	2143.75	2787.55	2091.17
5		InitSymRMS LLG (A)	3088.13	3084.65	3070.83	2344.67	2188.45	2239.84	3088.13	2188.45
6		Asym 3P	3219.53	3216.54	3204.65	2610.29	2429.76	2488.51	3219.53	2429.76
7		Asym SLG (A)	2538.07	2536.72	2531.4	512.94	511.57	512.6	2538.07	511.57
8		AsymFaultCurrentAtTime LL (A)	2788.19	2785.6	2775.31	2260.58	2104.23	2155.11	2788.19	2104.23
9		AsymFaultCurrentAtTime LLG (A)	3089.15	3085.68	3071.93	2350.19	2198.89	2248.93	3089.15	2198.89
10	EDPH	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
11		Symm 3P (A)	11940.48	11877.7	11634.16	5845.71	4761.88	4761.88	11940.48	4761.88
12		Symm SLG (A)	9408.69	9382.47	9279.61	604.28	603	603	9408.69	603
13		InitSymRMS LL (A)	10340.75	10286.39	10075.48	5062.53	4123.91	4123.91	10340.75	4123.91
14		InitSymRMS LLG (A)	11144.77	11085.79	10857.49	5210.09	4272.8	4272.8	11144.77	4272.8
15		Asym 3P	12727.57	12673.25	12462.5	7296.81	6240.06	6240.06	12727.57	6240.06
16		Asym SLG (A)	10107.53	10084.91	9996.1	604.28	603	603	10107.53	603
17		AsymFaultCurrentAtTime LL (A)	11022.4	10975.35	10792.84	6319.22	5404.05	5404.05	11022.4	5404.05
18		AsymFaultCurrentAtTime LLG (A)	11905.81	11853.26	11649.72	6381.14	5450.49	5450.48	11905.81	5450.48
19	EPH1	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
20		Symm 3P (A)	6605.68	6590.44	6530.25	4356.84	3774.09	3774.09	6605.68	3774.09
21		Symm SLG (A)	5153.19	5146.69	5120.95	571.08	569.75	569.75	5153.19	569.75
22		InitSymRMS LL (A)	5720.68	5707.49	5655.36	3773.13	3268.46	3268.46	5720.68	3268.46
23		InitSymRMS LLG (A)	6276.84	6260.58	6196.52	3896.94	3397.51	3397.51	6276.84	3397.51
24		Asym 3P	6622.47	6607.64	6549.09	4501.23	3990.87	3990.87	6622.47	3990.87
25		Asym SLG (A)	5178.04	5171.79	5147.06	571.08	569.75	569.75	5178.04	569.75
26		AsymFaultCurrentAtTime LL (A)	5735.23	5722.38	5671.68	3898.18	3456.19	3456.19	5735.23	3456.19
27		AsymFaultCurrentAtTime LLG (A)	6296.15	6280.27	6217.73	4008.1	3562.75	3562.75	6296.15	3562.75
28	EPH2	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
29		Symm 3P (A)	6980.36	6964.77	6903.12	4636.81	4021.31	4021.31	6980.36	4021.31
30		Symm SLG (A)	5294.35	5288.18	5263.77	575.34	574.74	574.74	5294.35	574.74
31		InitSymRMS LL (A)	6045.17	6031.67	5978.28	4015.59	3482.56	3482.56	6045.17	3482.56
32		InitSymRMS LLG (A)	6507.97	6491.3	6425.6	4144.45	3616.34	3616.34	6507.97	3616.34
33		Asym 3P	7013.71	6998.84	6940.17	4886	4388.69	4388.69	7013.71	4388.69
34		Asym SLG (A)	5329.23	5323.41	5300.4	575.34	574.74	574.74	5329.23	574.74
35		AsymFaultCurrentAtTime LL (A)	6074.04	6061.17	6010.36	4231.4	3800.71	3800.71	6074.04	3800.71
36		AsymFaultCurrentAtTime LLG (A)	6541.96	6525.9	6462.67	4338.72	3900.27	3900.27	6541.96	3900.27

Data Group 3. Short-circuit Calculation Tabulation (continued)

System Parameters			System Configuration				Maintenance Configuration			
			Utility Power			Standby Power	Isolate ATS	Isolate UPS		
			Unlimited Bus	500 MVA SCA	100 MVA SCA	GEN	GEN	GEN		
			Source	Source	Source	Source:	Circuit:	Circuit:		
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB		
#	Equip Bus	Field	Mode 1A	Mode 1B	Mode 1C	Mode 2	Mode 3	Mode 4	Max	Min
37	FLS-ELEV	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
38		Symm 3P (A)	7377.36	7357.63	7279.76	5612.84	-	-	7377.36	5612.84
39		Symm SLG (A)	5885.67	5876.95	5842.44	597.11	-	-	5885.67	597.11
40		InitSymRMS LL (A)	6388.98	6371.89	6304.46	4860.86	-	-	6388.98	4860.86
41		InitSymRMS LLG (A)	7008.83	6987.73	6904.72	5004.4	-	-	7008.83	5004.4
42		Asym 3P	7393.71	7374.44	7298.48	6604.84	-	-	7393.71	6604.84
43		Asym SLG (A)	5907.71	5899.27	5865.9	597.11	-	-	5907.71	597.11
44		AsymFaultCurrentAtTime LL (A)	6403.14	6386.45	6320.66	5719.96	-	-	6403.14	5719.96
45		AsymFaultCurrentAtTime LLG (A)	7027.1	7006.42	6925.12	5799.98	-	-	7027.1	5799.98
46	FLSDPH1	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
47		Symm 3P (A)	10252.23	10211.19	10050.76	4619.99	-	-	10252.23	4619.99
48		Symm SLG (A)	7823.85	7807.75	7744.31	576.14	-	-	7823.85	576.14
49		InitSymRMS LL (A)	8878.68	8843.15	8704.21	4001.03	-	-	8878.68	4001.03
50		InitSymRMS LLG (A)	9497.91	9457.72	9301.02	4127.38	-	-	9497.91	4127.38
51		Asym 3P	10568.36	10532.26	10391.45	4792.87	-	-	10568.36	4792.87
52		Asym SLG (A)	8096.24	8082.18	8026.82	576.14	-	-	8096.24	576.14
53		AsymFaultCurrentAtTime LL (A)	9152.46	9121.2	8999.25	4150.75	-	-	9152.46	4150.75
54		AsymFaultCurrentAtTime LLG (A)	9800.81	9764.47	9622.89	4261.39	-	-	9800.81	4261.39
55	GDPH	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
56		Symm 3P (A)	-	-	-	6246.18	4976.31	4976.31	6246.18	4976.31
57		Symm SLG (A)	-	-	-	609.54	608.11	608.11	609.54	608.11
58		InitSymRMS LL (A)	-	-	-	5409.35	4309.61	4309.61	5409.35	4309.61
59		InitSymRMS LLG (A)	-	-	-	5559.5	4460.62	4460.62	5559.5	4460.62
60		Asym 3P	-	-	-	8176.74	6804.96	6804.96	8176.74	6804.96
61		Asym SLG (A)	-	-	-	609.54	608.11	608.11	609.54	608.11
62		AsymFaultCurrentAtTime LL (A)	-	-	-	7081.26	5893.26	5893.26	7081.26	5893.26
63		AsymFaultCurrentAtTime LLG (A)	-	-	-	7127.68	5925.51	5925.51	7127.68	5925.51
64	NDPH	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
65		Symm 3P (A)	12218.47	12150.78	11888.49	-	-	-	12218.47	11888.49
66		Symm SLG (A)	9877.12	9847.34	9730.65	-	-	-	9877.12	9730.65
67		InitSymRMS LL (A)	10581.5	10522.88	10295.73	-	-	-	10581.5	10295.73
68		InitSymRMS LLG (A)	11478.16	11414.22	11167.12	-	-	-	11478.16	11167.12
69		Asym 3P	12896.56	12837.19	12607.2	-	-	-	12896.56	12607.2
70		Asym SLG (A)	10501.25	10475.23	10373.22	-	-	-	10501.25	10373.22
71		AsymFaultCurrentAtTime LL (A)	11168.75	11117.33	10918.15	-	-	-	11168.75	10918.15
72		AsymFaultCurrentAtTime LLG (A)	12141.45	12083.93	11861.5	-	-	-	12141.45	11861.5

Data Group 3. Equipment Bus Evaluation Tabulation

System Parameters			System Configuration				Maintenance Configuration			
			Utility Power			Standby Power	Isolate ATS	Isolate UPS		
			Unlimited Bus	500 MVA SCA	100 MVA SCA	GEN	GEN	GEN		
			Source	Source	Source	Source:	Circuit:	Circuit:		
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB		
#	Equip Bus	Field	Mode 1A	Mode 1B	Mode 1C	Mode 2	Mode 3	Mode 4	Max	Min
73	NPH	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
74		Symm 3P (A)	6654.65	6638.7	6575.72	-	-	-	6654.65	6575.72
75		Symm SLG (A)	5263.51	5256.53	5228.9	-	-	-	5263.51	5228.9
76		InitSymRMS LL (A)	5763.09	5749.28	5694.73	-	-	-	5763.09	5694.73
77		InitSymRMS LLG (A)	6335.34	6318.26	6250.99	-	-	-	6335.34	6250.99
78		Asym 3P	6668.49	6652.9	6591.39	-	-	-	6668.49	6591.39
79		Asym SLG (A)	5283.95	5277.2	5250.5	-	-	-	5283.95	5250.5
80		AsymFaultCurrentAtTime LL (A)	5775.08	5761.58	5708.31	-	-	-	5775.08	5708.31
81		AsymFaultCurrentAtTime LLG (A)	6351.3	6334.55	6268.65	-	-	-	6351.3	6268.65
82	SEDPH	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
83		Symm 3P (A)	14561.73	14462.13	14078.92	-	-	-	14561.73	14078.92
84		Symm SLG (A)	12152.18	12105.7	11924.34	-	-	-	12152.18	11924.34
85		InitSymRMS LL (A)	12610.82	12524.57	12192.7	-	-	-	12610.82	12192.7
86		InitSymRMS LLG (A)	13704.03	13612.3	13260.33	-	-	-	13704.03	13260.33
87		Asym 3P	15942.18	15855.21	15519.82	-	-	-	15942.18	15519.82
88		Asym SLG (A)	13360.72	13320.1	13161.28	-	-	-	13360.72	13161.28
89		AsymFaultCurrentAtTime LL (A)	13806.32	13731	13440.55	-	-	-	13806.32	13440.55
90		AsymFaultCurrentAtTime LLG (A)	15023.95	14941.38	14623.71	-	-	-	15023.95	14623.71
91	SESH	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
92		Symm 3P (A)	15058.55	14949.79	14532.1	-	-	-	15058.55	14532.1
93		Symm SLG (A)	12828.25	12775.39	12569.45	-	-	-	12828.25	12569.45
94		InitSymRMS LL (A)	13041.08	12946.89	12585.16	-	-	-	13041.08	12585.16
95		InitSymRMS LLG (A)	14231.13	14131.14	13750.39	-	-	-	14231.13	13750.39
96		Asym 3P	16512.34	16417	16049.97	-	-	-	16512.34	16049.97
97		Asym SLG (A)	14108.66	14062.3	13881.27	-	-	-	14108.66	13881.27
98		AsymFaultCurrentAtTime LL (A)	14300.1	14217.53	13899.68	-	-	-	14300.1	13899.68
99		AsymFaultCurrentAtTime LLG (A)	15620.97	15530.65	15186.2	-	-	-	15620.97	15186.2
100	UPS-MBP	Fault Time (cycle)	0.5	0.5	0.5	0.5	0.5	0.5	-	-
101		Symm 3P (A)	4263.53	4257.78	4234.96	3227.2	2921.37	3016.42	4263.53	2921.37
102		Symm SLG (A)	3357.1	3354.55	3344.47	540.06	538.67	539.76	3357.1	538.67
103		InitSymRMS LL (A)	3692.33	3687.35	3667.58	2794.84	2529.98	2612.29	3692.33	2529.98
104		InitSymRMS LLG (A)	4071.99	4065.57	4040.15	2900.38	2641.7	2722.97	4071.99	2641.7
105		Asym 3P	4266.6	4260.92	4238.36	3256.62	2972.21	3062.08	4266.6	2972.21
106		Asym SLG (A)	3362.73	3360.24	3350.35	540.06	538.67	539.76	3362.73	538.67
107		AsymFaultCurrentAtTime LL (A)	3694.98	3690.06	3670.53	2820.31	2574.01	2651.84	3694.98	2574.01
108		AsymFaultCurrentAtTime LLG (A)	4075.79	4069.43	4044.28	2921.85	2678.58	2756.18	4075.79	2678.58

Data Group 3. Protective Device Evaluation Tabulation

System Parameters			System Configuration				Maintenance Configuration	
			Utility Power			Standby Power	Isolate ATS	Isolate UPS
			Unlimited Bus	500 MVA SCA	100 MVA SCA	Generator	Generator	Generator
			Source	Source	Source	Source:	Circuit	Circuit
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
#	Device	Parameter	Mode 1A	Mode 1B	Mode 1C	Mode 2	Mode 3	Mode 4
1	ATS-ELEV-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
2		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
3		Frame/Model	PG	PG	PG	PG	PG	PG
4		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
5		Test X/R	4.899	4.899	4.899	4.899	4.90	4.90
6		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
7		DE_DAP_INT_Bus% (%)	21.29	21.29	21.29	0.00	0.00	0.00
8		DE_DAP_INT_Bus_Duty (kA)	13.84	13.84	13.84	0.00	0.00	0.00
9		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
10		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
11		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
12	ATS-ELEV-GM-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
13		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
14		Frame/Model	PG	PG	PG	PG	PG	PG
15		DE_Status	Unknown	Unknown	Unknown	Pass	Pass	Pass
16		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
17		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
18		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	10.05	8.32	8.32
19		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	6.54	5.41	5.41
20		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
21		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
22		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
23	ATS-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
24		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
25		Frame/Model	PG	PG	PG	PG	PG	PG
26		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
27		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
28		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
29		DE_DAP_INT_Bus% (%)	21.29	21.29	21.29	0.00	0.00	0.00
30		DE_DAP_INT_Bus_Duty (kA)	13.84	13.84	13.84	0.00	0.00	0.00
31		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
32		Sensor/Trip (A)	800	800	800	800	800.00	800.00
33		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
34	ATS-FLS-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
35		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
36		Frame/Model	PG	PG	PG	PG	PG	PG
37		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
38		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
39		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
40		DE_DAP_INT_Bus% (%)	21.29	21.29	21.29	0.00	0.00	0.00
41		DE_DAP_INT_Bus_Duty (kA)	13.8417	13.8417	13.8417	0	0.00	0.00
42		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
43		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
44		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
45	ATS-FLS-GM-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
46		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
47		Frame/Model	PG	PG	PG	PG	PG	PG
48		DE_Status	Unknown	Unknown	Unknown	Pass	Pass	Pass
49		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
50		InterruptingRating (kA)	65	65	65	65	65.00	65.00
51		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	10.05	8.32	8.32
52		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	6.54	5.41	5.41
53		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
54		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
55		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
56	ATS-GM-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
57		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
58		Frame/Model	PG	PG	PG	PG	PG	PG
59		DE_Status	Unknown	Unknown	Unknown	Pass	Unknown	Pass
60		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
61		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
62		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	10.05	0.00	8.32
63		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	6.54	0.00	5.41
64		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
65		Sensor/Trip (A)	800.00	800.00	800.00	800.00	800.00	800.00
66		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00

Data Group 3. Protective Device Evaluation Tabulation (continued)

System Parameters			System Configuration				Maintenance Configuration	
			Utility Power			Standby Power	Isolate ATS	Isolate UPS
			Unlimited Bus	500 MVA SCA	100 MVA SCA	Generator	Generator	Generator
			Source	Source	Source	Source:	Circuit	Circuit
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
#	Device	Parameter	Mode 1A	Mode 1B	Mode 1C	Mode 2	Mode 3	Mode 4
67	CH1-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
68		Description	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS
69		Frame/Model	LD	LD	LD	LD	LD	LD
70		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
71		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
72		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
73		DE_DAP_INT_Bus% (%)	45.88	45.88	45.88	23.41	19.95	19.95
74		DE_DAP_INT_Bus_Duty (kA)	11.47	11.47	11.47	5.85	4.99	4.99
75		Frame/Rating (A)	400.00	400.00	400.00	400.00	400.00	400.00
76		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
77		System Nominal Voltage (V)	208	208	208	208	208.00	208.00
78	CH2-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
79		Description	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS
80		Frame/Model	LD	LD	LD	LD	LD	LD
81		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
82		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
83		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
84		DE_DAP_INT_Bus% (%)	45.88	45.88	45.88	23.41	19.95	19.95
85		DE_DAP_INT_Bus_Duty (kA)	11.47	11.47	11.47	5.85	4.99	4.99
86		Frame/Rating (A)	400	400	400	400	400.00	400.00
87		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
88		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
89	CPL1-BB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
90		Description	15-70A	15-70A	15-70A	15-70A	15-70A	15-70A
91		Frame/Model	QO	QO	QO	QO	QO	QO
92		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
93		Test X/R	1.73	1.73	1.73	1.73	1.73	1.73
94		InterruptingRating (kA)	10.00	10.00	10.00	10.00	10.00	10.00
95		DE_DAP_INT_Bus% (%)	31.88	31.88	31.88	26.02	24.15	24.75
96		DE_DAP_INT_Bus_Duty (kA)	3.19	3.19	3.19	2.60	2.41	2.48
97		Frame/Rating (A)	20.00	20.00	20.00	20.00	20.00	20.00
98		Sensor/Trip (A)	20.00	20.00	20.00	20.00	20.00	20.00
99		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
100	CPL1-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
101		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
102		Frame/Model	JD	JD	JD	JD	JD	JD
103		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
104		Test X/R	4.899	4.899	4.899	4.899	4.90	4.90
105		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
106		DE_DAP_INT_Bus% (%)	16.83	16.83	16.83	12.91	11.69	12.07
107		DE_DAP_INT_Bus_Duty (kA)	4.21	4.21	4.21	3.23	2.92	3.02
108		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
109		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
110		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
111	CPL1-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
112		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
113		Frame/Model	JD	JD	JD	JD	JD	JD
114		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
115		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
116		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
117		DE_DAP_INT_Bus% (%)	12.75	12.75	12.75	10.41	9.66	9.90
118		DE_DAP_INT_Bus_Duty (kA)	3.19	3.19	3.19	2.60	2.41	2.48
119		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
120		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
121		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
122	EDPH-GMBB-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
123		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
124		Frame/Model	PG	PG	PG	PG	PG	PG
125		DE_Status	Unknown	Unknown	Unknown	Unknown	Pass	Unknown
126		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
127		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
128		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	0.00	8.32	0.00
129		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	0.00	5.41	0.00
130		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
131		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
132		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00

Data Group 3. Protective Device Evaluation Tabulation (continued)

System Parameters			System Configuration				Maintenance Configuration	
			Utility Power			Standby Power	Isolate ATS	Isolate UPS
			Unlimited Bus	500 MVA SCA	100 MVA SCA	Generator	Generator	Generator
			Source	Source	Source	Source:	Circuit	Circuit
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
#	Device	Parameter	Mode 1A	Mode 1B	Mode 1C	Mode 2	Mode 3	Mode 4
133	EDPH-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
134		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
135		Frame/Model	PG	PG	PG	PG	PG	PG
136		DE_Status	Pass	Pass	Pass	Pass	Unknown	Pass
137		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
138		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
139		DE_DAP_INT_Bus% (%)	17.65	17.65	17.65	9.00	0.00	7.67
140		DE_DAP_INT_Bus_Duty (kA)	11.47	11.47	11.47	5.85	0.00	4.99
141		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
142		Sensor/Trip (A)	800.00	800.00	800.00	800.00	800.00	800.00
143		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
144	EDPH-MBB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
145		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
146		Frame/Model	PG	PG	PG	PG	PG	PG
147		DE_Status	Unknown	Unknown	Unknown	Unknown	Pass	Unknown
148		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
149		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
150		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	0.00	7.67	0.00
151		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	0.00	4.99	0.00
152		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
153		Sensor/Trip (A)	800.00	800.00	800.00	800.00	800.00	800.00
154		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
155	EPH1-BB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
156		Description	15-70A	15-70A	15-70A	15-70A	15-70A	15-70A
157		Frame/Model	QO	QO	QO	QO	QO	QO
158		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
159		Test X/R	1.73	1.73	1.73	1.73	1.73	1.73
160		InterruptingRating (kA)	10.00	10.00	10.00	10.00	10.00	10.00
161		DE_DAP_INT_Bus% (%)	64.68	64.68	64.68	44.34	40.34	40.34
162		DE_DAP_INT_Bus_Duty (kA)	6.47	6.47	6.47	4.43	4.03	4.03
163		Frame/Rating (A)	20.00	20.00	20.00	20.00	20.00	20.00
164		Sensor/Trip (A)	20.00	20.00	20.00	20.00	20.00	20.00
165		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
166	EPH1-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
167		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
168		Frame/Model	JD	JD	JD	JD	JD	JD
169		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
170		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
171		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
172		DE_DAP_INT_Bus% (%)	45.88	45.88	45.88	23.41	19.95	19.95
173		DE_DAP_INT_Bus_Duty (kA)	11.47	11.47	11.47	5.85	4.99	4.99
174		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
175		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
176		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
177	EPH1-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
178		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
179		Frame/Model	JD	JD	JD	JD	JD	JD
180		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
181		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
182		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
183		DE_DAP_INT_Bus% (%)	25.87	25.87	25.87	17.43	15.10	15.10
184		DE_DAP_INT_Bus_Duty (kA)	6.47	6.47	6.47	4.36	3.77	3.77
185		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
186		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
187		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
188	EPH2-BB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
189		Description	15-70A	15-70A	15-70A	15-70A	15-70A	15-70A
190		Frame/Model	QO	QO	QO	QO	QO	QO
191		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
192		Test X/R	1.73	1.73	1.73	1.73	1.73	1.73
193		InterruptingRating (kA)	10.00	10.00	10.00	10.00	10.00	10.00
194		DE_DAP_INT_Bus% (%)	68.38	68.38	68.38	49.23	45.26	45.26
195		DE_DAP_INT_Bus_Duty (kA)	6.84	6.84	6.84	4.92	4.53	4.53
196		Frame/Rating (A)	20.00	20.00	20.00	20.00	20.00	20.00
197		Sensor/Trip (A)	20.00	20.00	20.00	20.00	20.00	20.00
198		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00

Data Group 3. Protective Device Evaluation Tabulation (continued)

System Parameters			System Configuration				Maintenance Configuration	
			Utility Power			Standby Power	Isolate ATS	Isolate UPS
			Unlimited Bus	500 MVA SCA	100 MVA SCA	Generator	Generator	Generator
			Source	Source	Source	Source:	Circuit	Circuit
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
#	Device	Parameter	Mode 1A	Mode 1B	Mode 1C	Mode 2	Mode 3	Mode 4
199	EPH2-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
200		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
201		Frame/Model	JD	JD	JD	JD	JD	JD
202		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
203		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
204		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
205		DE_DAP_INT_Bus% (%)	45.88	45.88	45.88	23.41	19.95	19.95
206		DE_DAP_INT_Bus_Duty (kA)	11.47	11.47	11.47	5.85	4.99	4.99
207		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
208		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
209		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
210	EPH2-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
211		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
212		Frame/Model	JD	JD	JD	JD	JD	JD
213		DE_Status	Pass	Pass	Pass	Pass	Pass	Pass
214		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
215		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
216		DE_DAP_INT_Bus% (%)	27.35	27.35	27.35	18.55	16.09	16.09
217		DE_DAP_INT_Bus_Duty (kA)	6.84	6.84	6.84	4.64	4.02	4.02
218		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
219		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
220		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
221	FLS-ELEV-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
222		Description	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS	LI, 400AS
223		Frame/Model	LD	LD	LD	LD	LD	LD
224		DE_Status	Pass	Pass	Pass	Pass	Unknown	Unknown
225		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
226		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
227		DE_DAP_INT_Bus% (%)	39.69	39.69	39.69	22.45	0.00	0.00
228		DE_DAP_INT_Bus_Duty (kA)	9.92	9.92	9.92	5.61	0.00	0.00
229		Frame/Rating (A)	400.00	400.00	400.00	400.00	400.00	400.00
230		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
231		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
232	FLSDPH1-BB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
233		Description	15-70A	15-70A	15-70A	15-70A	15-70A	15-70A
234		Frame/Model	QO	QO	QO	QO	QO	QO
235		DE_Status	Pass	Pass	Pass	Pass	Unknown	Unknown
236		Test X/R	1.73	1.73	1.73	1.73	1.73	1.73
237		InterruptingRating (kA)	10.00	10.00	10.00	10.00	10.00	10.00
238		DE_DAP_INT_Bus% (%)	72.00	72.00	72.00	47.48	0.00	0.00
239		DE_DAP_INT_Bus_Duty (kA)	7.20	7.20	7.20	4.75	0.00	0.00
240		Frame/Rating (A)	20.00	20.00	20.00	20.00	20.00	20.00
241		Sensor/Trip (A)	20.00	20.00	20.00	20.00	20.00	20.00
242		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
243	FLSDPH1-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
244		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
245		Frame/Model	JD	JD	JD	JD	JD	JD
246		DE_Status	Pass	Pass	Pass	Pass	Unknown	Unknown
247		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
248		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
249		DE_DAP_INT_Bus% (%)	28.80	28.80	28.80	18.48	0.00	0.00
250		DE_DAP_INT_Bus_Duty (kA)	7.20	7.20	7.20	4.62	0.00	0.00
251		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
252		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
253		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
254	FLSDPH2-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
255		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
256		Frame/Model	PG	PG	PG	PG	PG	PG
257		DE_Status	Pass	Pass	Pass	Pass	Unknown	Unknown
258		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
259		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
260		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	8.64	0.00	0.00
261		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	5.61	0.00	0.00
262		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
263		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
264		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00

Data Group 3. Protective Device Evaluation Tabulation (continued)

System Parameters			System Configuration				Maintenance Configuration	
			Utility Power			Standby Power	Isolate ATS	Isolate UPS
			Unlimited Bus	500 MVA SCA	100 MVA SCA	Generator	Generator	Generator
			Source	Source	Source	Source:	Circuit	Circuit
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
265	GDPH-GB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
266		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
267		Frame/Model	PG	PG	PG	PG	PG	PG
268		DE_Status	Unknown	Unknown	Unknown	Pass	Pass	Pass
269		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
270		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
271		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	10.05	8.32	8.32
272		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	6.54	5.41	5.41
273		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
274		Sensor/Trip (A)	800.00	800.00	800.00	800.00	800.00	800.00
275		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
276	GEN-IB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
277		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
278		Frame/Model	PG	PG	PG	PG	PG	PG
279		DE_Status	Unknown	Unknown	Unknown	Pass	Pass	Pass
280		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
281		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
282		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	10.53	8.96	8.96
283		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	6.85	5.82	5.82
284		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
285		Sensor/Trip (A)	800.00	800.00	800.00	800.00	800.00	800.00
286		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
287	NDPH-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
288		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
289		Frame/Model	PG	PG	PG	PG	PG	PG
290		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
291		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
292		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
293		DE_DAP_INT_Bus% (%)	21.29	21.29	21.29	0.00	0.00	0.00
294		DE_DAP_INT_Bus_Duty (kA)	13.84	13.84	13.84	0.00	0.00	0.00
295		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
296		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
297		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
298	NPH-BB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
299		Description	15-70A	15-70A	15-70A	15-70A	15-70A	15-70A
300		Frame/Model	QO	QO	QO	QO	QO	QO
301		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
302		Test X/R	1.73	1.73	1.73	1.73	1.73	1.73
303		InterruptingRating (kA)	10.00	10.00	10.00	10.00	10.00	10.00
304		DE_DAP_INT_Bus% (%)	65.11	65.11	65.11	0.00	0.00	0.00
305		DE_DAP_INT_Bus_Duty (kA)	6.51	6.51	6.51	0.00	0.00	0.00
306		Frame/Rating (A)	20.00	20.00	20.00	20.00	20.00	20.00
307		Sensor/Trip (A)	20.00	20.00	20.00	20.00	20.00	20.00
308		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
309	NPH-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
310		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
311		Frame/Model	JD	JD	JD	JD	JD	JD
312		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
313		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
314		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
315		DE_DAP_INT_Bus% (%)	46.84	46.84	46.84	0.00	0.00	0.00
316		DE_DAP_INT_Bus_Duty (kA)	11.71	11.71	11.71	0.00	0.00	0.00
317		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
318		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
319		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
320	NPH-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
321		Description	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS	LSI, 250AS
322		Frame/Model	JD	JD	JD	JD	JD	JD
323		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
324		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
325		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
326		DE_DAP_INT_Bus% (%)	26.04	26.04	26.04	0.00	0.00	0.00
327		DE_DAP_INT_Bus_Duty (kA)	6.51	6.51	6.51	0.00	0.00	0.00
328		Frame/Rating (A)	250.00	250.00	250.00	250.00	250.00	250.00
329		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
330		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00

Data Group 3. Protective Device Evaluation Tabulation (continued)

System Parameters			System Configuration				Maintenance Configuration	
			Utility Power			Standby Power	Isolate ATS	Isolate UPS
			Unlimited Bus	500 MVA SCA	100 MVA SCA	Generator	Generator	Generator
			Source	Source	Source	Source:	Circuit	Circuit
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
331	SEDH-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
332		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
333		Frame/Model	PG	PG	PG	PG	PG	PG
334		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
335		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
336		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
337		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	0.00	0.00	0.00
338		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	0.00	0.00	0.00
339		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
340		Sensor/Trip (A)	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
341		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
342	SESH-MB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
343		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
344		Frame/Model	PG	PG	PG	PG	PG	PG
345		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
346		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
347		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
348		DE_DAP_INT_Bus% (%)	22.32	22.32	22.32	0.00	0.00	0.00
349		DE_DAP_INT_Bus_Duty (kA)	14.51	14.51	14.51	0.00	0.00	0.00
350		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
351		Sensor/Trip (A)	1000.00	1000.00	1000.00	1000.00	1000.00	1000.00
352		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
353	T-UTIL-F	Manufacturer	S&C	S&C	S&C	S&C	S&C	S&C
354		Description	15E-200E Slow Speed	15E-200E Slow Speed	15E-200E Slow Speed	15E-200E Slow Speed	15E-200E Slow Speed	15E-200E Slow Speed
355		Frame/Model	SM-4, 30E	SM-4, 30E	SM-4, 30E	SM-4, 30E	SM-4, 30E	SM-4, 30E
356		DE_Status	Pass	Pass	Pass	Unknown	Unknown	Unknown
357		Test X/R	15.00	15.00	15.00	15.00	15.00	15.00
358		InterruptingRating (kA)	12.50	12.50	12.50	12.50	12.50	12.50
359		DE_DAP_INT_Bus% (%)	165.02	165.02	165.02	0.00	0.00	0.00
360		DE_DAP_INT_Bus_Duty (kA)	20.63	20.63	20.63	0.00	0.00	0.00
361		Frame/Rating (A)	30.00	30.00	30.00	30.00	30.00	30.00
362		Sensor/Trip (A)	30.00	30.00	30.00	30.00	30.00	30.00
363		System Nominal Voltage (V)	13800.00	13800.00	13800.00	13800.00	13800.00	13800.00
364	UPS-MBB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
365		Description	LSI, 400AS	LSI, 400AS	LSI, 400AS	LSI, 400AS	LSI, 400AS	LSI, 400AS
366		Frame/Model	LD	LD	LD	LD	LD	LD
367		DE_Status	Unknown	Unknown	Unknown	Unknown	Unknown	Pass
368		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
369		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
370		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	0.00	0.00	12.07
371		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	0.00	0.00	3.02
372		Frame/Rating (A)	400.00	400.00	400.00	400.00	400.00	400.00
373		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
374		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
375	UPS-MBB-FB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
376		Description	LSI, 400AS	LSI, 400AS	LSI, 400AS	LSI, 400AS	LSI, 400AS	LSI, 400AS
377		Frame/Model	LD	LD	LD	LD	LD	LD
378		DE_Status	Unknown	Unknown	Unknown	Unknown	Unknown	Pass
379		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
380		InterruptingRating (kA)	25.00	25.00	25.00	25.00	25.00	25.00
381		DE_DAP_INT_Bus% (%)	0.00	0.00	0.00	0.00	0.00	19.95
382		DE_DAP_INT_Bus_Duty (kA)	0.00	0.00	0.00	0.00	0.00	4.99
383		Frame/Rating (A)	400.00	400.00	400.00	400.00	400.00	400.00
384		Sensor/Trip (A)	400.00	400.00	400.00	400.00	400.00	400.00
385		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00
386	UPS-MIB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
387		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
388		Frame/Model	PG	PG	PG	PG	PG	PG
389		DE_Status	Pass	Pass	Pass	Pass	Pass	Unknown
390		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
391		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
392		DE_DAP_INT_Bus% (%)	6.47	6.47	6.47	4.96	4.49	0.00
393		DE_DAP_INT_Bus_Duty (kA)	4.21	4.21	4.21	3.23	2.92	0.00
394		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
395		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
396		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00

Data Group 3. Protective Device Evaluation Tabulation (continued)

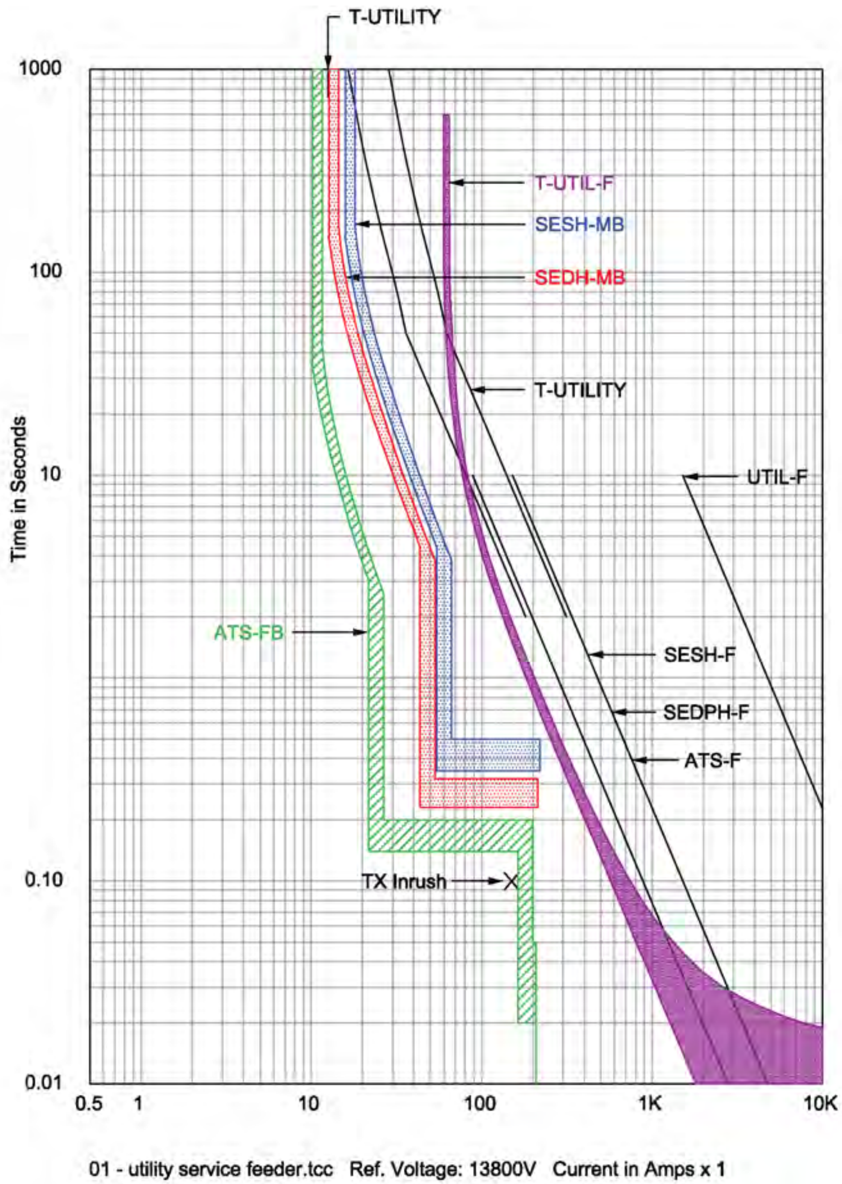
System Parameters			System Configuration				Maintenance Configuration	
			Utility Power			Standby Power	Isolate ATS	Isolate UPS
			Unlimited Bus	500 MVA SCA	100 MVA SCA	Generator	Generator	Generator
			Source	Source	Source	Source:	Circuit	Circuit
			T-Utility	T-Utility	T-Utility	GEN	EDPH-MBB	UPS-MBB-FB
397	UPS-RIB	Manufacturer	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D	SQUARE D
398		Description	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A	LSI, 250-1200A
399		Frame/Model	PG	PG	PG	PG	PG	PG
400		DE_Status	Pass	Pass	Pass	Pass	Pass	Unknown
401		Test X/R	4.90	4.90	4.90	4.90	4.90	4.90
402		InterruptingRating (kA)	65.00	65.00	65.00	65.00	65.00	65.00
403		DE_DAP_INT_Bus% (%)	17.65	17.65	17.65	9.00	7.67	0.00
404		DE_DAP_INT_Bus_Duty (kA)	11.47	11.47	11.47	5.85	4.99	0.00
405		Frame/Rating (A)	1200.00	1200.00	1200.00	1200.00	1200.00	1200.00
406		Sensor/Trip (A)	250.00	250.00	250.00	250.00	250.00	250.00
407		System Nominal Voltage (V)	208.00	208.00	208.00	208.00	208.00	208.00

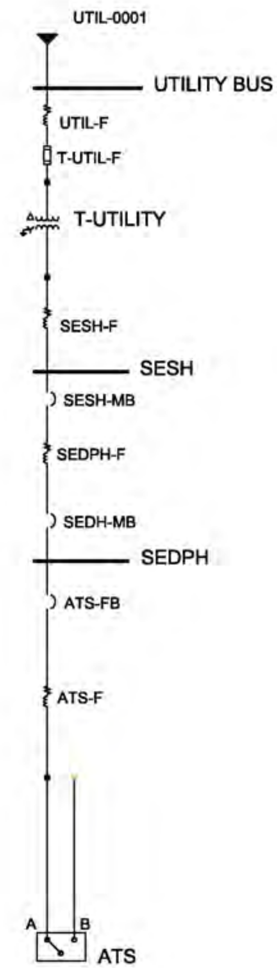
Data Group 4. Protective Device Coordination Analysis - TCC Plots

TCC Plots - Index					
Study #	Distribution Point	TCC No.	Distribution Segment		
			From	To	Description
1	SESH	TCC Plot 01	SESH-MB	ATS-FB	Essential Bus Connected to Commercial Utility
		TCC Plot 01A	SESH-MB	ATS-FB	SESH/SEDPH Ground Fault Protection
2	SEDPH	TCC Plot 02	SEDPH	CPL1	Critical Bus Connected to Commercial Utility Power Source
3	SEDPH	TCC Plot 03	SEDPH	Chiller-1	Chiller Connected to Commercial Utility Power Source
4	SEDPH	TCC Plot 04	SEDPH	NPH	Normal Bus Connected to Commercial Utility Power Source
5	SEDPH	TCC Plot 05	SEDPH	FLSDPH1	FLS Bus Connected to Commercial Utility Power Source
6	SEDPH	TCC Plot 06	SEDPH	FLSDPH2	FLS Bus Connected to Commercial Utility Power Source
7	GDPH	TCC Plot 07	GDPH	EDPH	Essential Bus Connected to Commercial Utility Power Source
8	GDPH	TCC Plot 08	GDPH	FLSDPH1	FLS Bus Connected to Commercial Generator Power Source
9	GDPH	TCC Plot 09	GDPH	FLSDPH2	FLS Elevator Bus Connected to Commercial Generator Power Source

TCC Plot 1 Diagram

Component Device	Field Parameter	Base Project
ATS-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	15
SEDH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	0.8
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	OFF
SESH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	1
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.4 (I^s T Off)
	Setting_INST	OFF
T-UTIL-F	Manufacturer	S&C
	Type	SM-4, 14.4kV E-Rated
	Frame	SM-4, 30E
	TCC No.	119-4, 119-4-2
	Trip (A)	30

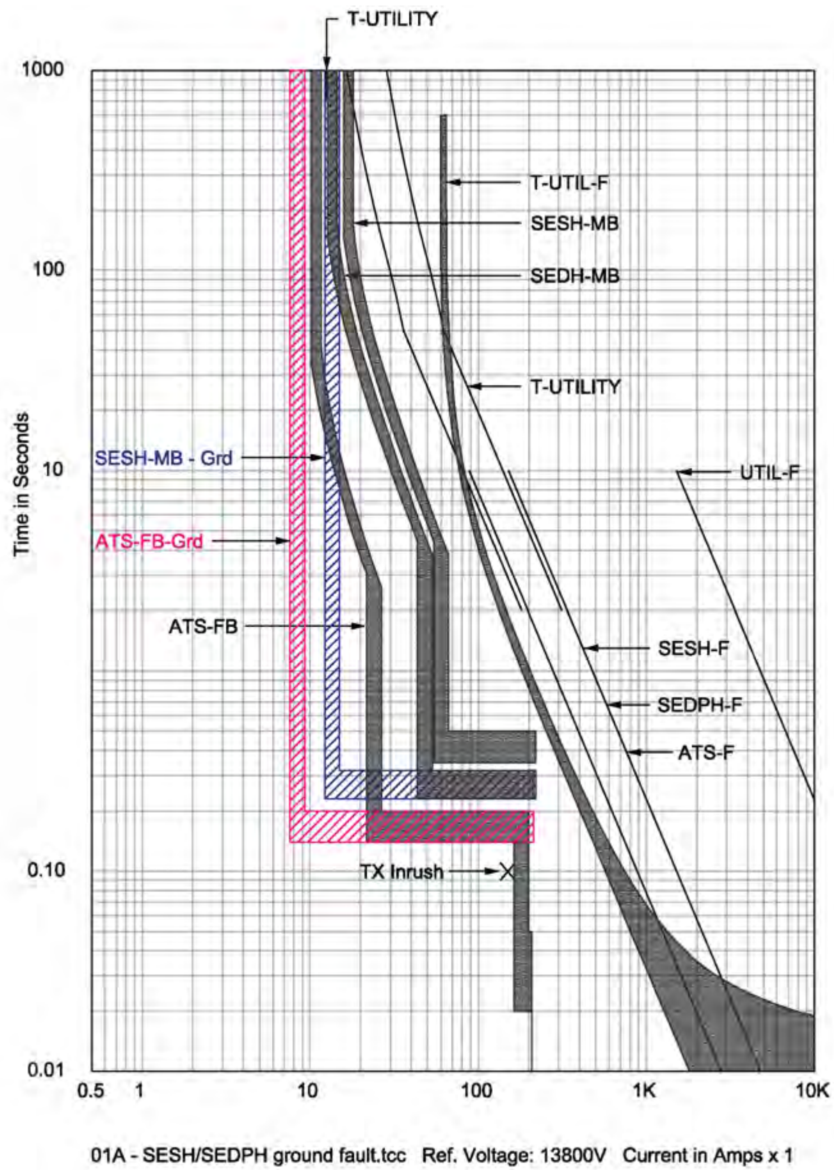


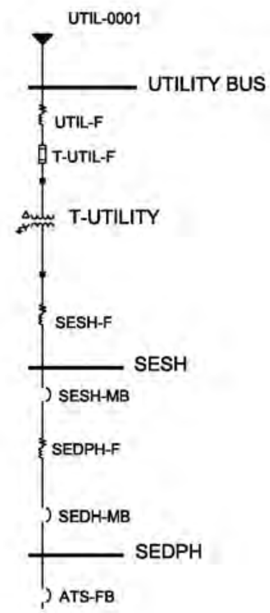


TCC Plot 1

TCC Plot 1A Diagram

Component Device	Field Parameter	Base Project
ATS-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	15
	Setting_GFPU	F
	Setting_GFD	0.2 (I^s T Off)
SEDH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	0.8
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	OFF
SESH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	1
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.4 (I^s T Off)
	Setting_INST	OFF
	Setting_GFPU	H
	Setting_GFD	0.3 (I^s T Off)
T-UTIL-F	Manufacturer	S&C
	Type	SM-4, 14.4kV E-Rated
	Frame	SM-4, 30E
	TCC No.	119-4, 119-4-2
	Trip (A)	30

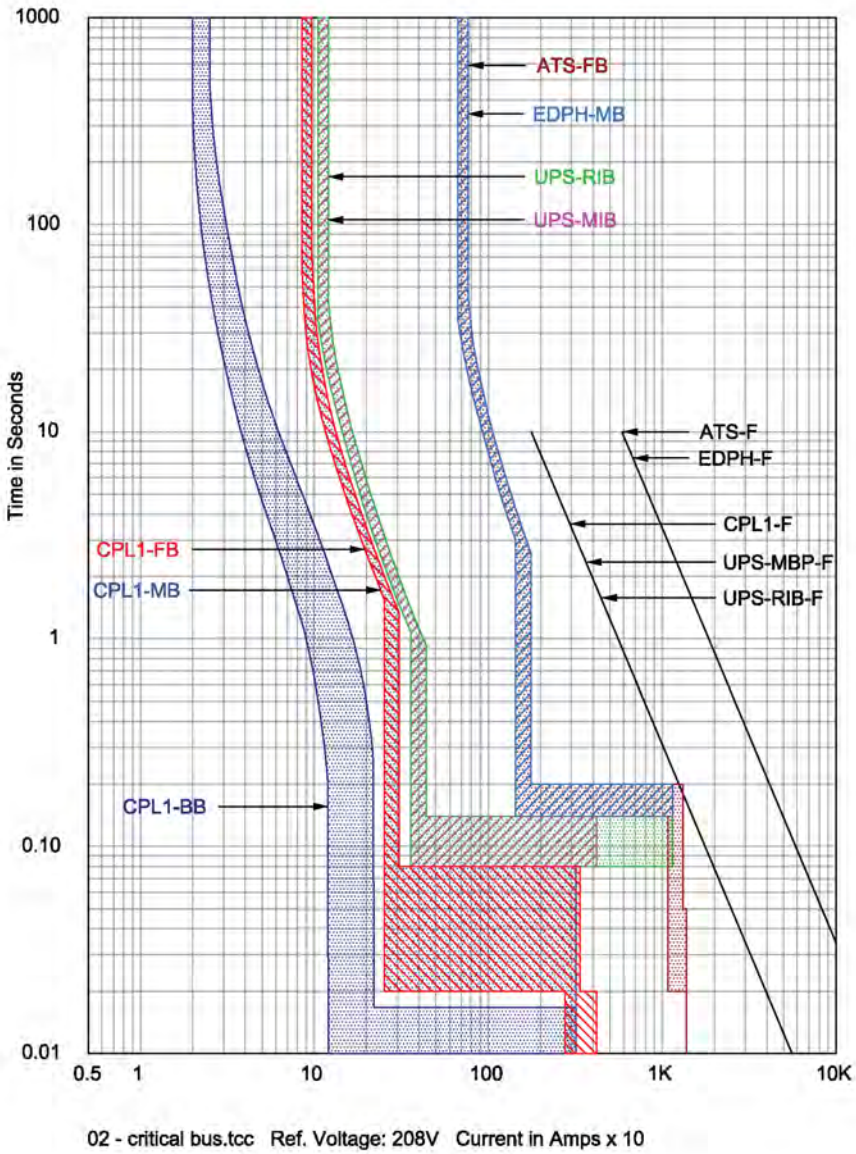


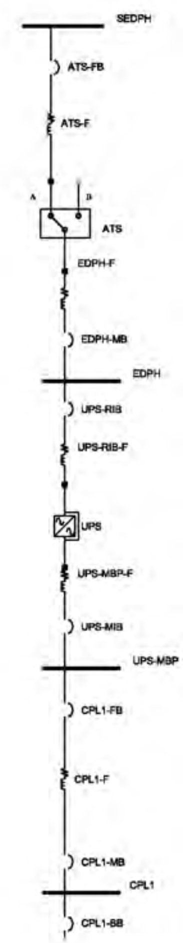


TCC Plot 1A

Plot 2 Diagram

Component Device	Field Parameter	Base Project
ATS-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	15
EDPH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	OFF
UPS-RIB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	250
	Setting_LTPU	0.4
	Setting_LTD	0.5
	Setting_STPU	4
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	OFF
UPS-MIB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	250
	Setting_LTPU	0.4
	Setting_LTD	0.5
	Setting_STPU	4
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	OFF
CPL1-FB	Manufacturer	SQUARE D
	Type	Powerpact J Frame, 5.2A/E & 6.2A/E
	Frame	JD Mission Critical Series
	TCC No.	S1A814__00
	Sensor Trip (A)	250
	Setting_LTPU	80
	Setting_LTD	0.5
	Setting_STPU	3.5
	Setting_STD	0.0 (I^s T Off)
	Setting_INST	12
CPL1-MB	Manufacturer	SQUARE D
	Type	Powerpact J Frame, 5.2A/E & 6.2A/E
	Frame	JD Mission Critical Series
	TCC No.	S1A814__00
	Sensor Trip (A)	250
	Setting_LTPU	80
	Setting_LTD	0.5
	Setting_STPU	3.5
	Setting_STD	0.0 (I^s T Off)
	Setting_INST	12
CPL1-BB	Manufacturer	SQUARE D
	Type	QO, 1-Pole
	Frame	QO
	TCC No.	730-2,3,4,5,6
	Trip (A)	20

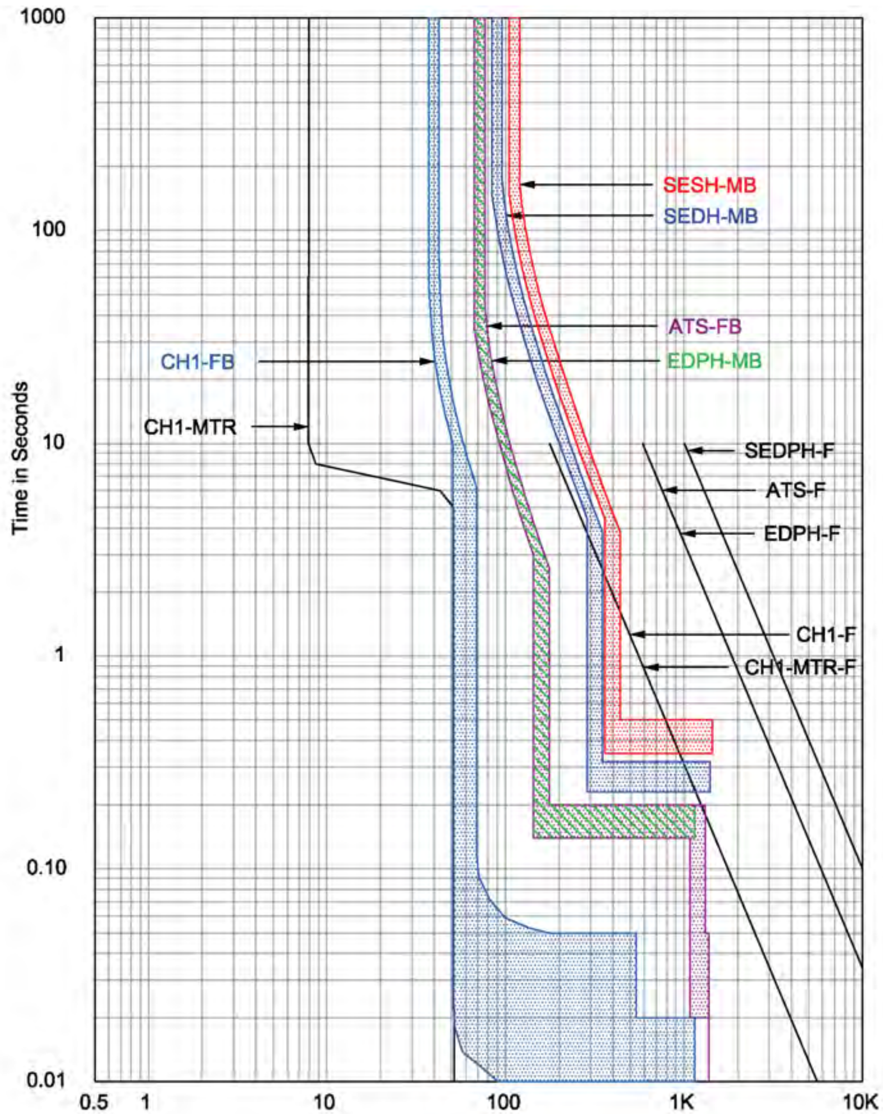




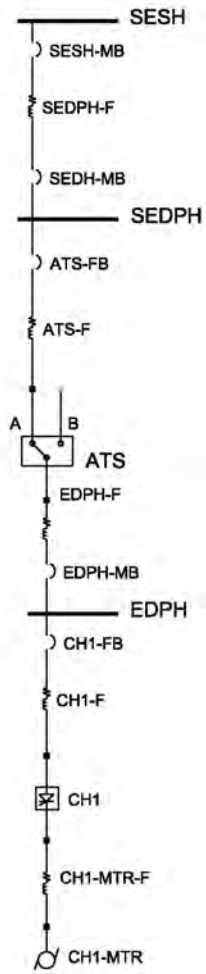
TCC Plot 2

TCC Plot 3 Diagram

Component Device	Field Parameter	Base Project
SESH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	1
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.4 (I^s T Off)
	Setting_INST	OFF
SEDH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	0.8
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	OFF
ATS-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	15
EDPH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	OFF
CH1-FB	Manufacturer	SQUARE D
	Type	PowerPact L-Frame, 3.3
	Frame	LD
	TCC No.	S1A81___00
	Sensor Trip (A)	400
	Setting_LTPU	350
	Setting_LTD	0.5
	Setting_STPU	-
	Setting_STD	-
	Setting_INST	1.5



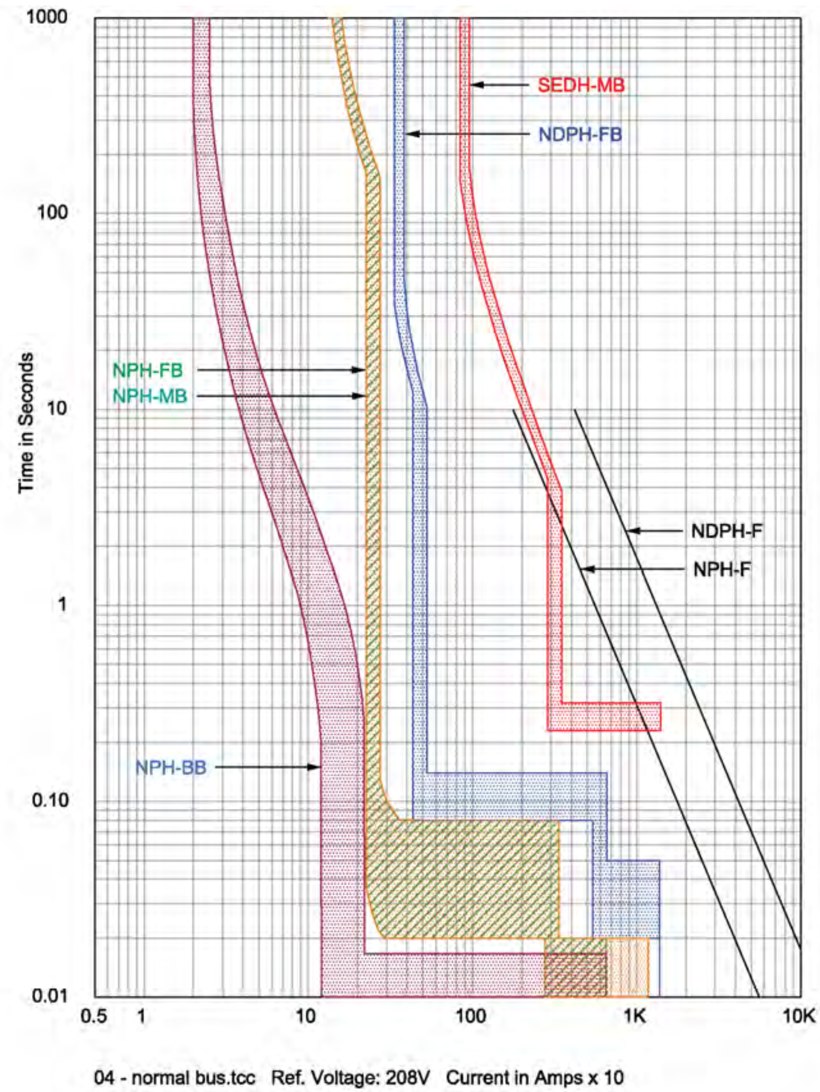
03 - chiller.tcc Ref. Voltage: 208V Current in Amps x 10

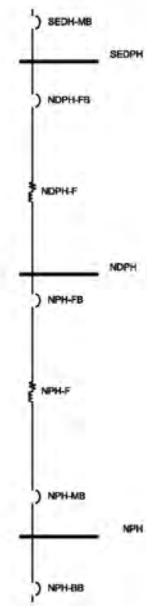


TCC Plot 3

TCC Plot 4 Diagram

Component Device	Field Parameter	Base Project
SEDH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	1
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	OFF
NDPH-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	400
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	1.5
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	15
NPH-FB	Manufacturer	SQUARE D
	Type	PowerPact J-Frame, 3.2S
	Frame	JD
	TCC No.	S1A814__00
	Sensor Trip (A)	250
	Setting_LTPU	125
	Setting_LTD	Fixed
	Setting_STPU	2
	Setting_STD	Fixed
	Setting_INST	12
NPH-MB	Manufacturer	SQUARE D
	Type	PowerPact J-Frame, 3.2S
	Frame	JD
	TCC No.	S1A814__00
	Sensor Trip (A)	250
	Setting_LTPU	125
	Setting_LTD	Fixed
	Setting_STPU	2
	Setting_STD	Fixed
	Setting_INST	12
NPH-BB	Manufacturer	SQUARE D
	Type	QO, 1-Pole
	Frame	QO
	TCC No.	730-2,3,4,5,6
	Sensor Trip (A)	20

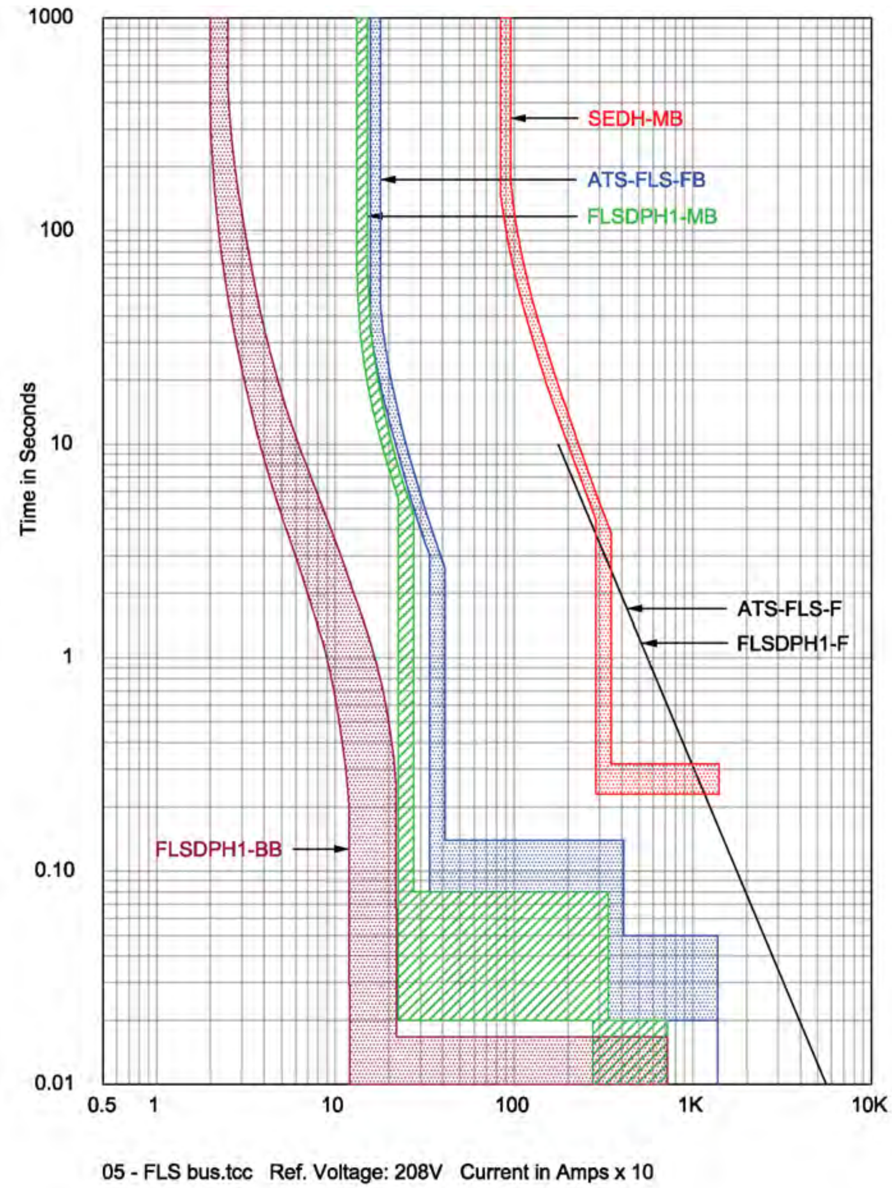


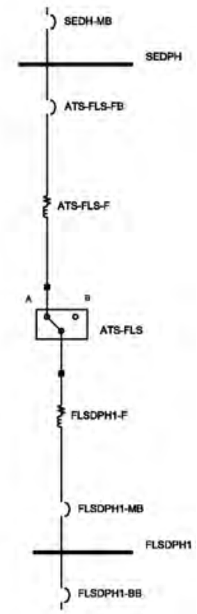


TCC Plot 4

TCC Plot 5 Diagram

Component Device	Field Parameter	Base Project
SEDH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	0.8
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	OFF
ATS-FLS-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	250
	Setting_LTPU	0.6
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	15
FLSDPH1-MB	Manufacturer	SQUARE D
	Type	Powerpact J Frame, 5.2A/E & 6.2A/E
	Frame	JD
	TCC No.	S1A814__00
	Sensor Trip (A)	250
	Setting_LTPU	125
	Setting_LTD	0.5
	Setting_STPU	2
	Setting_STD	0.0 (I^s T Off)
	Setting_INST	12
FLSDPH1-BB	Manufacturer	SQUARE D
	Type	QO, 1-Pole
	Frame	QO
	TCC No.	730-2,3,4,5,6
	Sensor Trip (A)	20

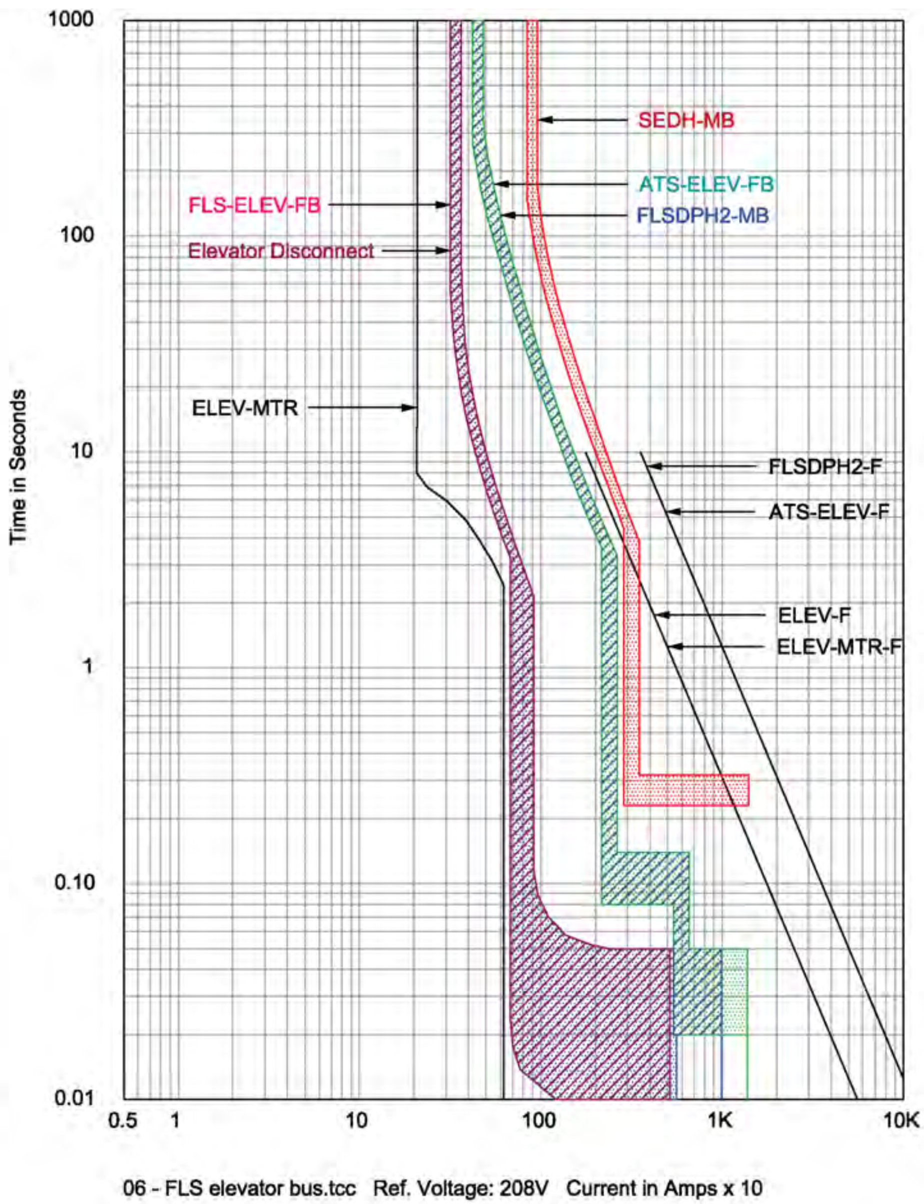


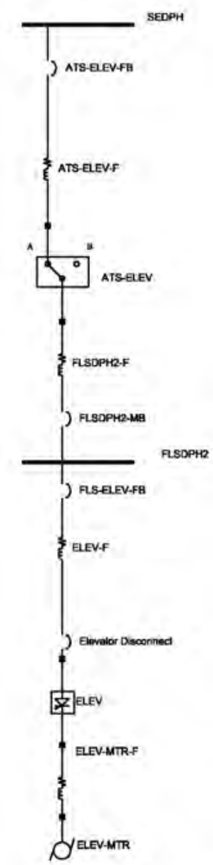


TCC Plot 5

TCC Plot 6 Diagram

Component Device	Field Parameter	Base Project
SEDH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	1000
	Setting_LTPU	0.8
	Setting_LTD	2
	Setting_STPU	4
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	OFF
ATS-ELEV-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	400
	Setting_LTPU	1
	Setting_LTD	4
	Setting_STPU	6
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	15
FLSDPH2-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	400
	Setting_LTPU	1
	Setting_LTD	4
	Setting_STPU	6
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	15
FLS-ELEV-FB	Manufacturer	SQUARE D
	Type	PowerPact L-Frame, 3.3
	Frame	LD
	TCC No.	S1A81__00
	Sensor Trip (A)	400
	Setting_LTPU	300
	Setting_LTD	0.5
	Setting_STPU	-
	Setting_STD	-
	Setting_INST	2
Elevator Disconnect	Manufacturer	SQUARE D
	Type	PowerPact L-Frame, 3.3
	Frame	LG
	TCC No.	S1A81__00
	Sensor Trip (A)	400
	Setting_LTPU	300
	Setting_LTD	0.5
	Setting_STPU	-
	Setting_STD	-
	Setting_INST	2

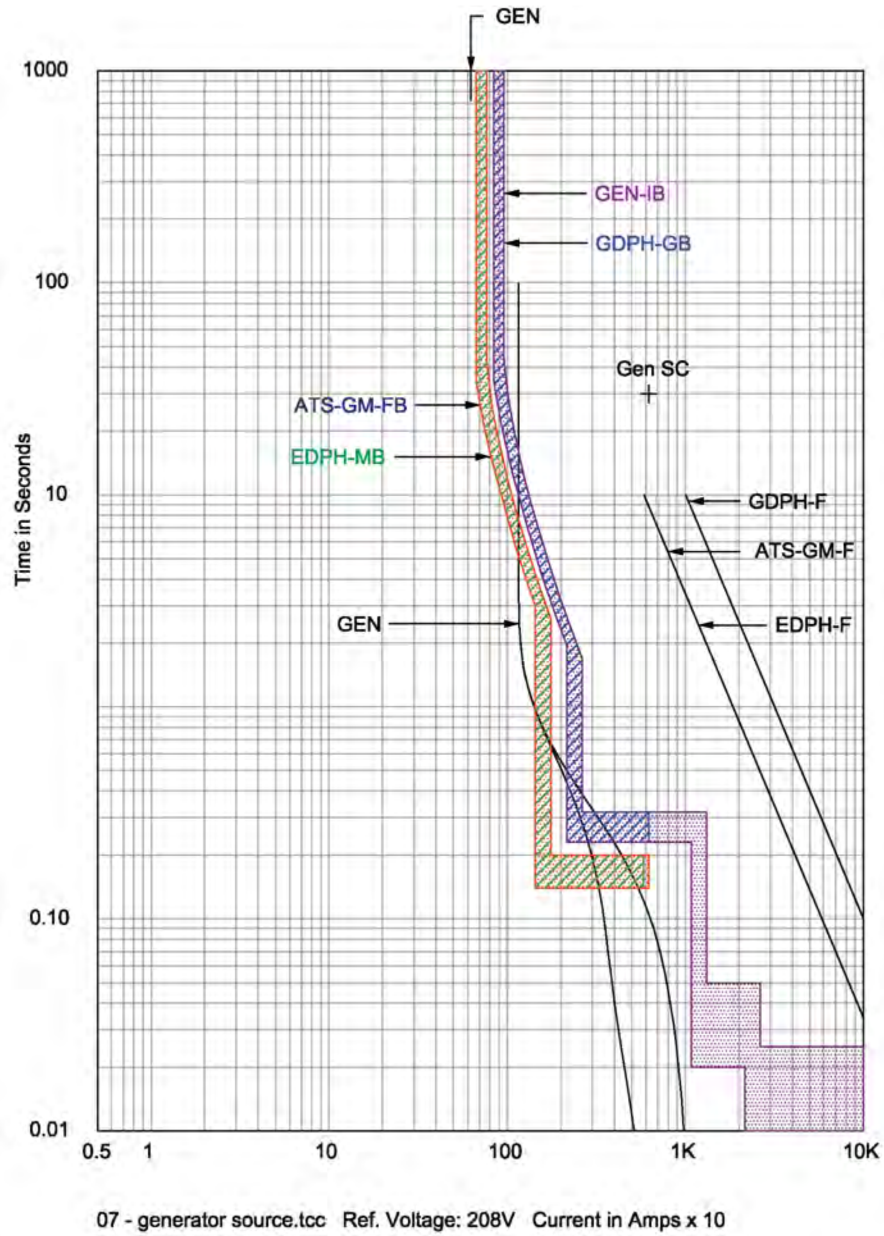


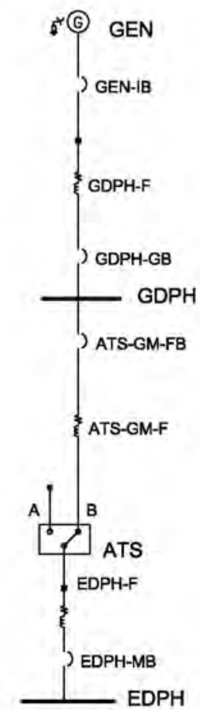


TCC Plot 6

TCC Plot 7 Diagram

Component Device	Field Parameter	Base Project
GEN-IB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	15
GDPH-GB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	15
ATS-GM-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	OFF
EDPH-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	0.8
	Setting_LTD	0.5
	Setting_STPU	2.5
	Setting_STD	0.2 (I^s T Off)
	Setting_INST	OFF

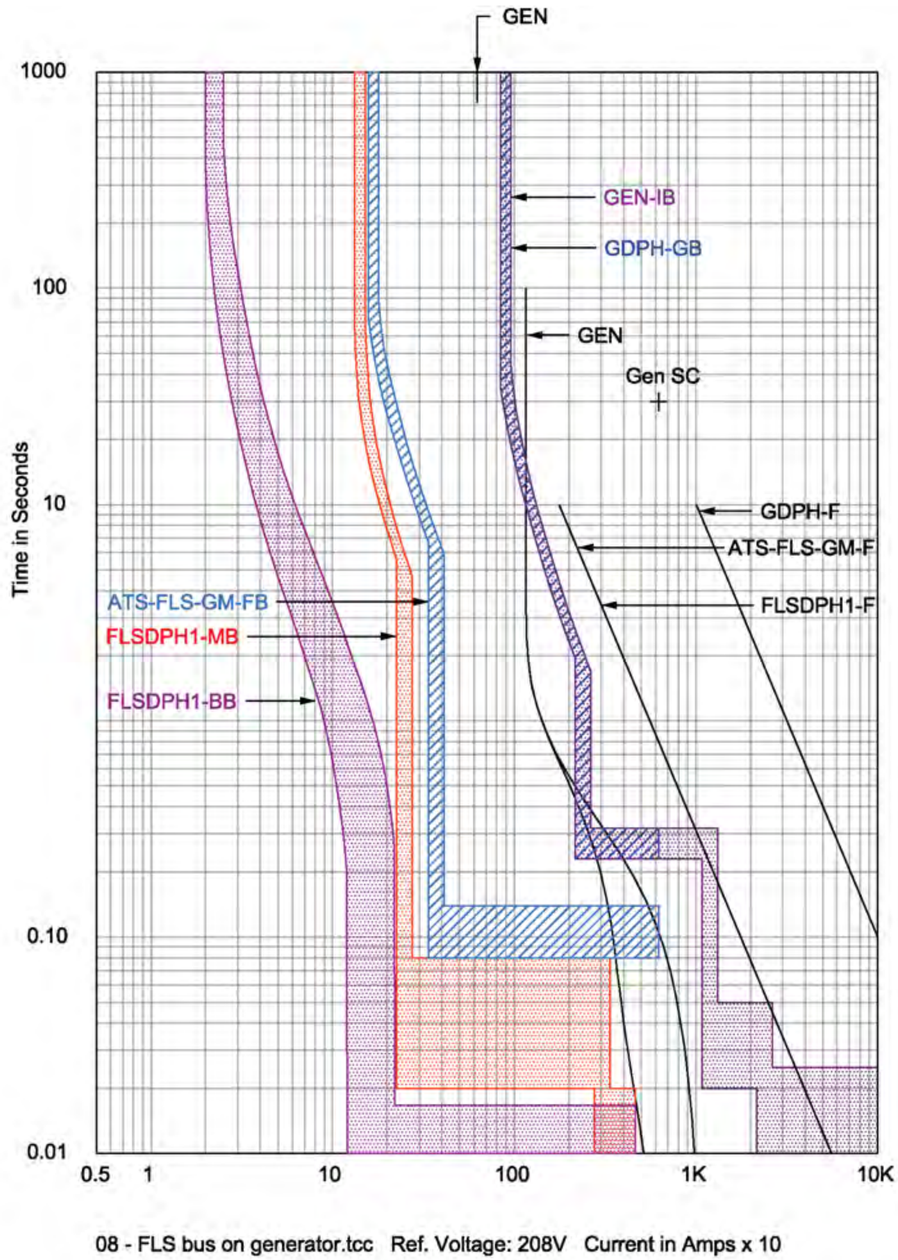


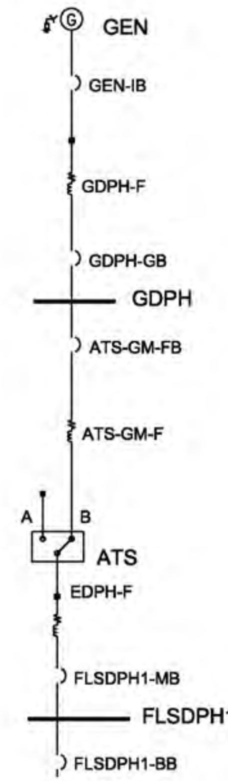


TCC Plot 7

TCC Plot 8 Diagram

Component Device	Field Parameter	Base Project
GEN-IB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	15
GDPH-GB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	15
ATS-FLS-GM-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	250
	Setting_LTPU	0.6
	Setting_LTD	1
	Setting_STPU	2.5
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	OFF
FLSDPH1-MB	Manufacturer	SQUARE D
	Type	Powerpact J Frame, 5.2A/E & 6.2A/E
	Frame	JD
	TCC No.	S1A814__00
	Sensor Trip (A)	250
	Setting_LTPU	125
	Setting_LTD	0.5
	Setting_STPU	2
	Setting_STD	0.0 (I^s T Off)
	Setting_INST	12
FLSDPH1-BB	Manufacturer	SQUARE D
	Type	QO, 1-Pole
	Frame	QO
	TCC No.	730-2,3,4,5,6
	Trip (A)	20

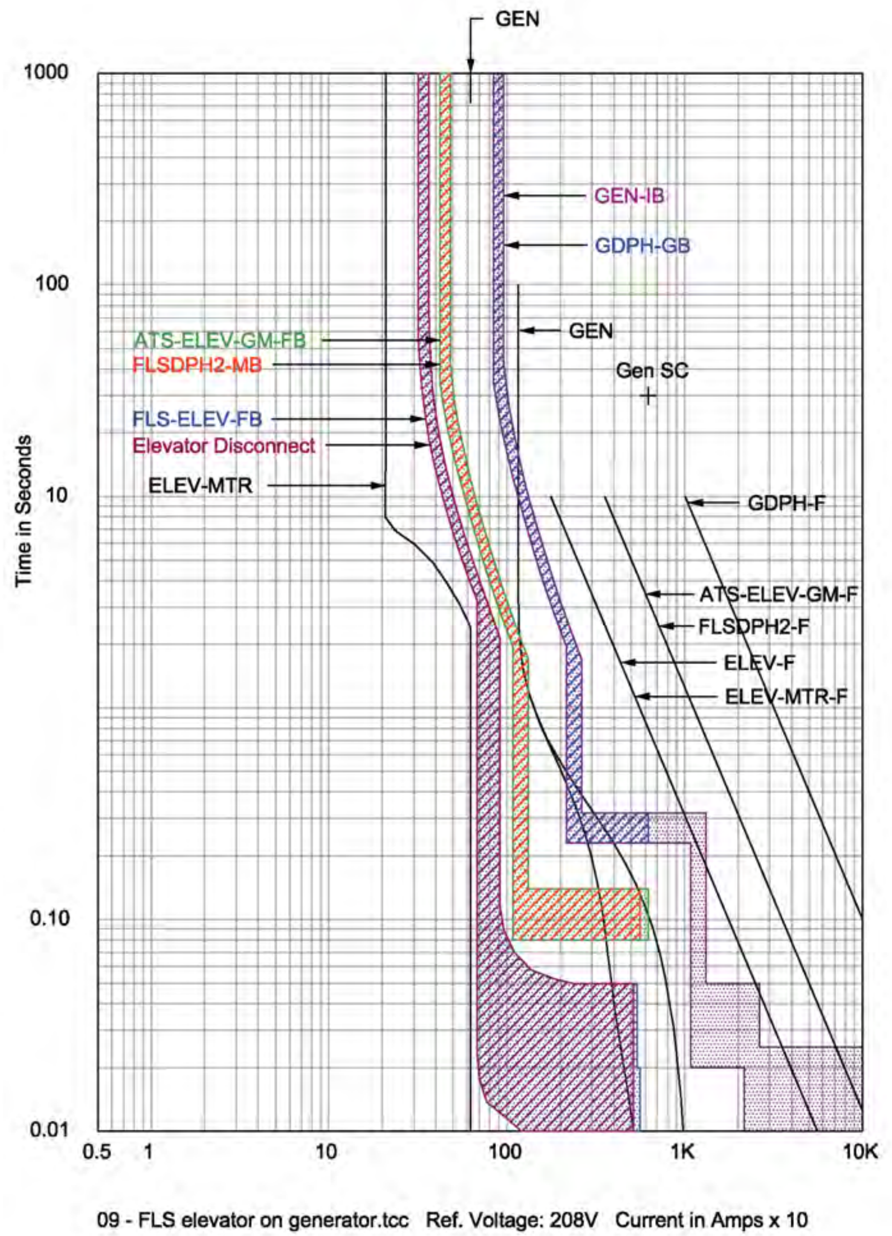


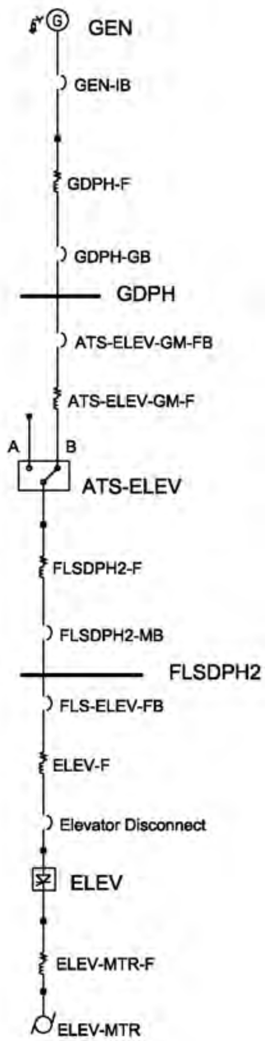


TCC Plot 8

TCC Plot 9 Diagram

Component Device	Field Parameter	Base Project
GEN-IB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	15
GDPH-GB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	800
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.3 (I^s T Off)
	Setting_INST	15
ATS-ELEV-GM-FB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	400
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	OFF
FLSDPH2-MB	Manufacturer	SQUARE D
	Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
	Frame	PG
	TCC No.	613-4, 5, 7, 10
	Sensor Trip (A)	400
	Setting_LTPU	1
	Setting_LTD	0.5
	Setting_STPU	3
	Setting_STD	0.1 (I^s T Off)
	Setting_INST	OFF
FLS-ELEV-FB	Manufacturer	SQUARE D
	Type	PowerPact L-Frame, 3.3
	Frame	LD
	TCC No.	S1A81___00
	Sensor Trip (A)	400
	Setting_LTPU	300
	Setting_LTD	0.5
	Setting_STPU	-
	Setting_STD	-
	Setting_INST	2
Elevator Disconnect	Manufacturer	SQUARE D
	Type	PowerPact L-Frame, 3.3
	Frame	LG
	TCC No.	S1A81___00
	Sensor Trip (A)	400
	Setting_LTPU	300
	Setting_LTD	0.5
	Setting_STPU	-
	Setting_STD	-
	Setting_INST	2





TCC Plot 9

Data Group 4. Protective Device Settings Tabulation

System Parameters			Protective Device Settings
Line #	**Component**	**Field Parameter**	**Base Project**
1	ATS-ELEV-FB	Manufacturer	SQUARE D
2		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
3		Frame/Model	PG
4		TCC No.	613-4, 5, 7, 10
5		Trip (A)	400
6		Setting_LTPU	1 (400A)
7		Setting_LTD	4
8		Setting_STPU	6 (2400A)
9		Setting_STD	0.1 (I^s T Off)
10		Setting_INST	15 (6000A)
11		Setting_GFPU	J (400A)
12		Setting_GFD	0.2 (I^s T Off)
13	ATS-ELEV-GM-FB	Manufacturer	SQUARE D
14		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
15		Frame/Model	PG
16		TCC No.	613-4, 5, 7, 10
17		Trip (A)	400
18		Setting_LTPU	1 (400A)
19		Setting_LTD	0.5
20		Setting_STPU	3 (1200A)
21		Setting_STD	0.1 (I^s T Off)
22		Setting_INST	OFF
23	ATS-FB	Manufacturer	SQUARE D
24		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
25		Frame/Model	PG
26		TCC No.	613-4, 5, 7, 10
27		Trip (A)	800
28		Setting_LTPU	0.8 (640A)
29		Setting_LTD	0.5
30		Setting_STPU	2.5 (1600A)
31		Setting_STD	0.2 (I^s T Off)
32		Setting_INST	15 (12000A)
33		Setting_GFPU	F (560A)
34		Setting_GFD	0.2 (I^s T Off)
35	ATS-FLS-FB	Manufacturer	SQUARE D
36		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
37		Frame/Model	PG
38		TCC No.	613-4, 5, 7, 10
39		Trip (A)	250
40		Setting_LTPU	0.6 (150A)
41		Setting_LTD	0.5
42		Setting_STPU	2.5 (375A)
43		Setting_STD	0.1 (I^s T Off)
44		Setting_INST	15 (3750A)

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	**Component**	**Field Parameter**	**Base Project**
45	ATS-FLS-GM-FB	Manufacturer	SQUARE D
46		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
47		Frame/Model	PG
48		TCC No.	613-4, 5, 7, 10
49		Trip (A)	250
50		Setting_LTPU	0.6 (150A)
51		Setting_LTD	1
52		Setting_STPU	2.5 (375A)
53		Setting_STD	0.1 (I^s T Off)
54		Setting_INST	OFF
55	ATS-GM-FB	Manufacturer	SQUARE D
56		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
57		Frame/Model	PG
58		TCC No.	613-4, 5, 7, 10
59		Trip (A)	800
60		Setting_LTPU	0.8 (640A)
61		Setting_LTD	0.5
62		Setting_STPU	2.5 (1600A)
63		Setting_STD	0.2 (I^s T Off)
64		Setting_INST	OFF
65	CH1-FB	Manufacturer	SQUARE D
66		Type	PowerPact L-Frame, 3.3
67		Frame/Model	LD
68		TCC No.	S1A81___00
69		Trip (A)	400.00
70		Setting_LTPU	350 (350A)
71		Setting_LTD	0.5
72		Setting_STPU	-
73		Setting_STD	-
74		Setting_INST	1.5 (600A)
75	CH2-FB	Manufacturer	SQUARE D
76		Type	PowerPact L-Frame, 3.3
77		Frame/Model	LD
78		TCC No.	S1A81___00
79		Trip (A)	400.00
80		Setting_LTPU	350 (350A)
81		Setting_LTD	0.5
82		Setting_STPU	-
83		Setting_STD	-
84		Setting_INST	1.5 (600A)
85	CPL1-BB	Manufacturer	SQUARE D
86		Type	QO, 1-Pole
87		Frame/Model	QO
88		TCC No.	730-2,3,4,5,6
89		Trip (A)	20.00

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	**Component**	**Field Parameter**	**Base Project**
90	CPL1-FB	Manufacturer	SQUARE D
91		Type	Powerpact J Frame, 5.2A/E & 6.2A/E
92		Frame/Model	JD
93		TCC No.	S1A814__00
94		Trip (A)	250.00
95		Setting_LTPU	80 (80A)
96		Setting_LTD	0.5
97		Setting_STPU	3.5 (280A)
98		Setting_STD	0.0 (I^s T Off)
99		Setting_INST	12 (3000A)
100	CPL1-MB	Manufacturer	SQUARE D
101		Type	Powerpact J Frame, 5.2A/E & 6.2A/E
102		Frame/Model	JD
103		TCC No.	S1A814__00
104		Trip (A)	250.00
105		Setting_LTPU	80 (80A)
106		Setting_LTD	0.5
107		Setting_STPU	3.5 (280A)
108		Setting_STD	0.0 (I^s T Off)
109		Setting_INST	12 (3000A)
110	EDPH-GMBB-FB	Manufacturer	SQUARE D
111		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
112		Frame/Model	PG
113		TCC No.	613-4, 5, 7, 10
114		Trip (A)	250.00
115		Setting_LTPU	0.4 (100A)
116		Setting_LTD	0.5
117		Setting_STPU	1.5 (150A)
118		Setting_STD	0.1 (I^s T Off)
119		Setting_INST	2 (500A)
120	EDPH-MB	Manufacturer	SQUARE D
121		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
122		Frame/Model	PG
123		TCC No.	613-4, 5, 7, 10
124		Trip (A)	800.00
125		Setting_LTPU	0.8 (640A)
126		Setting_LTD	0.5
127		Setting_STPU	2.5 (1600A)
128		Setting_STD	0.2 (I^s T Off)
129		Setting_INST	OFF

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	Component	Field Parameter	Base Project
130	EDPH-MBB	Manufacturer	SQUARE D
131		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
132		Frame/Model	PG
133		TCC No.	613-4, 5, 7, 10
134		Trip (A)	800.00
135		Setting_LTPU	0.8 (640A)
136		Setting_LTD	0.5
137		Setting_STPU	3 (1920A)
138		Setting_STD	0.2 (I^s T Off)
139		Setting_INST	15 (12000A)
140	Elevator Disc	Manufacturer	SQUARE D
141		Type	PowerPact L-Frame, 3.3
142		Frame/Model	LG
143		TCC No.	S1A81___00
144		Trip (A)	400.00
145		Setting_LTPU	300 (300A)
146		Setting_LTD	0.5
147		Setting_STPU	-
148		Setting_STD	-
149		Setting_INST	2 (800A)
150	EPH1-BB	Manufacturer	SQUARE D
151		Type	QO, 1-Pole
152		Frame/Model	QO
153		TCC No.	730-2,3,4,5,6
154		Trip (A)	20.00
155	EPH1-FB	Manufacturer	SQUARE D
156		Type	PowerPact J-Frame, 3.2S
157		Frame/Model	JD
158		TCC No.	S1A814__00
159		Trip (A)	250.00
160		Setting_LTPU	70 (70A)
161		Setting_LTD	Fixed
162		Setting_STPU	4 (280A)
163		Setting_STD	Fixed
164		Setting_INST	12 (3000A)
165	EPH1-MB	Manufacturer	SQUARE D
166		Type	PowerPact J-Frame, 3.2S
167		Frame/Model	JD
168		TCC No.	S1A814__00
169		Trip (A)	250.00
170		Setting_LTPU	70 (70A)
171		Setting_LTD	Fixed
172		Setting_STPU	4 (280A)
173		Setting_STD	Fixed
174		Setting_INST	12 (3000A)

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	**Component**	**Field Parameter**	**Base Project**
175	EPH2-BB	Manufacturer	SQUARE D
176		Type	QO, 1-Pole
177		Frame/Model	QO
178		TCC No.	730-2,3,4,5,6
179		Trip (A)	20.00
180	EPH2-FB	Manufacturer	SQUARE D
181		Type	PowerPact J-Frame, 3.2S
182		Frame/Model	JD
183		TCC No.	S1A814__00
184		Trip (A)	250.00
185		Setting_LTPU	150 (150A)
186		Setting_LTD	Fixed
187		Setting_STPU	4 (600A)
188		Setting_STD	Fixed
189		Setting_INST	12 (3000A)
190	EPH2-MB	Manufacturer	SQUARE D
191		Type	PowerPact J-Frame, 3.2S
192		Frame/Model	JD
193		TCC No.	S1A814__00
194		Trip (A)	250.00
195		Setting_LTPU	150 (150A)
196		Setting_LTD	Fixed
197		Setting_STPU	4 (600A)
198		Setting_STD	Fixed
199		Setting_INST	12 (3000A)
200	FLS-ELEV-FB	Manufacturer	SQUARE D
201		Type	PowerPact L-Frame, 3.3
202		Frame/Model	LD
203		TCC No.	S1A81___00
204		Trip (A)	400.00
205		Setting_LTPU	300 (300A)
206		Setting_LTD	0.5
207		Setting_STPU	-
208		Setting_STD	-
209		Setting_INST	2 (800A)
210	FLSDPH1-BB	Manufacturer	SQUARE D
211		Type	QO, 1-Pole
212		Frame/Model	QO
213		TCC No.	730-2,3,4,5,6
214		Trip (A)	20.00

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	Component	Field Parameter	Base Project
215	FLSDPH1-MB	Manufacturer	SQUARE D
216		Type	Powerpact J Frame, 5.2A/E & 6.2A/E
217		Frame/Model	JD
218		TCC No.	S1A814__00
219		Trip (A)	250.00
220		Setting_LTPU	125 (125A)
221		Setting_LTD	0.5
222		Setting_STPU	2 (250A)
223		Setting_STD	0.0 (I^s T Off)
224		Setting_INST	12 (3000A)
225	FLSDPH2-MB	Manufacturer	SQUARE D
226		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
227		Frame/Model	PG
228		TCC No.	613-4, 5, 7, 10
229		Trip (A)	400.00
230		Setting_LTPU	1 (400A)
231		Setting_LTD	0.5
232		Setting_STPU	3 (1200A)
233		Setting_STD	0.1 (I^s T Off)
234		Setting_INST	OFF
235	GDPH-GB	Manufacturer	SQUARE D
236		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
237		Frame/Model	PG
238		TCC No.	613-4, 5, 7, 10
239		Trip (A)	800.00
240		Setting_LTPU	1 (800A)
241		Setting_LTD	0.5
242		Setting_STPU	3 (2400A)
243		Setting_STD	0.3 (I^s T Off)
244		Setting_INST	15 (12000A)
245	GEN-IB	Manufacturer	SQUARE D
246		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
247		Frame/Model	PG
248		TCC No.	613-4, 5, 7, 10
249		Trip (A)	800.00
250		Setting_LTPU	1 (800A)
251		Setting_LTD	0.5
252		Setting_STPU	3 (2400A)
253		Setting_STD	0.3 (I^s T Off)
254		Setting_INST	15 (12000A)

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	Component	Field Parameter	Base Project
255	NDPH-FB	Manufacturer	SQUARE D
256		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
257		Frame/Model	PG
258		TCC No.	613-4, 5, 7, 10
259		Trip (A)	400.00
260		Setting_LTPU	0.8 (320A)
261		Setting_LTD	0.5
262		Setting_STPU	1.5 (480A)
263		Setting_STD	0.1 (I^s T Off)
264		Setting_INST	15 (6000A)
265	NPH-BB	Manufacturer	SQUARE D
266		Type	QO, 1-Pole
267		Frame/Model	QO
268		TCC No.	730-2,3,4,5,6
269		Trip (A)	20.00
270	NPH-FB	Manufacturer	SQUARE D
271		Type	PowerPact J-Frame, 3.2S
272		Frame/Model	JD
273		TCC No.	S1A814__00
274		Trip (A)	250.00
275		Setting_LTPU	125 (125A)
276		Setting_LTD	Fixed
277		Setting_STPU	2 (250A)
278		Setting_STD	Fixed
279		Setting_INST	12 (3000A)
280	NPH-MB	Manufacturer	SQUARE D
281		Type	PowerPact J-Frame, 3.2S
282		Frame/Model	JD
283		TCC No.	S1A814__00
284		Trip (A)	250.00
285		Setting_LTPU	125 (125A)
286		Setting_LTD	Fixed
287		Setting_STPU	2 (250A)
288		Setting_STD	Fixed
289		Setting_INST	12 (3000A)
290	SEDH-MB	Manufacturer	SQUARE D
291		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
292		Frame/Model	PG
293		TCC No.	613-4, 5, 7, 10
294		Trip (A)	1000.00
295		Setting_LTPU	0.8 (800A)
296		Setting_LTD	2
297		Setting_STPU	4 (3200A)
298		Setting_STD	0.3 (I^s T Off)
299		Setting_INST	OFF

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	Component	Field Parameter	Base Project
300	SESH-MB	Manufacturer	SQUARE D
301		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
302		Frame/Model	PG
303		TCC No.	613-4, 5, 7, 10
304		Trip (A)	1000.00
305		Setting_LTPU	1 (1000A)
306		Setting_LTD	2
307		Setting_STPU	4 (4000A)
308		Setting_STD	0.4 (I^s T Off)
309		Setting_INST	OFF
310		Setting_GFPU	H (900A)
311		Setting_GFD	0.3 (I^s T Off)
312	T-UTIL-F	Manufacturer	S&C
313		Type	SM-4, 14.4kV E-Rated
314		Frame/Model	SM-4, 30E
315		TCC No.	119-4, 119-4-2
316		Trip (A)	30.00
317	UPS-MBB	Manufacturer	SQUARE D
318		Type	Powerpact L-Frame, 5.3A/E & 6.3A/E
319		Frame/Model	LD
320		TCC No.	S1A816__00
321		Trip (A)	400.00
322		Setting_LTPU	125 (125A)
323		Setting_LTD	0.5
324		Setting_STPU	1.5 (187.5A)
325		Setting_STD	0.0 (I^s T Off)
326		Setting_INST	1.5 (600A)
327	UPS-MBB-FB	Manufacturer	SQUARE D
328		Type	Powerpact L-Frame, 5.3A/E & 6.3A/E
329		Frame/Model	LD
330		TCC No.	S1A816__00
331		Trip (A)	400.00
332		Setting_LTPU	150 (150A)
333		Setting_LTD	0.5
334		Setting_STPU	1.5 (225A)
335		Setting_STD	0.0 (I^s T Off)
336		Setting_INST	12 (4800A)

Data Group 4. Protective Device Settings Tabulation (continued)

System Parameters			Protective Device Settings
Line #	Component	Field Parameter	Base Project
337	UPS-MIB	Manufacturer	SQUARE D
338		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
339		Frame/Model	PG
340		TCC No.	613-4, 5, 7, 10
341		Trip (A)	250.00
342		Setting_LTPU	0.4 (100A)
343		Setting_LTD	0.5
344		Setting_STPU	4 (400A)
345		Setting_STD	0.1 (I^s T Off)
346		Setting_INST	OFF
347	UPS-RIB	Manufacturer	SQUARE D
348		Type	Powerpact P-Frame, 5.0 & 6.0 A/P/H
349		Frame/Model	PG
350		TCC No.	613-4, 5, 7, 10
351		Trip (A)	250.00
352		Setting_LTPU	0.4 (100A)
353		Setting_LTD	0.5
354		Setting_STPU	4 (400A)
355		Setting_STD	0.1 (I^s T Off)
356		Setting_INST	OFF

Data Group 5. Arc-Flash Calculation - Bus Tabulation

Line #	Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time/Tol (sec.)	Equip Type	Electrode Config	Box Width (in)	Box Height (in)	Box Depth (in)	Gap (mm)	Arc Flash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
1	CPL1 (225A)	CPL1-MB	0.208	3.22	1.51	3.22	1.51	0.08	0.0000	PNL	VCBB	12	14	8	25	7	18	0.20	(*S1)	
2	EDPH (800A)	EDPH-MB	0.208	11.88	6.07	10.73	5.49	0.2	0.0000	PNL	VCBB	12	14	10	25	28	18	2.69	(*S1)	
3	EPH1 (225A)	EPH1-MB	0.208	6.59	3.20	6.59	3.20	0.08	0.0000	PNL	VCBB	12	14	8	25	11	18	0.48	(*S1)	
4	EPH2 (225A)	EPH2-MB	0.208	6.96	3.40	6.39	3.12	0.08	0.0000	PNL	VCBB	12	14	8	25	11	18	0.51	(*S1)	
5	FLSDPH1 (225A)	FLSDPH1-MB	0.208	7.36	3.08	7.33	3.07	0.08	0.0000	PNL	VCBB	12	14	10	25	12	18	0.57	(*S1)	
6	FLSDPH2 (400A)	FLSDPH2-MB	0.208	10.21	5.15	8.89	4.48	0.14	0.0000	PNL	VCBB	12	14	10	25	21	18	1.62	(*S1)	
7	NDPH (400A)	NDPH-FB	0.208	12.15	6.23	11.91	6.11	0.14	0.0000	PNL	VCBB	12	14	10	25	24	18	2.04	(*S1)	25
8	NPH (225A)	NPH-MB	0.208	6.64	3.23	6.64	3.23	0.08	0.0000	PNL	VCBB	12	14	8	25	11	18	0.48	(*S1)	
9	SEDPH (1200A)	SEDH-MB	0.208	14.46	5.84	11.75	4.74	0.32	0.0000	SWG	HCB	20	20	20	32	47	24	4.65	(*S1)	
10	SESH (1200A)	T-UTIL-F	0.208	14.95	6.04	12.26	4.95	2	0.0000	SWG	HCB	20	20	20	32	115	24	28.8	(*N9) (*S1)	125
11	UPS-MBP (225A)	UPS-MIB	0.208	4.26	2.01	4.26	2.01	0.14	0.0000	PNL	VCBB	12	14	10	25	12	18	0.60	(*S1)	
12	GDPH (800A)	GEN-IB	0.208	6.25	2.42	3.90	1.51	2	0.0000	SWG	HCB	20	20	20	32	63	24	8.41	(*N9) (*S3)	

(*N9) - Max Arcing Duration Reached

(*S1) - Short Circuit Scenario
500 MVA Utility SCA

(*S2) - Short Circuit Scenario
100 MVA Utility SCA

(*S3) - Short Circuit Scenario
Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)

Data Group 5. Arc-Flash Analysis – Typical Equipment Class Electrode Configurations

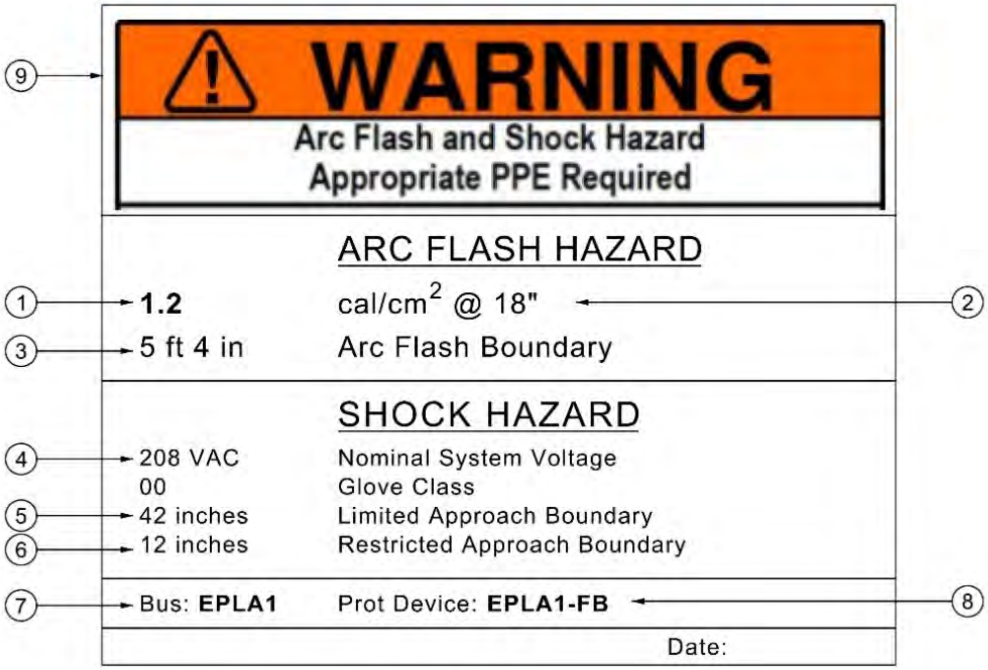
Equipment Enclosure Size and Electrode Configuration Table										
Item #	Distribution Equipment Type	Equipment Voltage Class		Equipment Type	Electrode Configuration	Busbar Gap (mm)	Equipment Enclosure Dimensions			Working Distance (inches)
		Lower Limit (Volts)	Upper Limit (Volts)				Width (inches)	Height (inches)	Depth (inches)	
1	Panelboard	50	600	PNL	VCBB	25	12	14	8	18
2	Safety Disconnect Switch	50	600	PNL	VCBB	25	12	14	8	18
3	Enclosed Circuit Breaker	50	600	PNL	VCBB	25	12	14	8	18
4	Motor Starter Control Panel	50	600	PNL	VCBB	25	12	14	8	18
5	Elevator Control Panel	50	600	PNL	VCBB	25	12	14	8	18
6	Chiller Control Panel	50	600	PNL	VCBB	25	12	14	8	18
7	Automatic Transfer Switch	50	600	PNL	VCBB	25	12	14	8	18
8	Manual Transfer Switch	50	600	PNL	VCBB	25	12	14	8	18
9	Motor Control Center	50	600	MCC	VCBB	25	12	14	8	18
10	Switchboard	50	600	SWG	HCB	32	20	20	20	24
11	Switchgear	50	600	SWG	HCB	32	20	20	20	24
12	UPS	50	600	PNL	VCBB	25	12	14	8	18
13	Variable Frequency Drive	50	600	PNL	VCBB	25	12	14	8	18
14	Dry-type Transformer	50	600	PNL	VCBB	25	12	14	8	18
1	Automatic Transfer Switch	601	5000	SWG	HCB	104	36	36	36	36
2	Chiller Control Panel	601	5000	MCC	HCB	104	26	26	26	36
3	Motor Control Center	601	5000	MCC	HCB	104	26	26	26	36
4	Sectionalizing Switch	601	5000	SWG	HCB	104	36	36	36	36
5	Switch	601	5000	SWG	HCB	104	36	36	36	36
6	Switchgear	601	5000	SWG	HCB	104	36	36	36	36
7	Variable Frequency Drive	601	5000	SWG	HCB	104	36	36	36	36
8	Transformer	601	5000	SWG	HCB	104	36	36	36	36
1	Automatic Transfer Switch	5001	15000	SWG	HCB	152	30	45	30	36
2	Chiller Control Panel	5001	15000	MCC	HCB	152	36	36	36	36
3	Motor Control Center	5001	15000	MCC	HCB	152	36	36	36	36
4	Sectionalizing Switch	5001	15000	SWG	HCB	152	30	45	30	36
5	Switch	5001	15000	SWG	HCB	152	30	45	30	36
6	Switchgear	5001	15000	SWG	HCB	152	30	45	30	36
7	Variable Frequency Drive	5001	15000	SWG	HCB	152	30	45	30	36
8	Transformer	5001	15000	SWG	HCB	152	30	45	30	36

Notes:

1. Table equipment enclosure dimensions are based on typical power distribution equipment configurations for indicated equipment voltage classifications in absence of actual equipment manufacturer installation data.

Data Group 5. Arc-Flash Warning Label – Example Format

Refer to JO 3900.64 – Air Traffic Organization Electrical Safety Program for arc flash warning label requirements.



Label Notes:

1. PPE -Incident Energy: The incident energy value that determines the required PPE outlined in NFPA 70E 130.5 (C)(1) and as referenced in the arc flash summary tabular results.
2. Working Distance: The distance from the arc source and the worker's face or chest.
3. Arc Flash Protection Boundary: When an arc flash hazard exists, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur. The Boundary distance overrides the Approach distances.
4. Bus Voltage Rating: Voltage rating at the equipment being analyzed.
5. Limited Approach: An approach limit at a distance from an exposed live part within which a shock hazard exists. This is the closest approach distance for an unqualified worker unless additional protective measures are used; an unqualified worker may only enter this area if accompanied by a qualified worker at all times.
6. Restricted Approach: An approach limit at a distance from an exposed live part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the live part. This is the closest approach distance for a qualified worker unless additional protective measures are used.
7. Bus: "Bus" represents the actual equipment being analyzed (i.e. Switchgear, Panelboard, Safety Disconnect, etc.)
8. Protective Device: Protective device that is clearing the fault for the associated equipment, this may not always be the next upstream device due to coordination.
9. Warning: Label alert Statement, "WARNING" for incident energy exposure between 0 and 40 cal/cm^2 and "DANGEROUSL for anything above an incident energy of 40 cal/cm^2.

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Appendix G. Protective Device Coordination – Illustrative Examples

1. Overview. This section contains five coordination examples as shown in Table G-1.

Table G-1: Coordination Examples

No.	Power Distribution Type	Application Description
1	208V Radial	• Small facilities with 208Y/120V, 4-wire distribution • < 300kVA utility transformer capacity • Radial distribution configuration with utility + standby E/G + conditioned power
2	480V Radial	• Small facilities with 480V, 3-wire distribution • > 300kVA utility transformer capacity • Radial distribution configuration with utility + standby E/G + conditioned power
3	480V CPDS Type Basic	• Small facilities with 480V, 3-wire distribution • > 300kVA utility transformer capacity • Critical power distribution system (CPDS) with utility + standby E/G + conditioned power
4	480V CPDS Type 1	• Intermediate to large facilities with 480V, 3-wire distribution • > 500kVA utility transformer capacity • Critical power distribution system (CPDS) with utility + standby E/G + conditioned power
5	480V CPDS Type 2	• Intermediate to large facilities with 480V, 3-wire distribution • > 500kVA utility transformer capacity • Critical power distribution system (CPDS) with redundant power paths, utility + standby E/G + conditioned power

Note: The illustrative examples should not be read as a template or used as a form to fill in. The user is responsible for the final content and report format. The example calculations provided are intentionally over-simplified to clarify the process involved and illustrate the results. They do not provide definitive numbers or values and are for guidance only.

2. Objectives. This section provides information on the following topics:

a. Definition of the protection system

b. Determination of selective coordination levels using coordination tools including time-current curves (TCC) and manufacturer's published short circuit selective coordination data.

3. Purpose. The illustrative examples provide information on the following topics:

a. Determination of circuit breaker device pairing combinations to provide an optimal compromise between protection and selectivity.

b. Determination of circuit breaker settings to achieve reduction of arc flash energy without compromising selective coordination in the protection system.

4. Short-Circuit Analysis. A short-circuit study was conducted for each example system architecture to calculate fault current at pertinent locations throughout the distribution system. A system model for each example was created using SKM Systems Analysis Software.

a. The analysis begins at the utility and generator power sources.

b. Power source short-circuit contributions were estimated to establish system fault current values. The following short-circuit scenarios were used to develop the calculation model:

(1) Commercial utility power source – infinite bus contribution to establish distribution equipment short-circuit ratings in absence of actual data.

(2) Commercial utility power source – Maximum/Minimum contribution to establish a realistic estimate for utility short-circuit contribution in absence of actual utility data. The max/min scenarios are required to facilitate system arc flash risk assessment. The selection of max/min values must be part of the design analysis to validate distribution system capabilities. The examples use following max/min values:

(a) Minimum: 100 MVA power source available short-circuit contribution

(b) Maximum: 500 MVA power source available short-circuit contribution.

(3) Generator power source.

c. The examples are not fully developed power designs and include minimum feeder circuit impedance conditions.

5. Protective Device Coordination Analysis. The protective device coordination study determines protective device settings in order to provide an optimal compromise between protection and selectivity. The illustrative examples use Schneider Electric power distribution equipment.

Using the appropriate maximum/minimum fault currents, the time-current coordination curves were plotted as operating time versus current magnitudes to show protective device tripping and/or clearing characteristics and coordination among these devices.

To achieve the optimum protection and selectivity, the following guidelines were followed:

a. Ideally, the settings of any overcurrent device should be high enough to permit the continuous full-load operating capacity of the conductors and the equipment they supply, and to ride through system temporary disturbances such as in-rush current. On the other hand, the settings should be low enough to provide overload and short-circuit protection under minimum fault conditions.

b. Considering any two protection devices in series:

(1) Devices connected in series do not coordinate in the instantaneous tripping region unless there is sufficient impedance between the devices.

(2) In case involving redundant protective devices, non-selective circuit breaker operation is of little or no concern. Protective devices are redundant if, regardless of which device opens, the same system outage occurs. In general, in order to improve overall system protection and coordination, redundant devices are intentionally set to overlap one another.

c. Considering devices in series with overlap in the instantaneous region:

(1) Breaker-to-breaker selective coordination evaluation is based upon Schneider Electric circuit breaker combination data published in Data Bulletin 0100DB0501, Short Circuit Selective Coordination for Low Voltage Circuit breakers, 11/2016.

d. Critical Bus selective coordination at critical panelboards.

(1) Critical panelboard main and upstream feeder devices shall be mission critical J-frame and L-frame devices with micrologic 5.2/3 trip units. Selective coordination with the downstream branch circuit breaker device is per Schneider Electric circuit breaker combination data published in Data Bulletin 0100DB0501, Short Circuit Selective Coordination for Low Voltage Circuit breakers, 11/2016, Appendix A, J- and L-Frame Mission Critical Breakers used on downstream circuit breakers.

6. Power Distribution System Hierarchy. The protection system includes both 480V and 208V distribution elements organized by following subsystem distribution groups:

a. Commercial Utility Service Entrance Equipment

b. Generator Power Bus

c. Building Service (Normal) Power Bus

d. Essential Power Bus

e. Critical Power Bus

f. Fire Life Safety (FLS) Power Bus.

The illustration in Figure G-1 depicts a generic 480V CPDS Type 2 power bus layout example. A simplified power diagram is included with each coordination example to illustrate the basic system architecture and circuit layout used for the development of system protection schemes and coordination plots.

7. System Coordination Requirements. The distribution system must be designed to maximize system coordination to the extent practical. The designer must strive to achieve coordination objectives for protection of people and equipment and ensure continuity of power service to facility loads.

System-level selective coordination requirements:

a. Commercial Utility Service Equipment.

(1) The main service disconnecting means must selectively coordinate with downstream normal/essential/FLS power subsystem feeder protective devices.

b. Generator Power Bus:

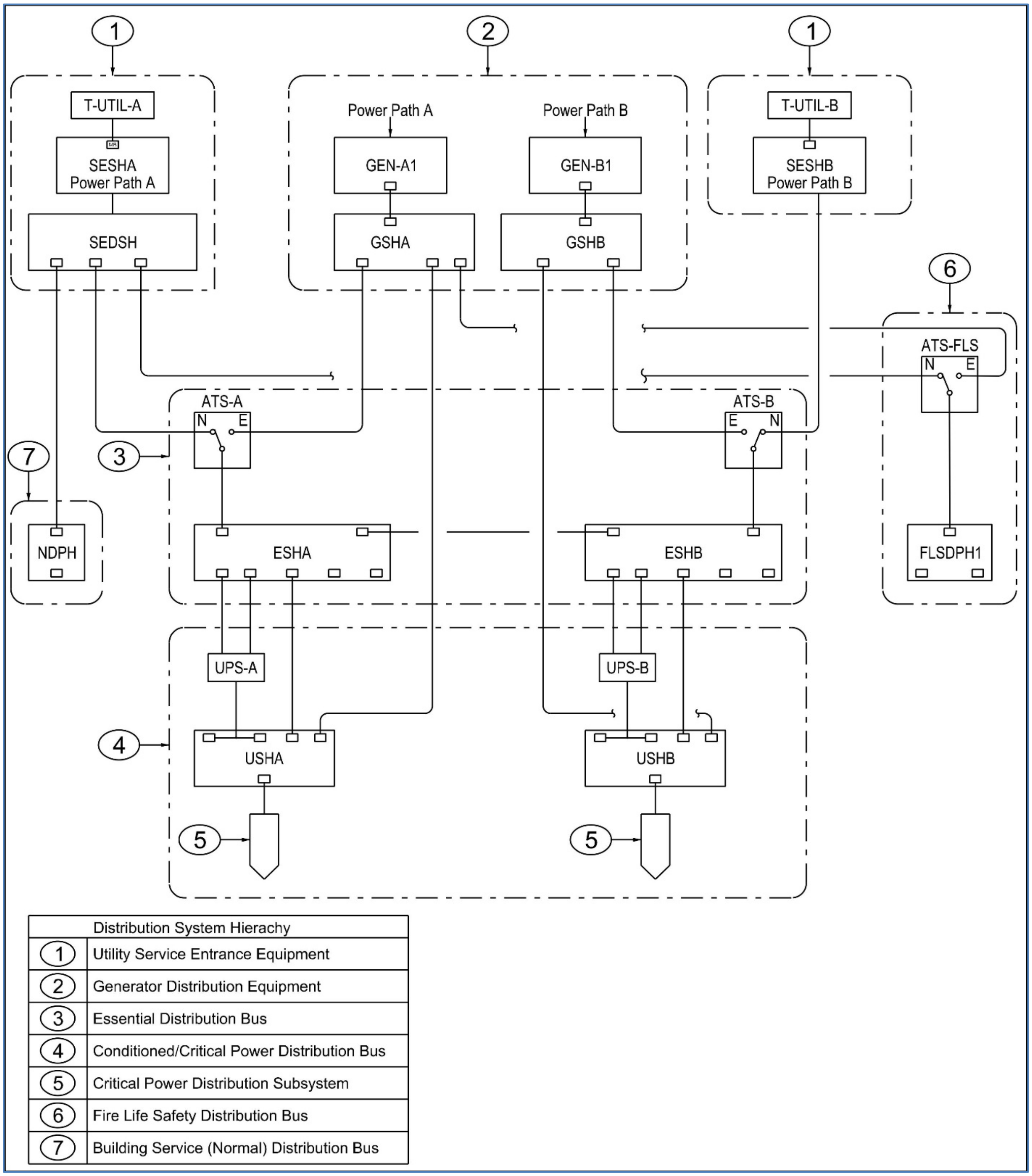
(2) The supply side protective devices must selectively coordinate with downstream essential/FLS power subsystem feeder protective devices.

c. Building Service (Normal) Power Bus.

(1) The subsystem supply side feeder protection device(s) must selectively coordinate with upstream power source equipment to ensure continuity of service to the essential/FLS/critical subsystem power loads.

(2) Branch distribution loads should be selectively coordinated to extent practical.

Figure G-1: CPDS Power System Hierarchy



d. Essential Power Bus.

(1) The subsystem supply side feeder protection device(s) must selectively coordinate with upstream power source equipment to ensure continuity of service to FLS/critical subsystem power loads.

(a) Maintenance Tie Circuits: Coordination of redundant power systems must coordinate to a level such that a fault on path A, of a redundant distribution system, will not disrupt or cause loss of service continuity to path B distribution system.

(2) Conditioned/critical bus subsystem distribution paths must selectively coordinate with the essential bus upstream feeder protective devices.

(3) Facility essential power distribution must selectively coordinate for following special conditions to ensure power service continuity:

(a) Unmanned NAS Facilities

(b) Facility power branch circuits to equipment that directly controls the landing of aircraft.

(4) Other facility essential branch panelboard loads must selectively coordinate to extent practical.

e. FLS Power Bus.

(1) The subsystem supply side feeder protection device(s) must selectively coordinate with the upstream power source equipment to ensure continuity of service to essential/critical subsystem power loads.

(2) Distribution and branch panelboard loads must be selectively coordinated in accordance with NEC requirements.

f. Critical Power Bus.

(1) The subsystem supply side feeder protection device(s) must selectively coordinate with the upstream essential power system loads.

(2) The critical branch panelboard main and upstream feeder protective device must selectively coordinate with downstream branch circuit breaker devices.

(3) Coordination of redundant maintenance power paths must coordinate to a level such that a fault on path A, of a redundant distribution system, will not disrupt or cause loss of service continuity to path B distribution system.

8. Critical Bus Protection System. The critical bus was selected to illustrate the selective coordination procedures. Figure G-2 depicts a generic CPDS type 2 critical bus configuration. The subsystem is characterized by transformation and switching equipment, feeders, branch circuit loads, and redundant circuit connections.

a. Designated protection layers depict circuit elements that must be selectively coordinated with upstream and downstream protection devices.

b. The protection layers, starting from the load to power source, include:

(1) Critical branch circuit load

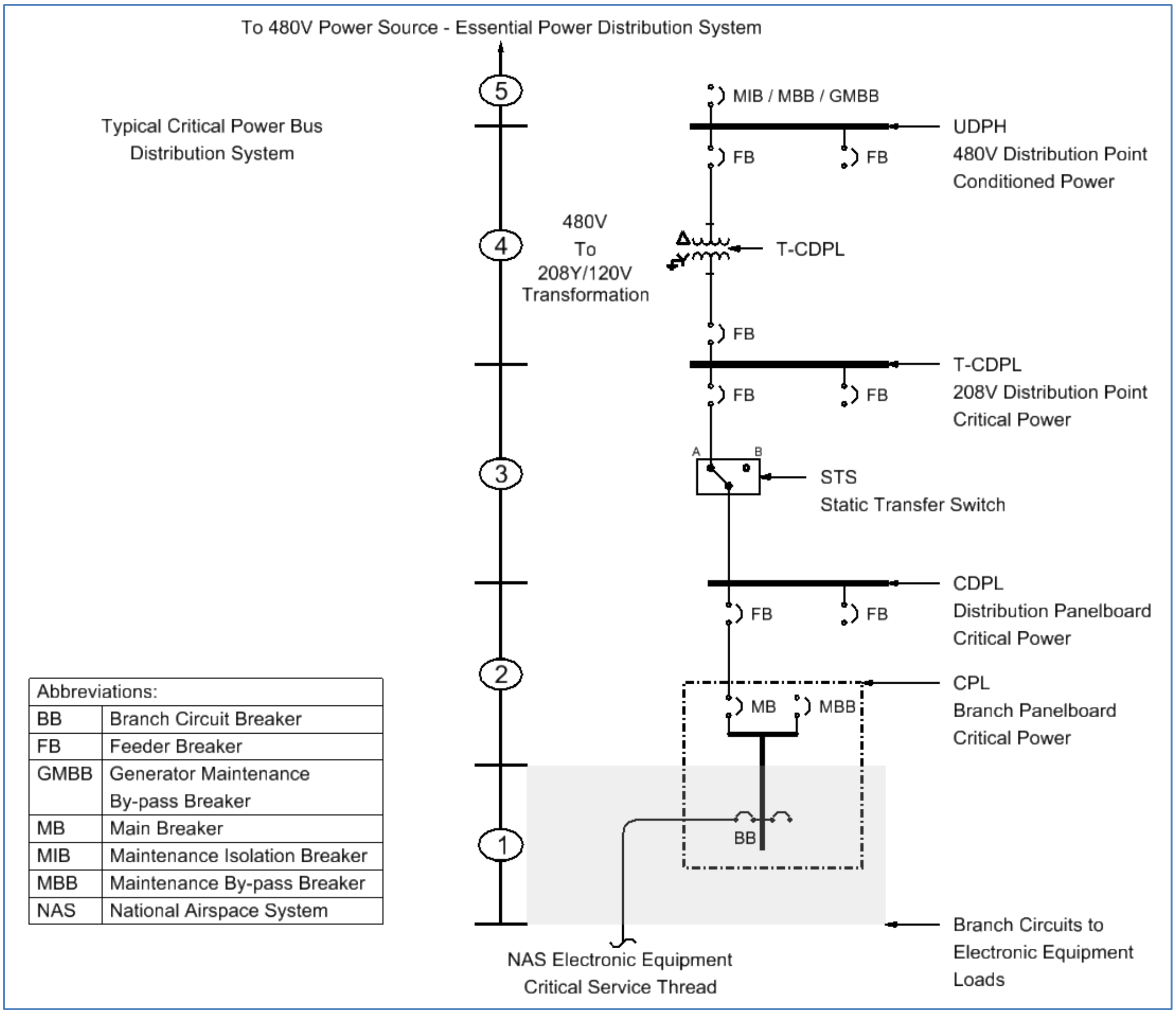
(2) Feed circuit supplying the branch panelboard

(3) Feeder circuit supplying the static transfer switch (STS)

(4) Conditioned power subsystem with 480V to 208Y/120V transformation

(5) 480V conditioned power source distribution point.

Figure G-2: Device Coordination Levels



9. Time-Current Characteristic Plots. An index listing of time-current characteristic (TCC) plots for the coordination examples is shown in Table G-2.

Table G-2: TCC Plots Index

No.	Power Distribution Type	TCC Plot Descriptions
1	208V Radial	• TCC-1, UPL to EDP (Utility Power) • TCC-2, EDP to T-UTIL • TCC-3, EDP to GEN • TCC-4, UPL to EDP (E/G Power)
2	480V Radial	• TCC-1, UPL to UDPH (Utility Power) • TCC-2, UDPH to EDPH (Utility Power) • TCC-3, EDPH to T-UTIL • TCC-4, EDPH to GEN • TCC-5, UDPH to EDPH (E/G Power) • TCC-6, UPL to UDPH (E/G Power)
3	480V CPDS Type Basic	• TCC-1, CPL1 to UPH (Utility Power) • TCC-2, UPH to ESH (Utility Power) • TCC-3, ESH to T-UTIL • TCC-4, ESH to GEN • TCC-5, UPH to ESH (E/G Power) • TCC-6, CPL1 to UPH (E/G Power)
4	480V CPDS Type 1	• TCC-1, CPL1 to USHA (Utility Power) • TCC-2, USHA to ESHA (Utility Power) • TCC-3, ESHA to T-UTIL • TCC-4, ESH to GEN • TCC-5, USHA to ESHA (E/G Power) • TCC-6, CPL1 to USHA (E/G Power)
5	480V CPDS Type 2	• TCC-1, CPL1 to USHA (Utility Power) • TCC-2, USHA to ESHA (Utility Power) • TCC-3, ESHA to T-UTIL • TCC-4, ESH to GEN • TCC-5, USHA to ESHA (E/G Power) • TCC-6, CPL1 to USHA (E/G Power)

10. Coordination Example – 208V Radial. System configuration includes following power distribution elements:

a. Power distribution paths:

(1) Commercial utility bus

(2) Generator power source

(3) Essential bus

(4) Normal bus

(5) Conditioned bus.

b. System power distribution buses:

(1) SEDP: commercial utility service disconnecting means

(2) MDP: facility main normal power distribution point

(3) EDP: facility essential power distribution point

(4) UPS-MBP: conditioned power bus, supplied from uninterruptible power source

(5) UDPL: conditioned power distribution point

(6) UPL: conditioned power branch circuit panelboard.

c. Power sources:

(1) T-UTIL: commercial utility transformer:

(a) Voltage classification: 13.8kV primary to 208Y/120V secondary, 60 Hz

(b) Rating: 225kVA, 5.75% nominal impedance

(c) Type: oil/air cooled, pad mounted.

(2) GEN: standby diesel-engine generator:

(a) Voltage classification: 208Y/120V, 60 Hz

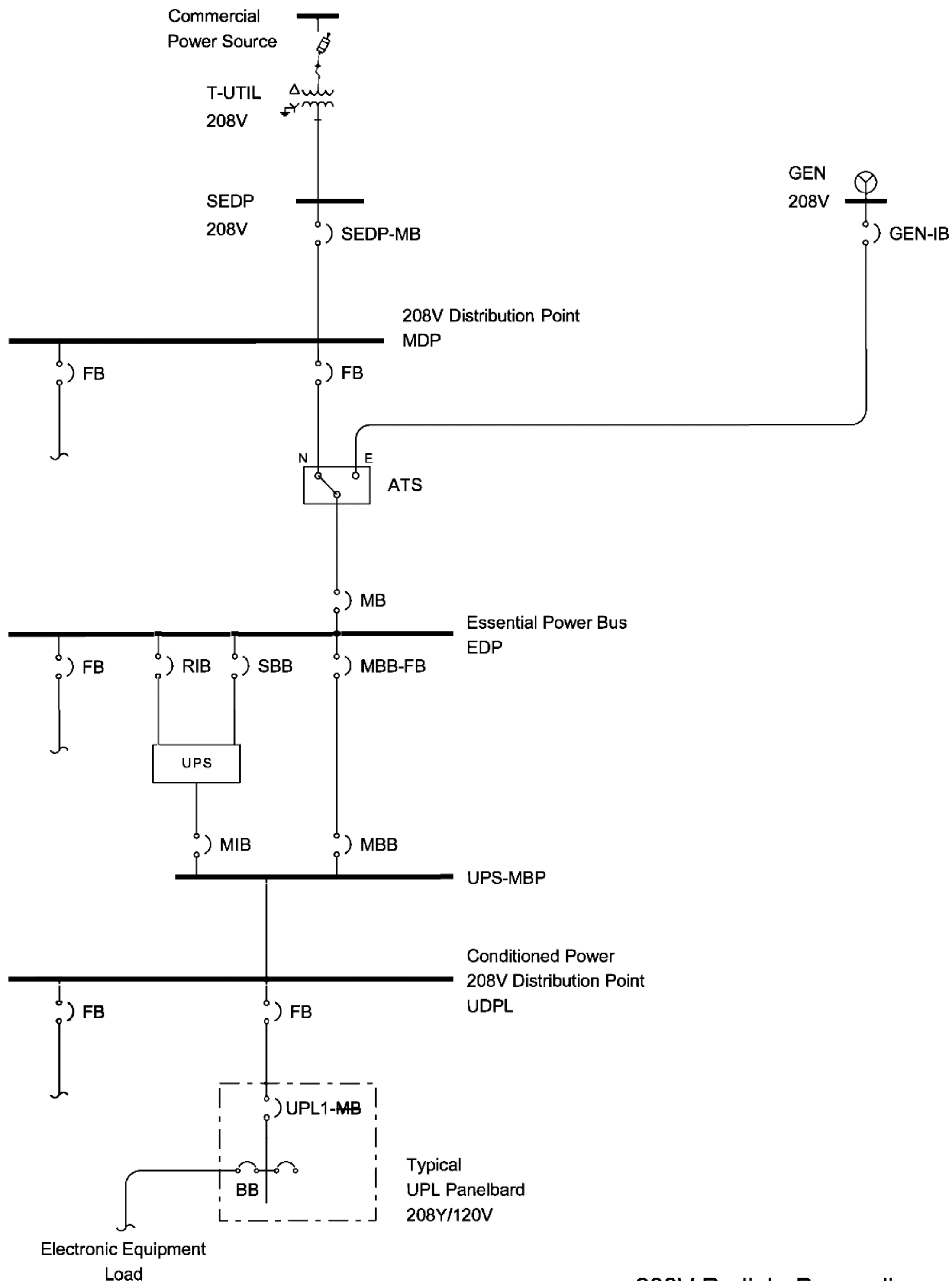
(b) Rating: 150kW, 0.8 power factor.

(3) UPS: uninterruptible power source.

d. Power transfer switches:

(1) ATS: automatic transfer switch.

208V Radial Power Diagram



208V Radial - Power diagram

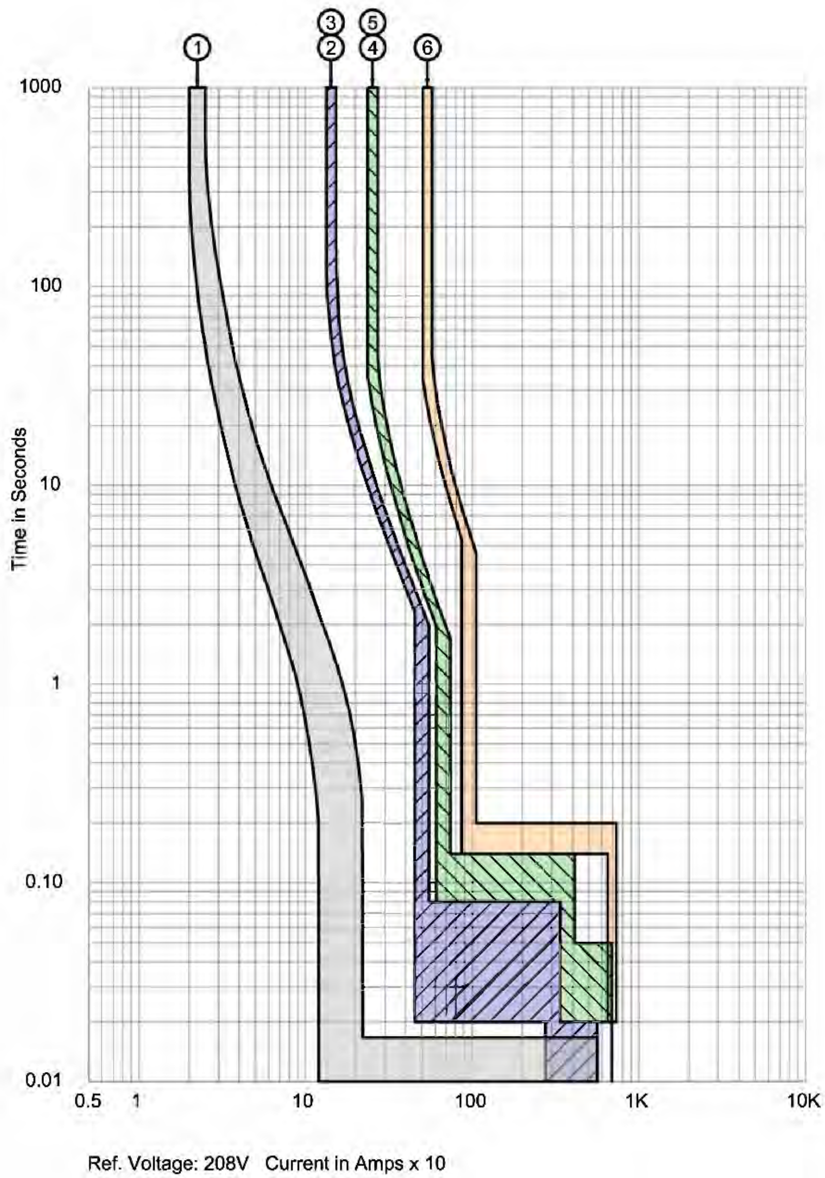
208V Radial TCC-1 Plot

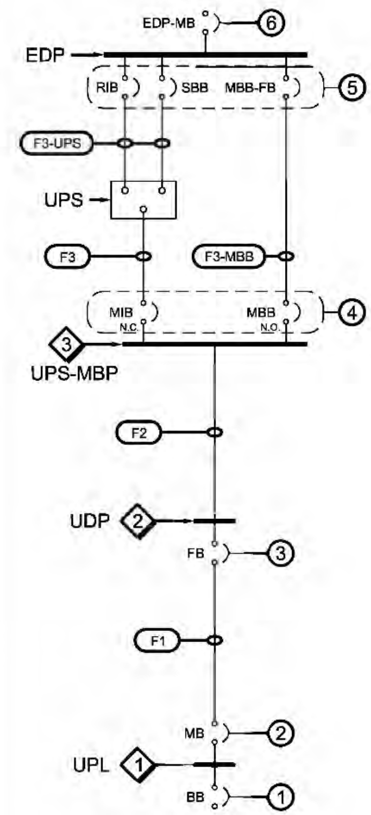
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 2, STD = 0.2 (I^s T Off)
		INST = 12
5	RIB	PG, 250A Sensor, ML5.0 LSI
	SBB	LTPU (A) = 0.9, LTD = 0.5
	MBB-FB	STPU = 3, STD = 0.1 (I^s T Off)
		INST = 15
4	MBB	PG, 250A Sensor, ML5.0 LSI
	MIB	LTPU (A) = 0.9, LTD = 0.5
		STPU = 3, STD = 0.0 (I^s T Off)
		INST = 15
3	UPL-FB	JD, 250A Sensor, ML5.2 LSI
2	UPL-MB	Mission Critical Series
		LTPU (A) = 125A, LTD = 1
		STPU = 4, STD = 0.0 (I^s T Off)
		INST = 12
1	UPL-BB	QO, 20A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
3	UPS-MBP	Isc 3P RMS Sym (kA)	6.73	6.86	-
	I-Line Dist Panelboard	Iarc fault (kA)	2.98	3.04	-
	208Y/120V	Energy (Cal/cm-sq)	0.94	0.96	-
	400A Min. Bus Rating				
2	UDP	Isc 3P RMS Sym (kA)	6.36	6.47	-
	I-Line Dist Panelboard	Iarc fault (kA)	2.80	2.85	-
	208Y/120V	Energy (Cal/cm-sq)	0.88	0.89	-
	400A Min. Bus Rating				
1	UPL	Isc 3P RMS Sym (kA)	5.54	5.61	-
	NQOB Panelboard	Iarc fault (kA)	2.40	2.44	-
	208Y/120V	Energy (Cal/cm-sq)	0.43	0.43	-
	125A Min. Bus Rating				





208V Radial: TCC-1

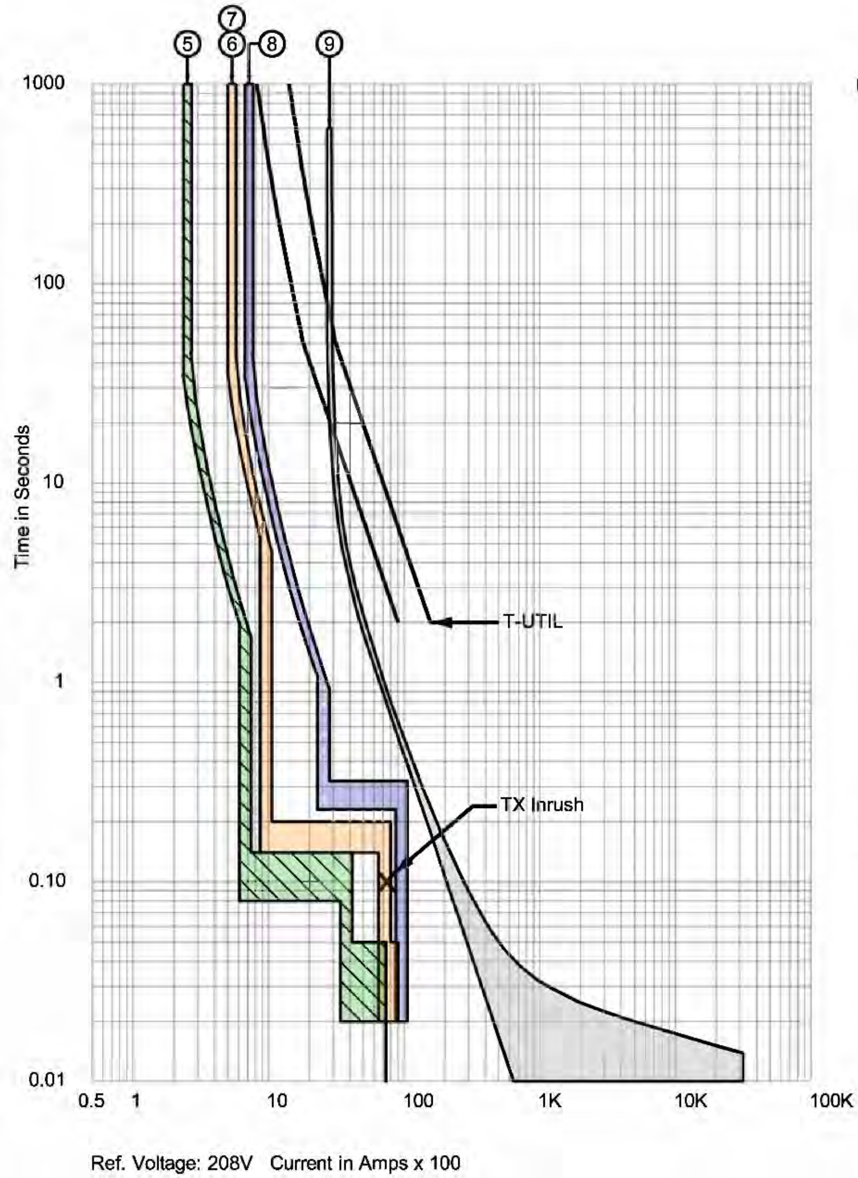
208V Radial TCC-2 Plot

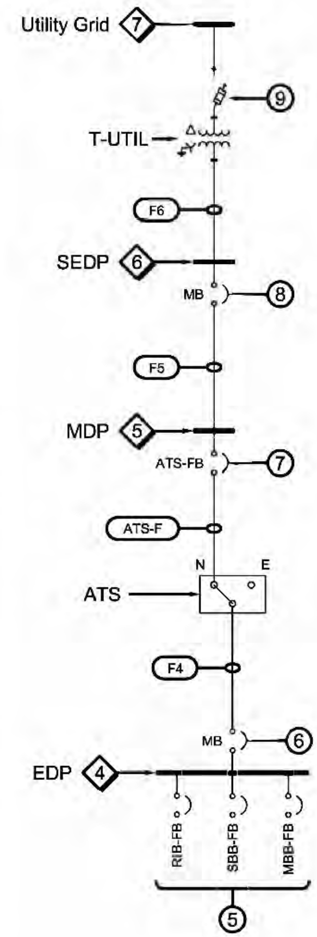
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
9	T-UTIL-F	14.4 kV, E-Rated Fuse
		Type: S&C, SM-4, 3E-200E
		Standard Speed, 20A
		TCC No.: 153-4
8	SEDP-MB	PG, 800A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 12
7	ATS-FB	PG, 600A Sensor, ML5.0 LSI
6	EDP-MB	LTPU (A) = 0.8, LTD = 0.5
		STPU = 2, STD = 0.2 (I^s T Off)
		INST = 12
5	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 3, STD = 0.1 (I^s T Off)
		INST = 15

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
7	Utility Grid Connection	SCA (MVA)	100	500	-
6	SEDP	Isc 3P RMS Sym (kA)	9.15	9.39	-
	QE2 Switchboard	Iarc fault (kA)	4.15	4.27	-
	208Y/120V	Energy (Cal/cm-sq)	19.0	19.5	-
	800A Min. Bus Rating				
5	MDP	Isc 3P RMS Sym (kA)	8.72	8.93	-
	I-Line Dist. Panelboard	Iarc fault (kA)	3.94	4.04	-
	208Y/120V	Energy (Cal/cm-sq)	2.87	2.95	-
	800A Min. Bus Rating				
4	EDP	Isc 3P RMS Sym (kA)	7.15	7.29	-
	I-Line Dist. Panelboard	Iarc fault (kA)	3.18	3.25	-
	208Y/120V	Energy (Cal/cm-sq)	1.43	1.46	-
	600A Min. Bus Rating				





208V Radial: TCC-2

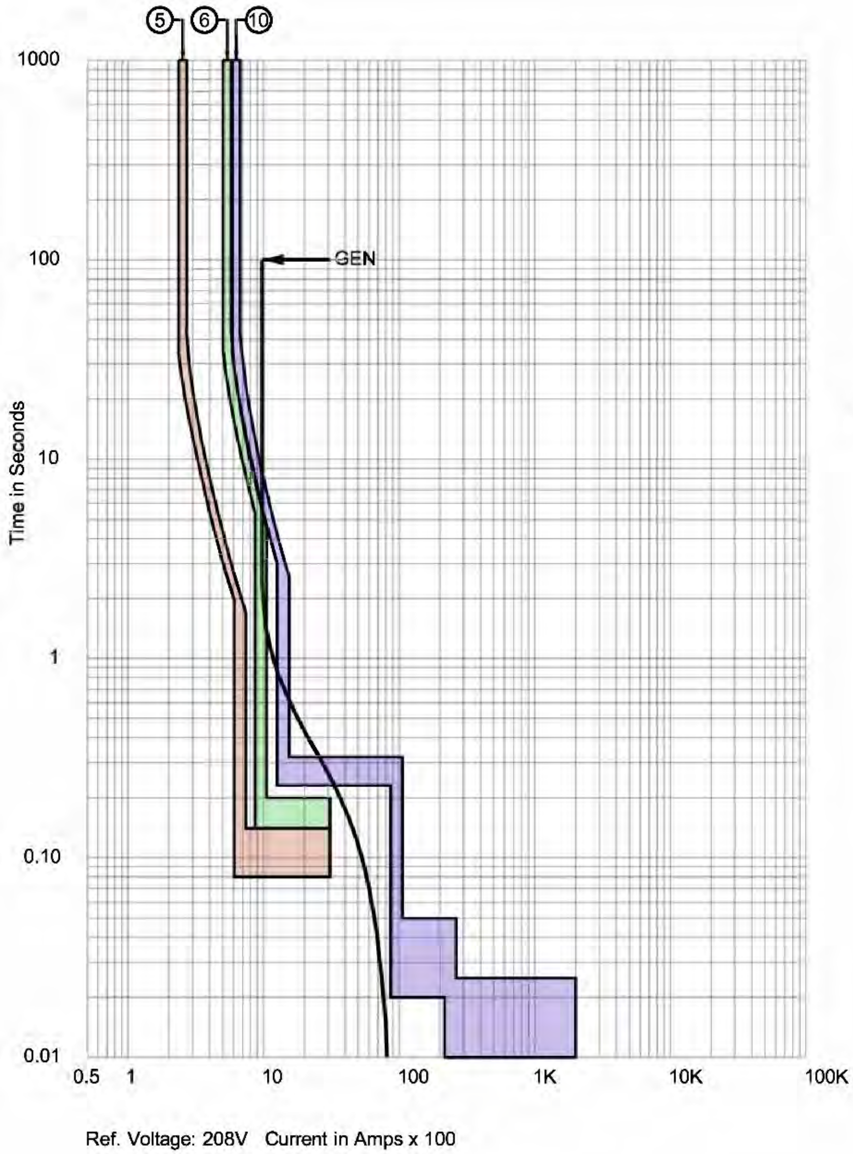
208V Radial TCC-3 Plot

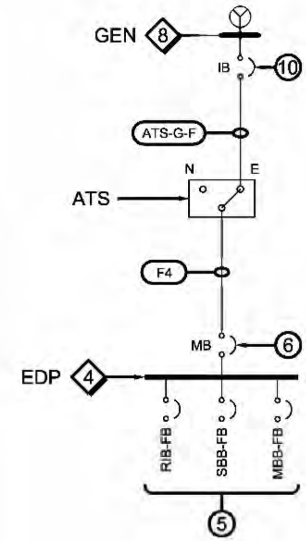
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
10	GEN-IB	PG, 800A Sensor, ML5.0 LSI
		LTPU (A) = 0.7, LTD = 0.5
		STPU = 2.5, STD = 0.3 (I^s T Off)
		INST = 12
6	EDP-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 2, STD = 0.2 (I^s T Off)
		INST = 15
5	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 3, STD = 0.1 (I^s T Off)
		INST = 15

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
8	Generator Output	Isc 3P RMS Sym (kA)	-	-	3.46
4	EDP	Isc 3P RMS Sym (kA)	-	-	3.10
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	1.28
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.55
	600A Min. Bus Rating				





208V Radial: TCC-3

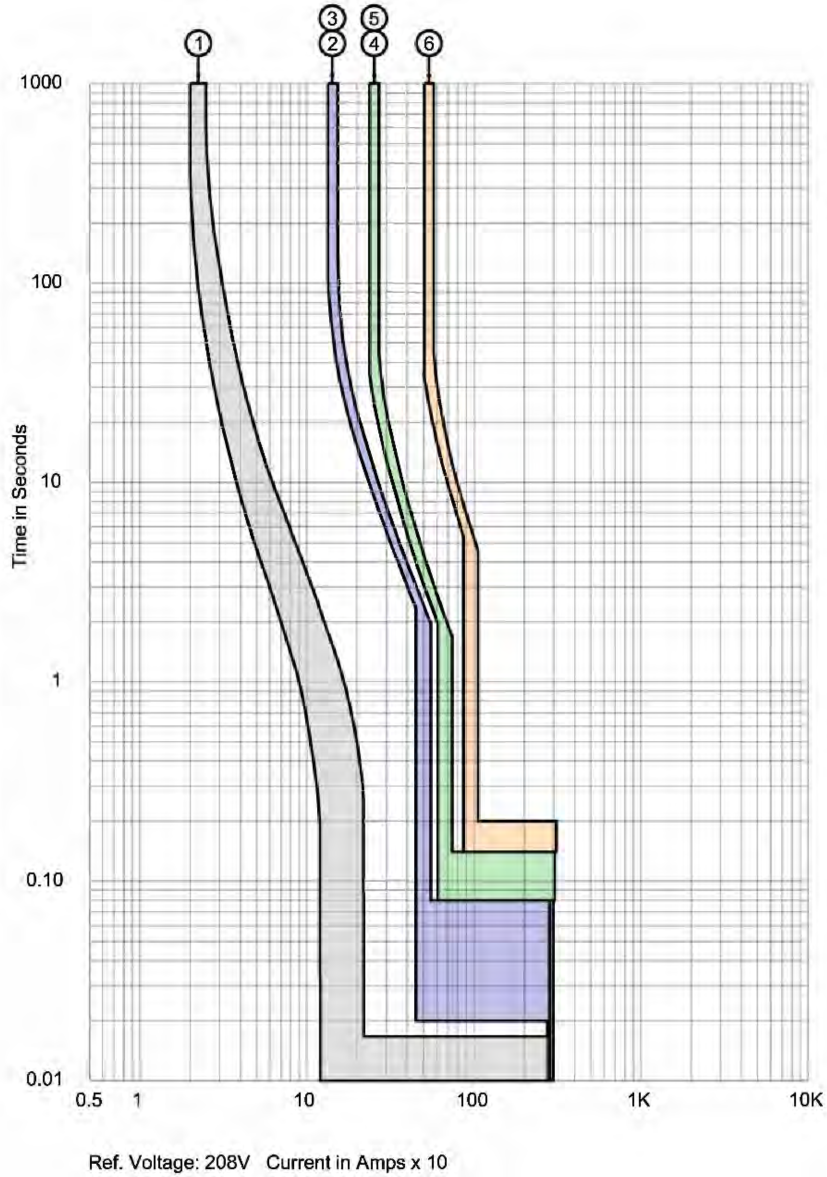
208V Radial TCC-4 Plot

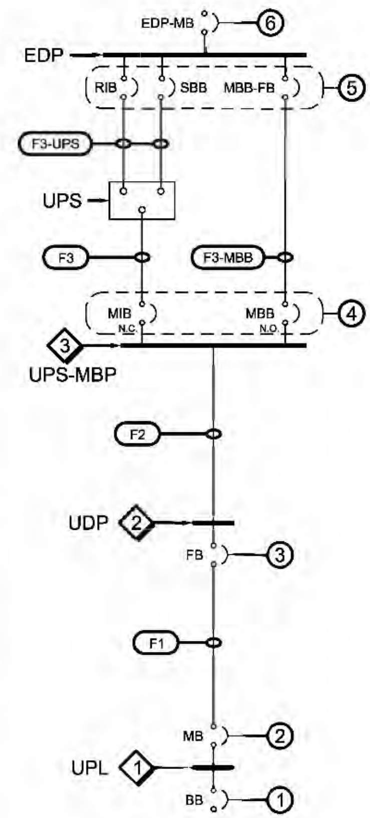
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	EDP-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 2, STD = 0.2 (I^s T Off)
		INST = 12
5	RIB	PG, 250A Sensor, ML5.0 LSI
	SBB	LTPU (A) = 0.9, LTD = 0.5
	MBB-FB	STPU = 3, STD = 0.1 (I^s T Off)
		INST = 15
4	MBB	PG, 250A Sensor, ML5.0 LSI
	MIB	LTPU (A) = 0.9, LTD = 0.5
		STPU = 3, STD = 0.0 (I^s T Off)
		INST = 15
3	UPL-FB	JD, 250A Sensor, ML5.2 LSI
2	UPL-MB	Mission Critical Series
		LTPU (A) = 125A, LTD = 1
		STPU = 4, STD = 0.0 (I^s T Off)
		INST = 12
1	UPL-BB	QO, 20A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
3	UPS-MBP	Isc 3P RMS Sym (kA)	-	-	3.04
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	1.25
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.37
	400A Min. Bus Rating				
2	UDP	Isc 3P RMS Sym (kA)	-	-	2.97
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	1.22
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.37
	400A Min. Bus Rating				
1	UPL	Isc 3P RMS Sym (kA)	-	-	2.83
	NQOB Panelboard	Iarc fault (kA)	-	-	1.16
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.20
	125A Min. Bus Rating				





208V Radial: TCC-4

11. Coordination Example – 480V Radial. System configuration includes following power distribution elements:

a. Power distribution paths:

(1) Commercial utility bus

(2) Generator bus

(3) Essential bus

(4) Normal bus

(5) Conditioned bus

(6) Fire life safety (FLS) bus.

b. System power distribution buses:

(1) SESH: commercial utility service disconnecting means

(2) SEDPH: facility main 480V normal power distribution point

(3) EDPH: 480V essential power distribution point

(4) GDPH: 480V generator power distribution point

(5) NDPH: 480V normal power distribution point

(6) UPS-MBP: 480V conditioned power source

(7) UDPH: 480V conditioned power distribution point

(8) UDPL: 208V conditioned power distribution point

(9) UPL: 208Y/120V conditioned power branch circuit panelboard.

c. Power sources:

(1) T-UTIL: commercial utility transformer:

(a) Voltage classification: 13.8kV primary to 480Y/277V secondary, 60 Hz

(b) Rating: 500kVA, 5.75% nominal impedance

(c) Type: oil/air cooled, pad mounted.

(2) GEN: standby diesel-engine generator:

(a) Voltage classification: 480Y/120V, 60 Hz

(b) Rating: 375kW, 0.8 power factor.

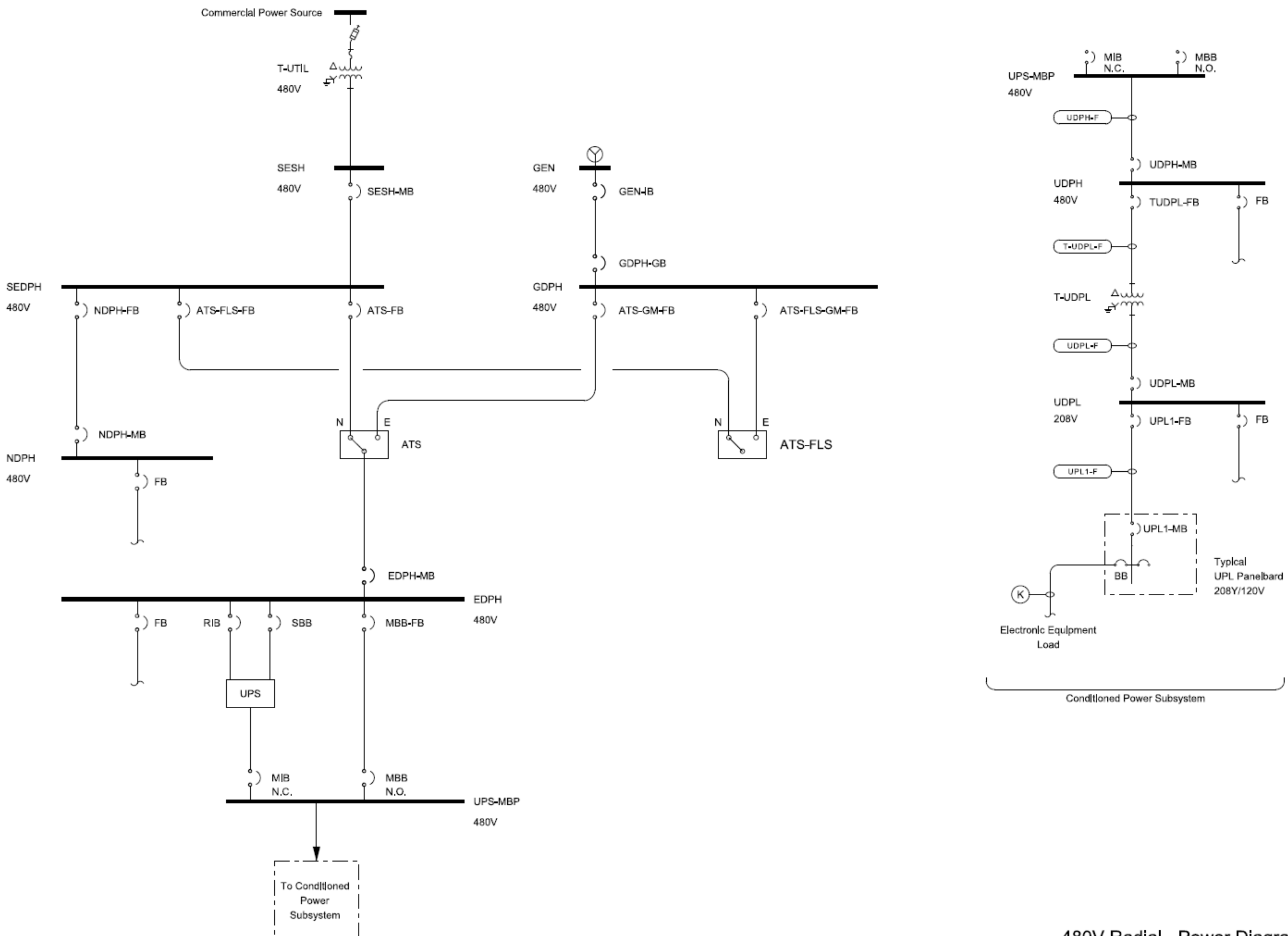
(3) UPS: uninterruptible power source.

d. Power transfer switches:

(1) ATS: essential power automatic transfer switch

(2) ATS-FLS: fire life safety automatic transfer switch.

480V Radial Power Diagram



480V Radial - Power Diagram

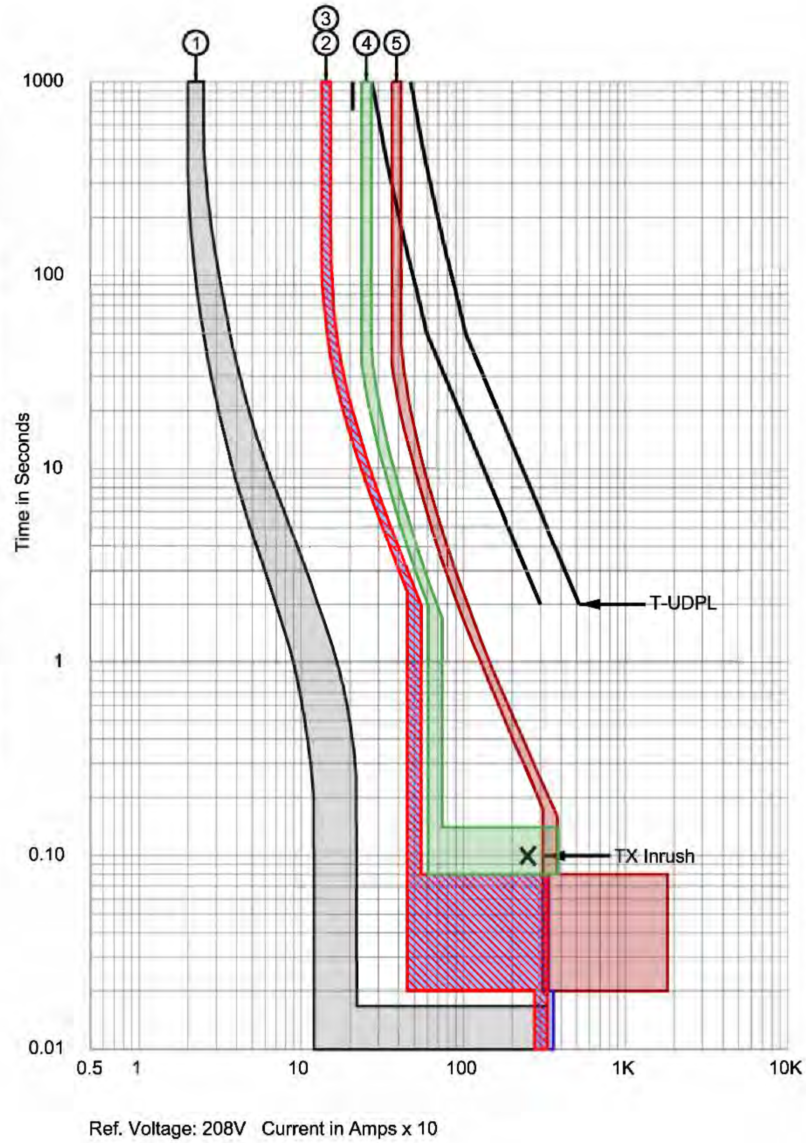
480V Radial TCC-1 Plot

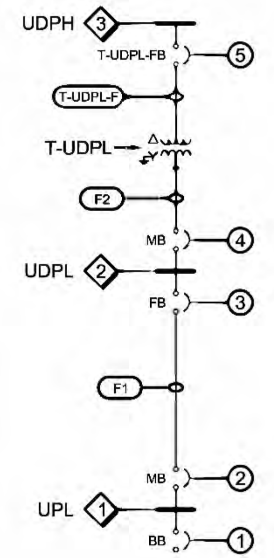
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
5	T-UDPL-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^s T Off)
		INST = OFF
4	UDPL-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 3, STD = 0.1 (I^s T Off)
		INST = OFF
3	UPL-FB	JD, 250A Sensor, ML5.2 LSI
2	UPL-MB	Mission Critical Series
		LTPU (A) = 125A, LTD = 1
		STPU = 4, STD = 0.0 (I^s T Off)
		INST = 12
1	UPL-BB	QO, 20A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
3	UDPH	Isc 3P RMS Sym (kA)	7.87	8.28	-
	I-Line Dist Panelboard	Iarc fault (kA)	5.95	6.28	-
	208Y/120V	Energy (Cal/cm-sq)	0.66	0.70	-
	600A Min. Bus Rating				
2	UDPL	Isc 3P RMS Sym (kA)	3.87	3.90	-
	I-Line Dist Panelboard	Iarc fault (kA)	1.62	1.64	-
	208Y/120V	Energy (Cal/cm-sq)	0.49	0.50	-
	400A Min. Bus Rating				
1	UPL	Isc 3P RMS Sym (kA)	3.52	3.55	-
	NQOB Panelboard	Iarc fault (kA)	1.47	1.48	-
	208Y/120V	Energy (Cal/cm-sq)	0.25	0.26	-
	125A Min. Bus Rating				





480V Radial: TCC-1

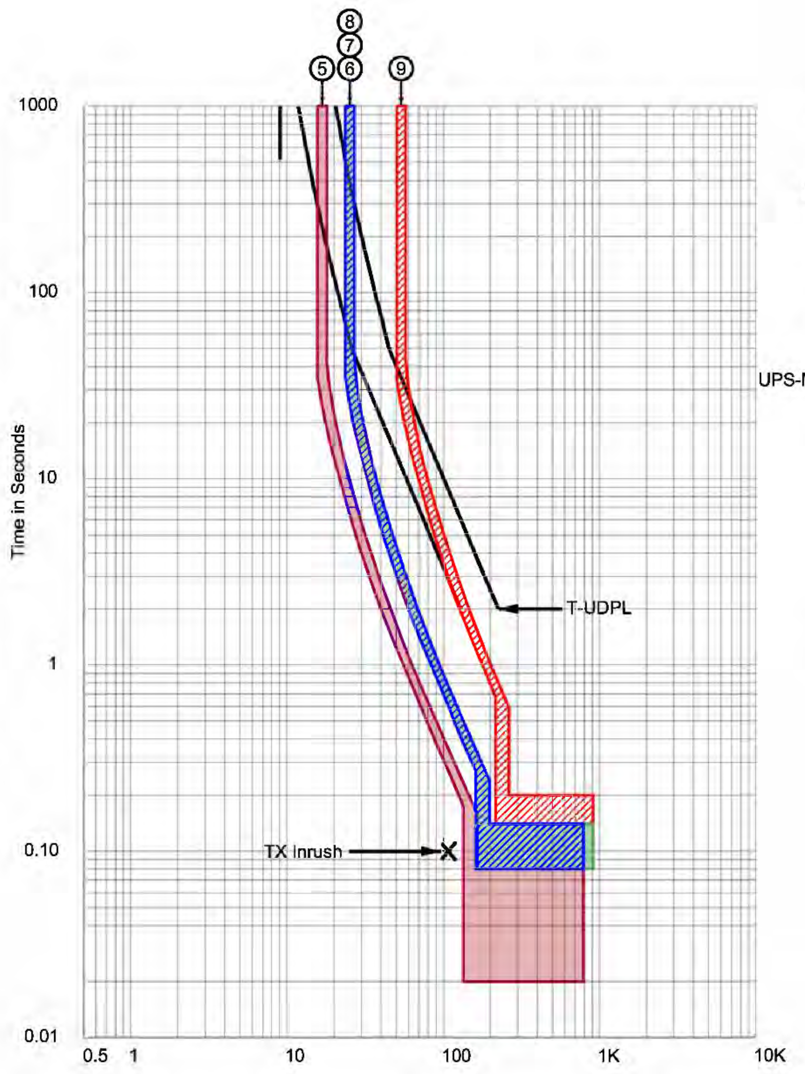
480V Radial TCC-2 Plot

TCC Device

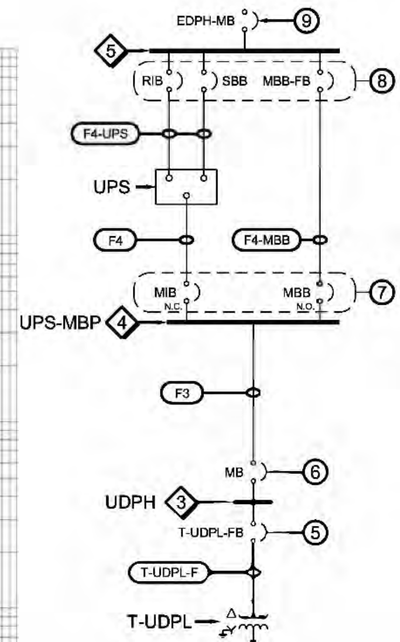
No.	Device Name	Device Type / Trip Unit Settings
9	EDPH-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
7	UPS-MBP-MIB	PG, 250A Sensor, ML5.0 LSI
	UPS-MBP-MBB	LTPU (A) = 0.9, LTD = 0.5
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
6	UDPH-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
5	T-UDPL-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	EDPH	Isc 3P RMS Sym (kA)	9.06	9.63	-
	I-Line Dist. Panelboard	Iarc fault (kA)	6.89	7.35	-
	480V	Energy (Cal/cm-sq)	0.77	0.82	-
	600A Min. Bus Rating				
4	UPS-MBP	Isc 3P RMS Sym (kA)	8.79	9.32	-
	I-Line Dist. Panelboard	Iarc fault (kA)	6.68	7.11	-
	480V	Energy (Cal/cm-sq)	0.75	0,79	-
	600A Min. Bus Rating				
3	UDPH	Isc 3P RMS Sym (kA)	7.87	8.28	-
	I-Line Dist. Panelboard	Iarc fault (kA)	5.95	6.28	-
	480V	Energy (Cal/cm-sq)	0.66	0.70	-
	600A Min. Bus Rating				



Ref. Voltage: 480V Current in Amps x 10



480V Radial: TCC-2

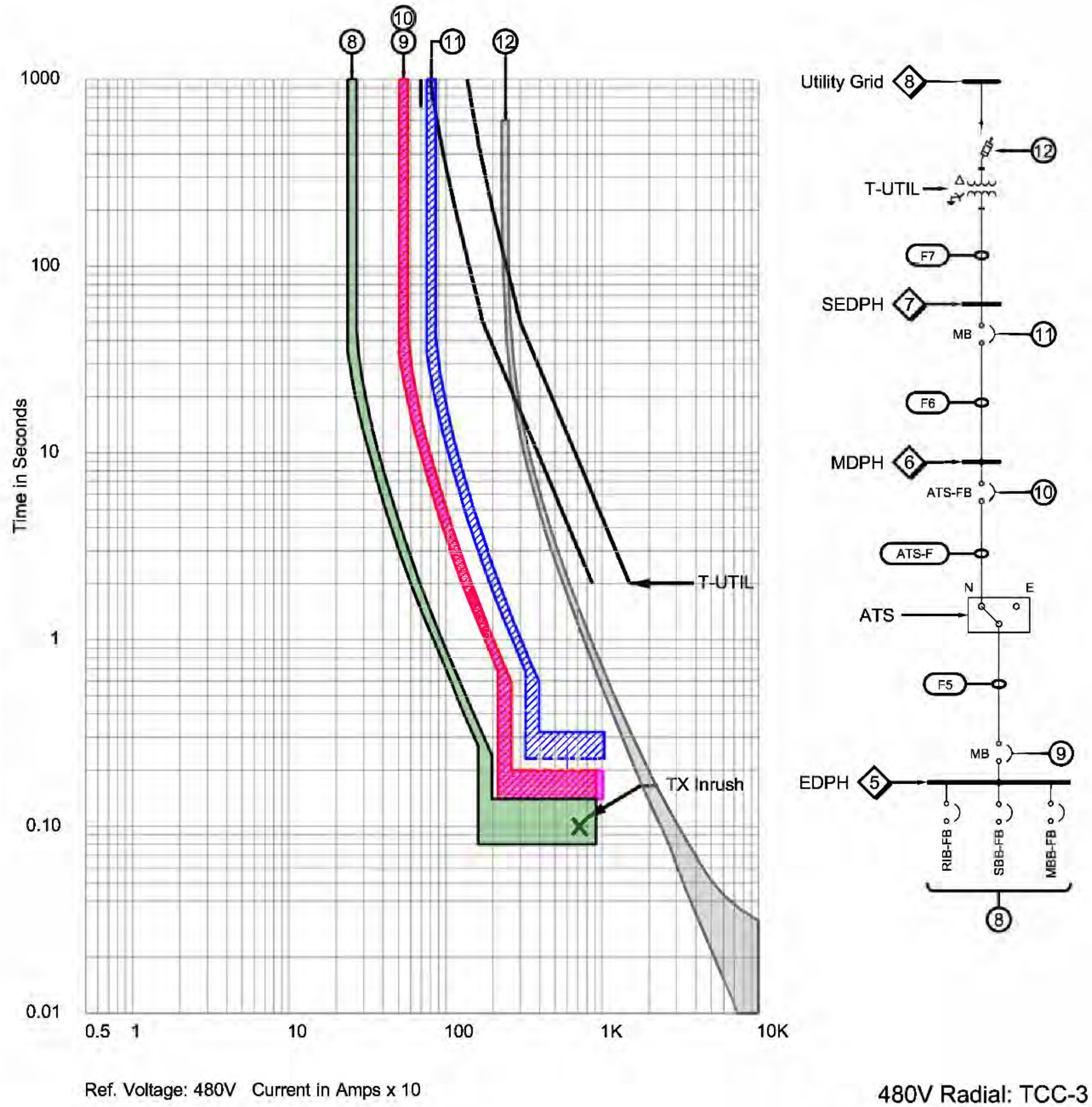
480V Radial TCC-3 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
12	T-UTIL-F	13.8 kV, E-Rated Fuse
		Type: S&C, SM-4, 15E-200E
		Slow Speed, 40A
		TCC No.: 119-4
11	SEDP-MB	PG, 800A Sensor, ML5.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 5, STD = 0.3 (I^s T Off)
		INST = 15
10	ATS-FB	PG, 600A Sensor, ML5.0 LSI
9	EDPH-MB	LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
8	Utility Grid Connection	SCA (MVA)	100	500	-
6	SEDPH	Isc 3P RMS Sym (kA)	9.93	10.62	-
	QE2 Switchboard	Iarc fault (kA)	6.65	7.13	-
	480Y/277V	Energy (Cal/cm-sq)	27.6	25.4	-
	800A Min. Bus Rating				
5	MDPH	Isc 3P RMS Sym (kA)	9.78	10.45	-
	I-Line Dist. Panelboard	Iarc fault (kA)	7.47	8.00	-
	480V	Energy (Cal/cm-sq)	2.35	2.52	-
	800A Min. Bus Rating				
5	EDPH	Isc 3P RMS Sym (kA)	9.06	9.63	-
	I-Line Dist. Panelboard	Iarc fault (kA)	6.89	7.35	-
	480V	Energy (Cal/cm-sq)	0.77	0.82	-
	600A Min. Bus Rating				



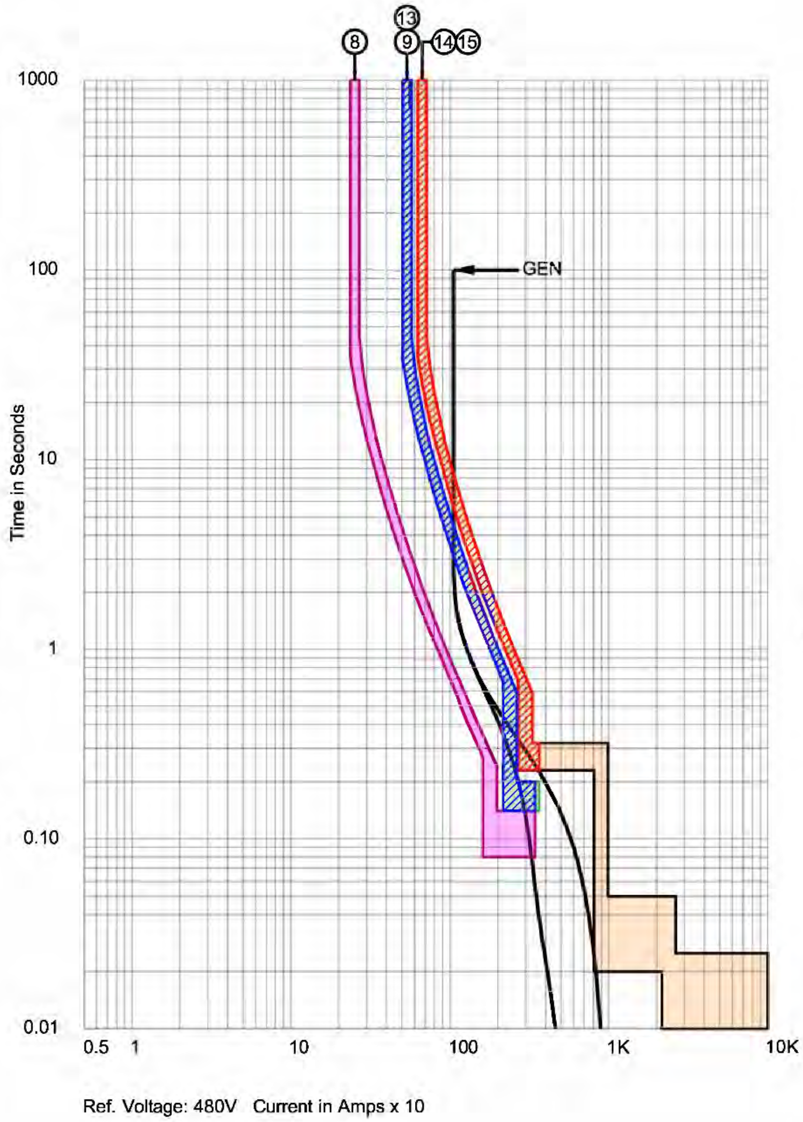
480V Radial TCC-4 Plot

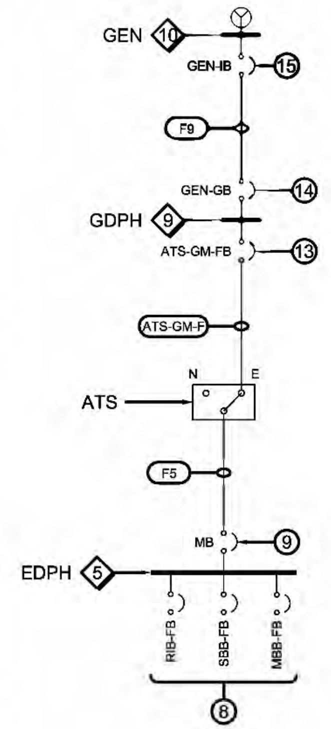
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
15	GEN-IB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 1.0, LTD = 0.5
		STPU = 5, STD = 0.3 (I^t T Off)
		INST = 15
14	GEN-GB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 1.0, LTD = 0.5
		STPU = 5, STD = 0.3 (I^t T Off)
		INST = OFF
13	ATS-GM-FB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^t T Off)
		INST = OFF
9	EDPH-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^t T Off)
		INST = OFF
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 8, STD = 0.1 (I^t T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
10	Generator Output	Isc 3P RMS Sym (kA)	-	-	3.75
9	GDPH	Isc 3P RMS Sym (kA)	-	-	3.68
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.35
	480Y/277V	Energy (Cal/cm-sq)	-	-	8.74
	800A Min. Bus Rating				
5	EDPH	Isc 3P RMS Sym (kA)	-	-	3.56
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.59
	480V	Energy (Cal/cm-sq)	-	-	0.77
	600A Min. Bus Rating				





480V Radial: TCC-4

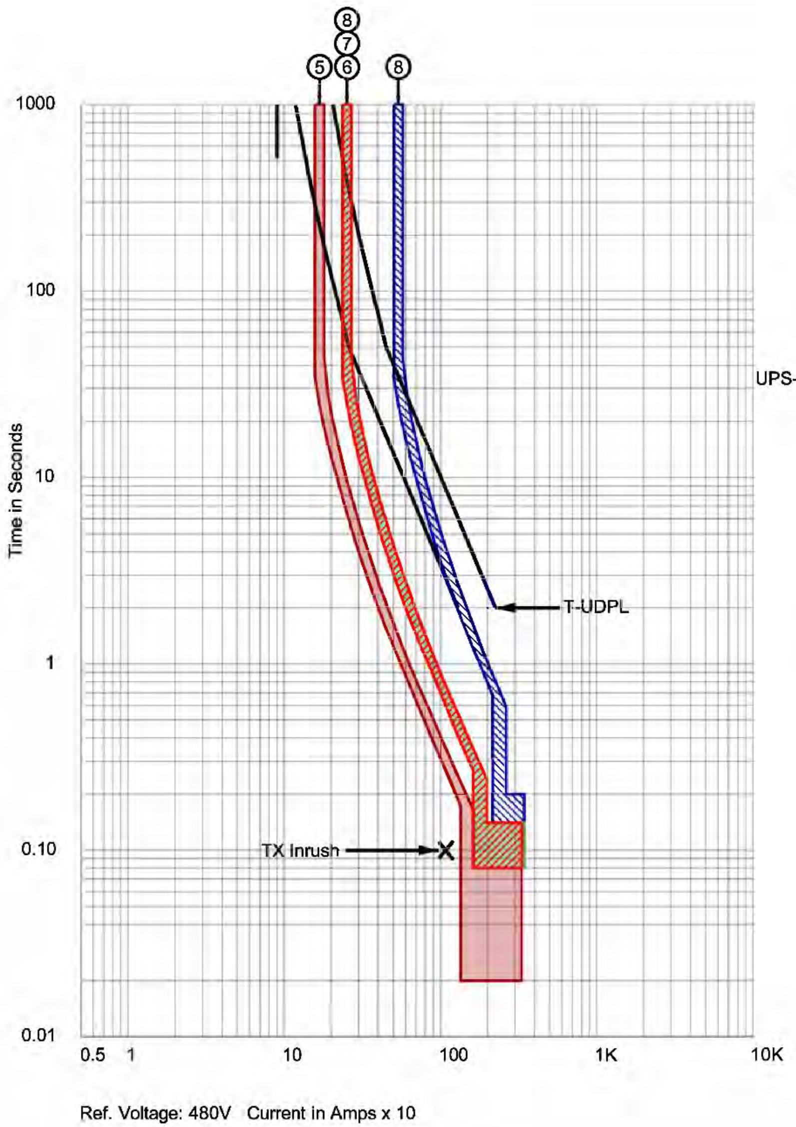
480V Radial TCC-5 Plot

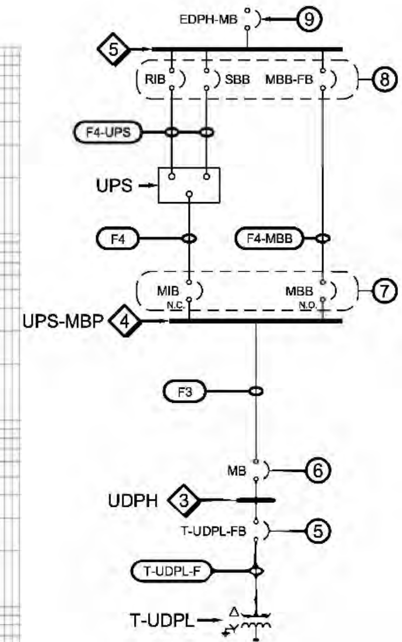
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
9	EDPH-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
7	ATS-FB	PG, 250A Sensor, ML5.0 LSI
	EDP-MB	LTPU (A) = 0.9, LTD = 0.5
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
6	UDPH-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
5	T-UDPL-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	EDPH	Isc 3P RMS Sym (kA)	-	-	3.56
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.59
	480V	Energy (Cal/cm-sq)	-	-	0.77
	600A Min. Bus Rating				
4	UPS-MBP	Isc 3P RMS Sym (kA)	-	-	3.53
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.56
	480V	Energy (Cal/cm-sq)	-	-	0.27
	600A Min. Bus Rating				
3	UDPH	Isc 3P RMS Sym (kA)	-	-	3.39
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.46
	480V	Energy (Cal/cm-sq)	-	-	0.26
	600A Min. Bus Rating				





480V Radial: TCC-5

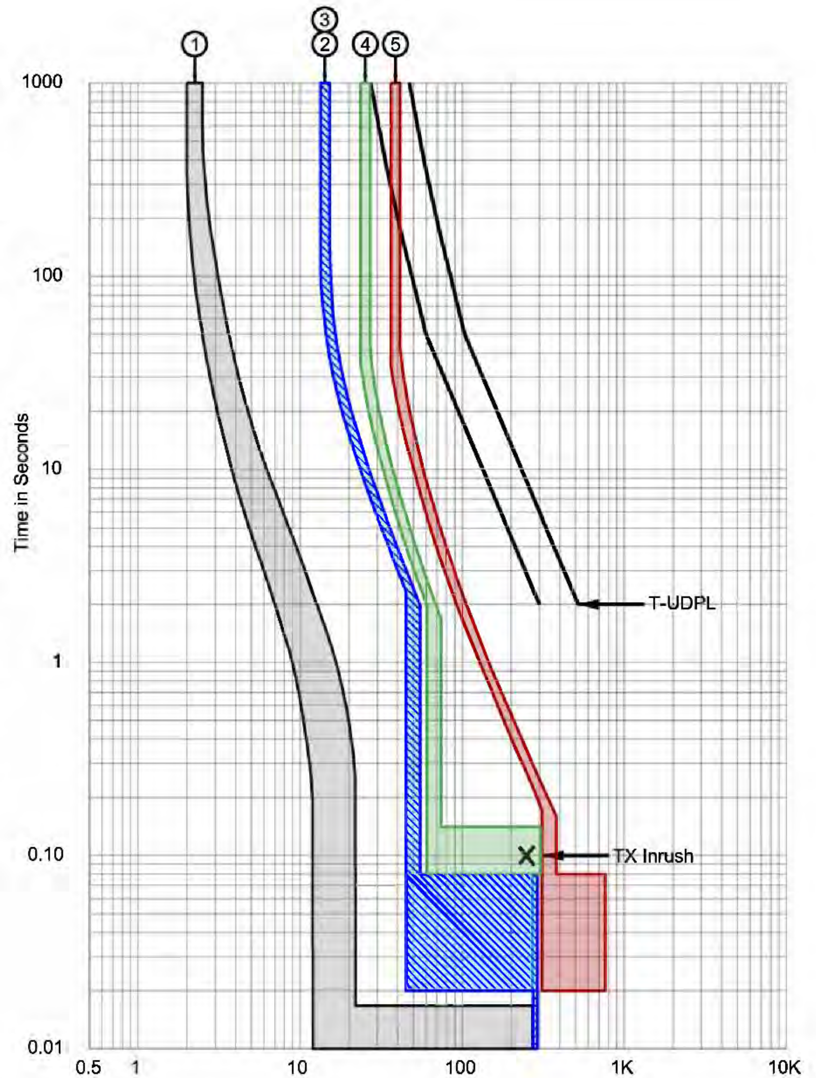
480V Radial TCC-6 Plot

TCC Device

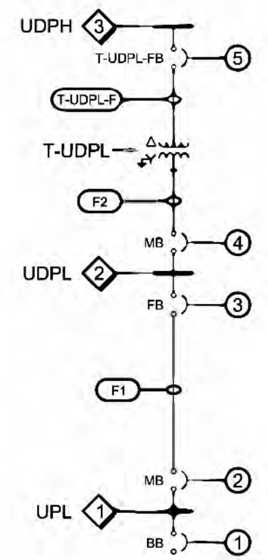
No.	Device Name	Device Type / Trip Unit Settings
5	T-UDPL-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^s T Off)
		INST = OFF
4	UDPL-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 3, STD = 0.1 (I^s T Off)
		INST = OFF
3	UPL-FB	JD, 250A Sensor, ML5.2 LSI
2	UPL-MB	Mission Critical Series
		LTPU (A) = 125A, LTD = 1
		STPU = 4, STD = 0.0 (I^s T Off)
		INST = 12
1	UPL-BB	QO, 20A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
3	UDPH	Isc 3P RMS Sym (kA)	-	-	3.39
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	2.46
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.26
	600A Min. Bus Rating				
2	UDPL	Isc 3P RMS Sym (kA)	-	-	3.11
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	1.28
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.39
	400A Min. Bus Rating				
1	UPL	Isc 3P RMS Sym (kA)	-	-	2.90
	NQOB Panelboard	Iarc fault (kA)	-	-	1.19
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.20
	125A Min. Bus Rating				



Ref. Voltage: 208V Current in Amps x 10



480V Radial: TCC-6

12. Coordination Example – 480V CPDS Type Basic. System configuration includes following power distribution elements:

a. Power distribution paths:

(1) Commercial utility bus

(2) Generator bus

(3) Essential bus

(4) Normal bus

(5) Conditioned and critical power buses

(6) Fire life safety (FLS) bus

(7) Maintenance bus.

b. System power distribution buses:

(1) SESH: commercial utility service disconnecting means

(2) SEDSH: facility main 480V normal power distribution point

(3) ESH: 480V essential power distribution point

(4) GSH: 480V generator power distribution point

(5) NDPH: 480V normal power distribution point

(6) UPS-MBP: 480V conditioned power source

(7) UPH: 480V conditioned power distribution point

(8) CDPL: 208V critical power distribution point

(9) CPL: 208Y/120V conditioned power branch circuit panelboard.

c. Power sources:

(1) T-UTIL: commercial utility transformer:

a) Voltage classification: 13.8kV primary to 480Y/277V secondary, 60 Hz
b) Rating: 500kVA, 5.75% nominal impedance
c) Type: oil/air cooled, pad mounted.

(2) GEN: standby diesel-engine generator:

a) Voltage classification: 480Y/120V, 60 Hz
b) Rating: 375kW, 0.8 power factor.

(3) UPS: uninterruptible power source.

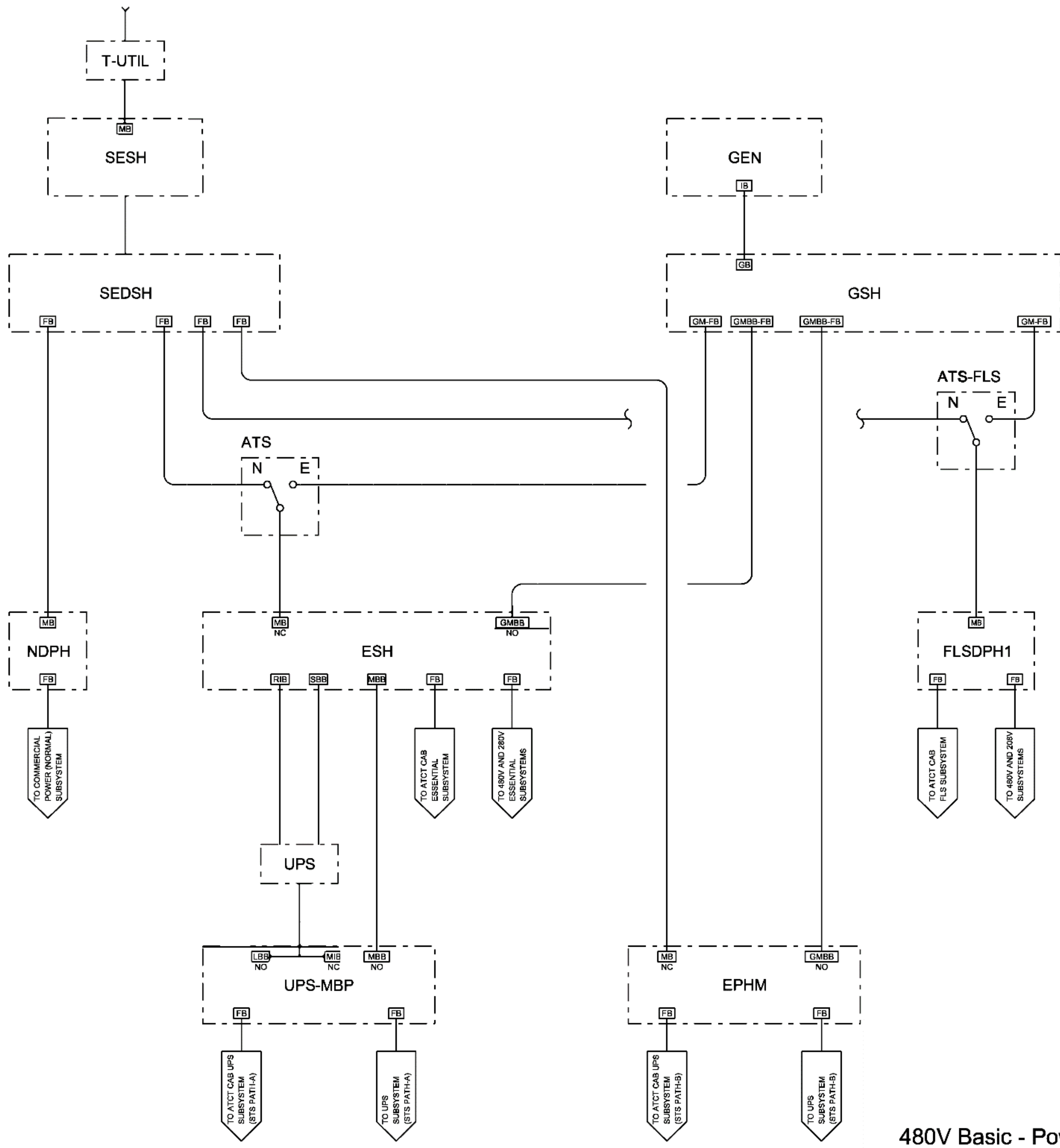
d. Power transfer switches:

(1) ATS: essential power automatic transfer switch

(2) ATS-FLS: fire life safety automatic transfer switch

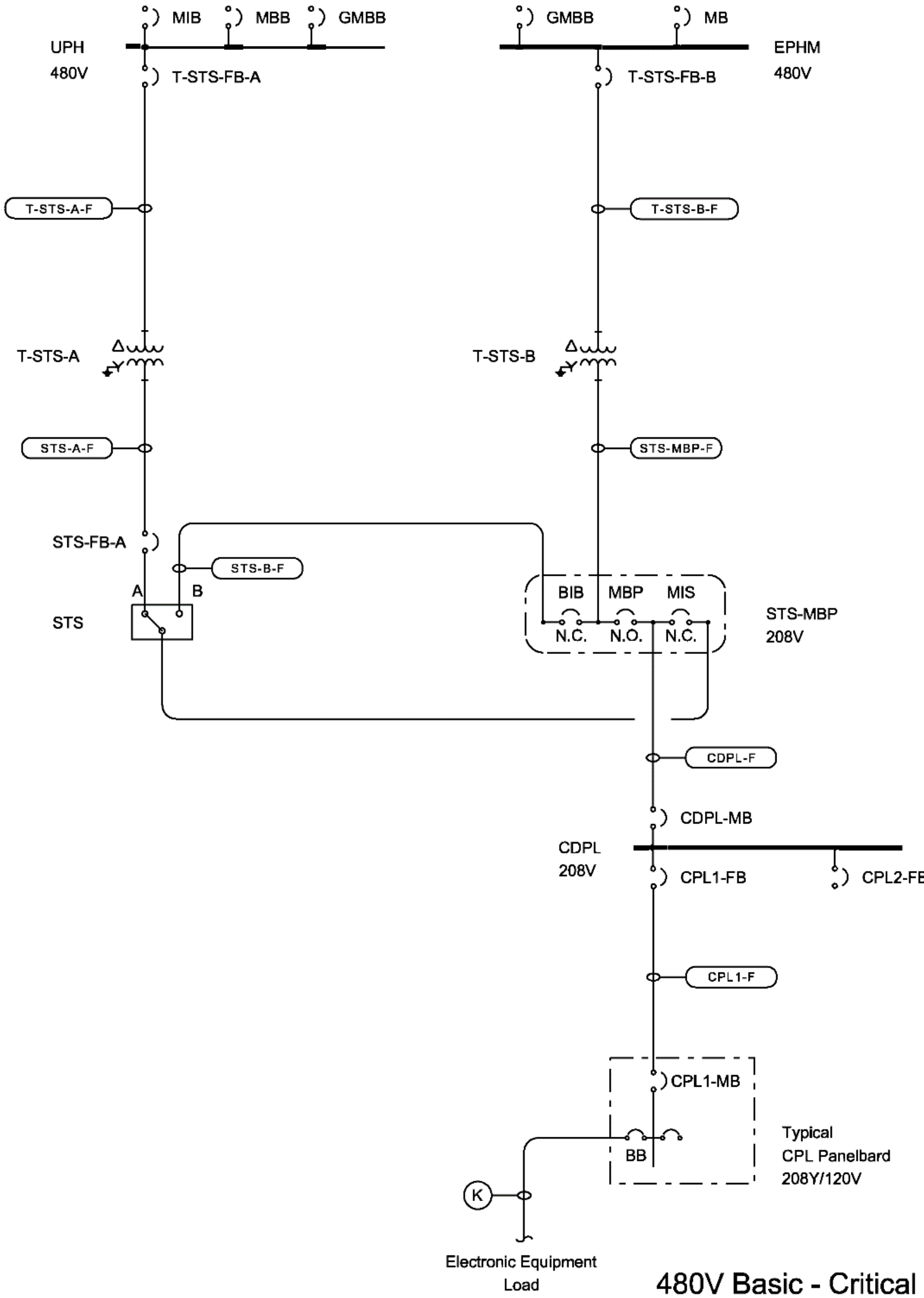
(3) STS: critical power static transfer switch.

480V CPDS Type Basic Power Diagram 1



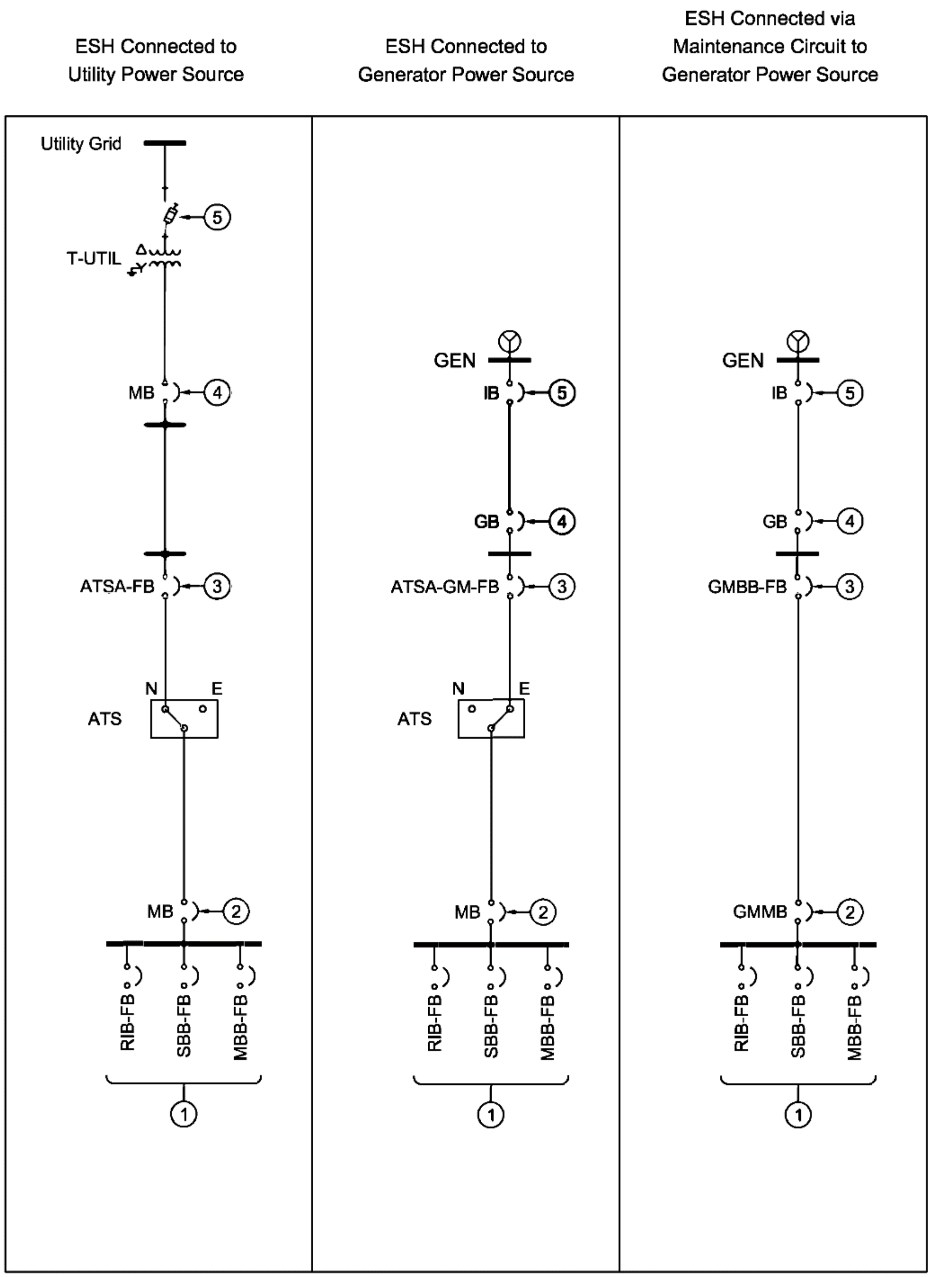
480V Basic - Power Diagram

480V CPDS Type Basic Critical Subsystem Power Diagram 2



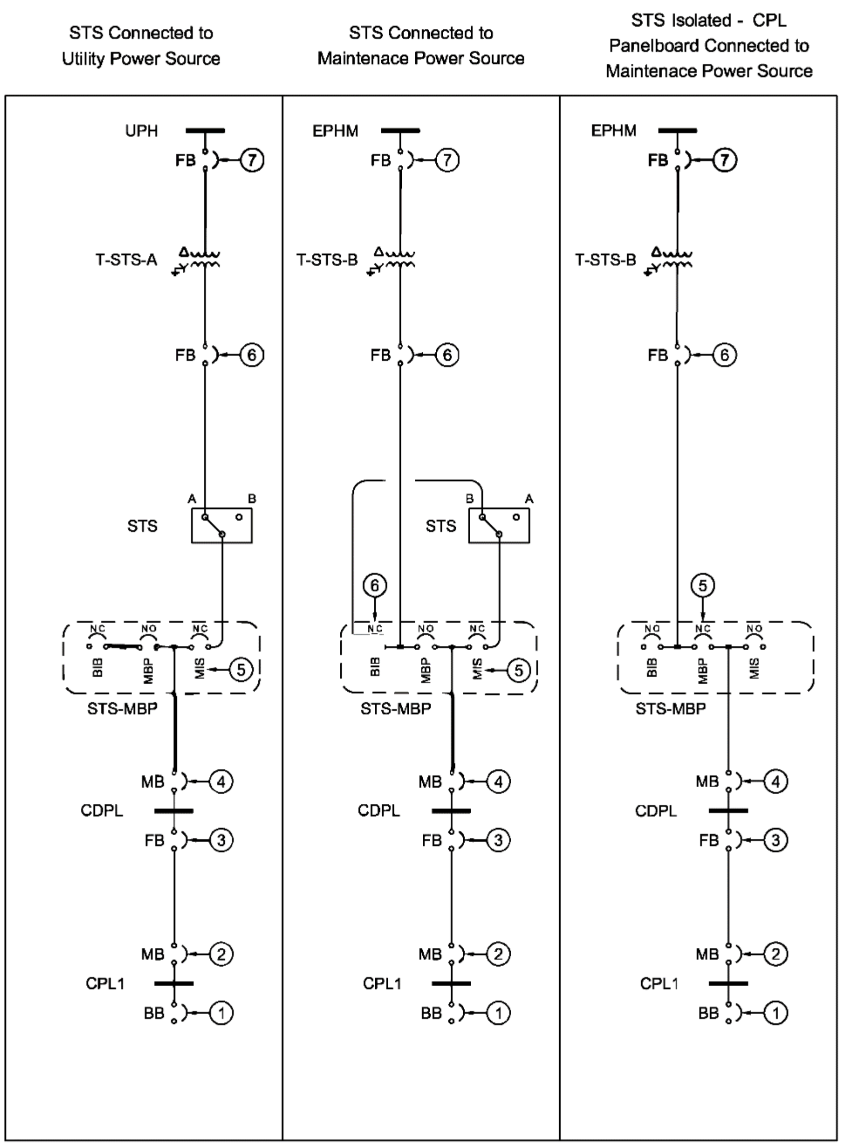
480V Basic - Critical Subsystem Power Diagram

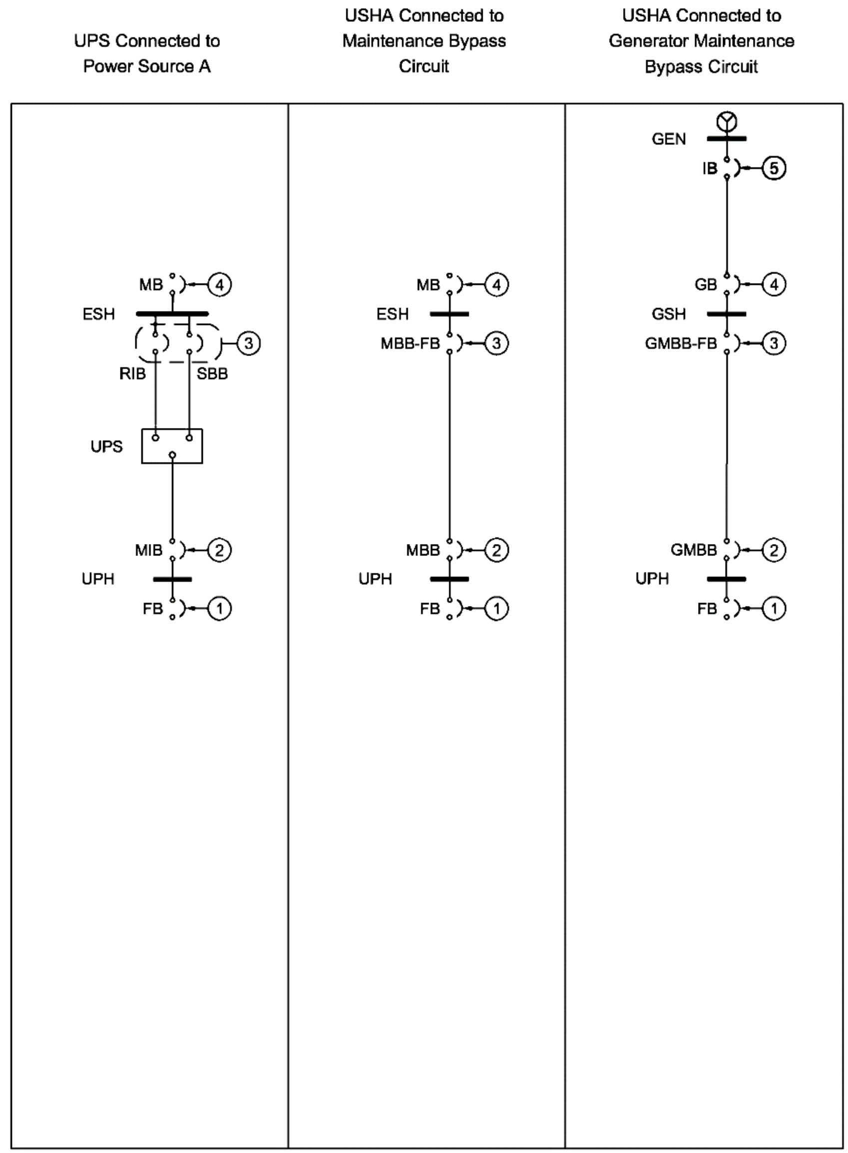
480V CPDS Type Basic Maintenance Path Power Diagram 3



480V Basic - Maintenance Path Power Diagrams

480V CPDS Type Basic Maintenance Path Power Diagram 4





480V Basic - Maintenance Path Power Diagrams

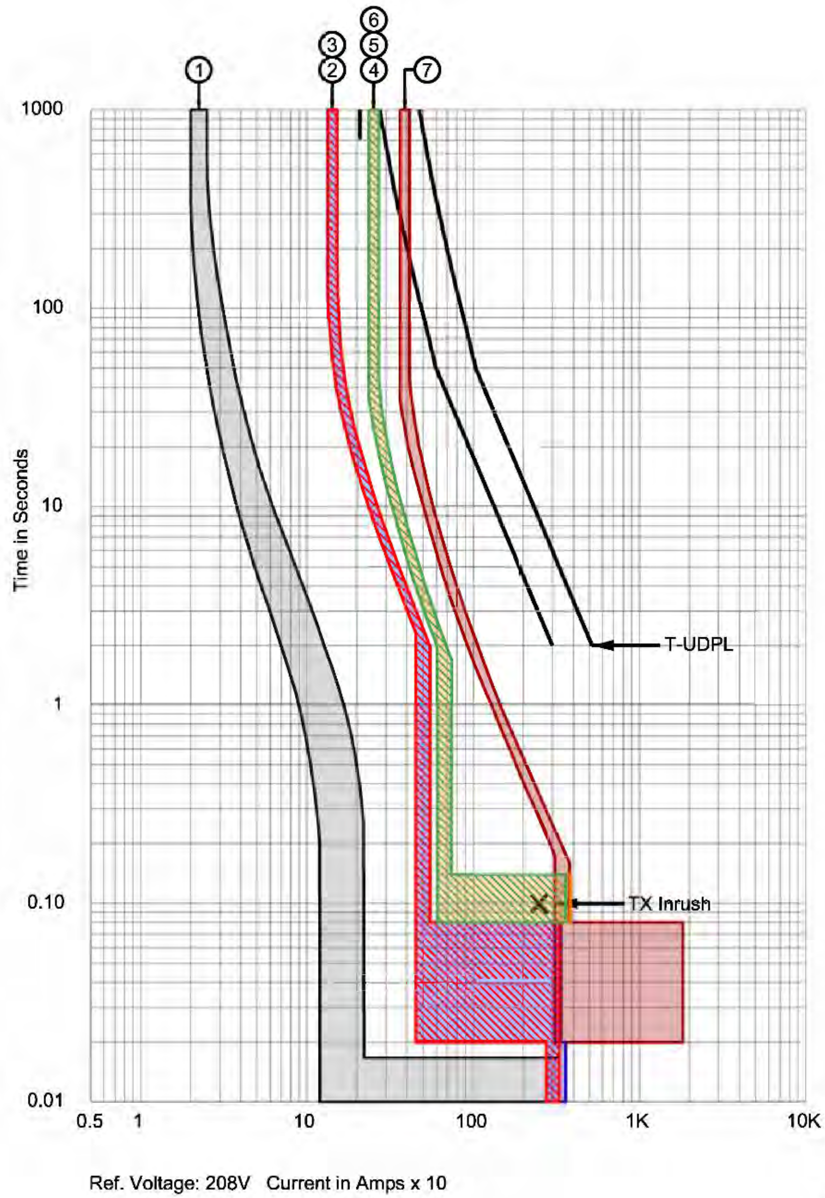
480V CPDS Type Basic TCC-1 Plot

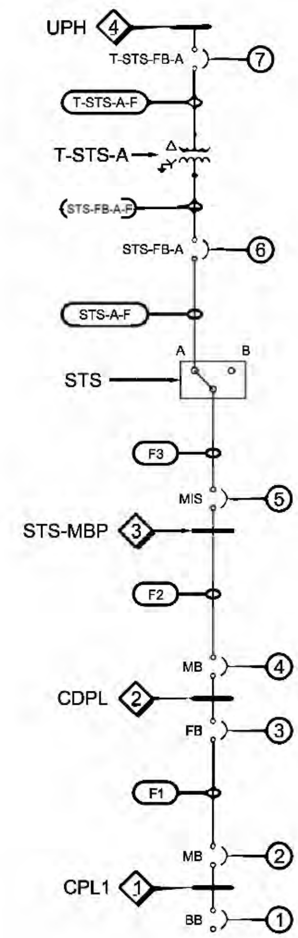
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
7	T-STS-FB-A	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^s T Off)
		INST = OFF
6	STS-FB-A	PG, 250A Sensor, ML5.0 LSI
5	STS-MBP-MIS	LTPU (A) = 0.9, LTD = 0.5
4	CDPL-MB	STPU = 3, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
		LTPU (A) = 125A, LTD = 1
		STPU = 4, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 20A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
4	UPH	Isc 3P RMS Sym (kA)	7.50	7.87	-
	I-Line Dist Panelboard	Iarc fault (kA)	5.66	5.95	-
	480V	Energy (Cal/cm-sq)	1.75	1.85	-
	800A Min. Bus Rating				
3	STS-MBP	Isc 3P RMS Sym (kA)	3.69	3.72	-
	I-Line Dist Panelboard	Iarc fault (kA)	1.55	1.56	-
	208Y/120V	Energy (Cal/cm-sq)	0.47	0.47	-
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	3.57	3.60	-
	I-Line Dist Panelboard	Iarc fault (kA)	1.49	1.50	-
	208Y/120V	Energy (Cal/cm-sq)	0.45	0.46	-
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	3.27	3.30	-
	NQOB Panelboard	Iarc fault (kA)	1.35	1.36	-
	208Y/120V	Energy (Cal/cm-sq)	0.23	0.24	-
	125A Min. Bus Rating				





480V CPDS Type Basic: TCC-1

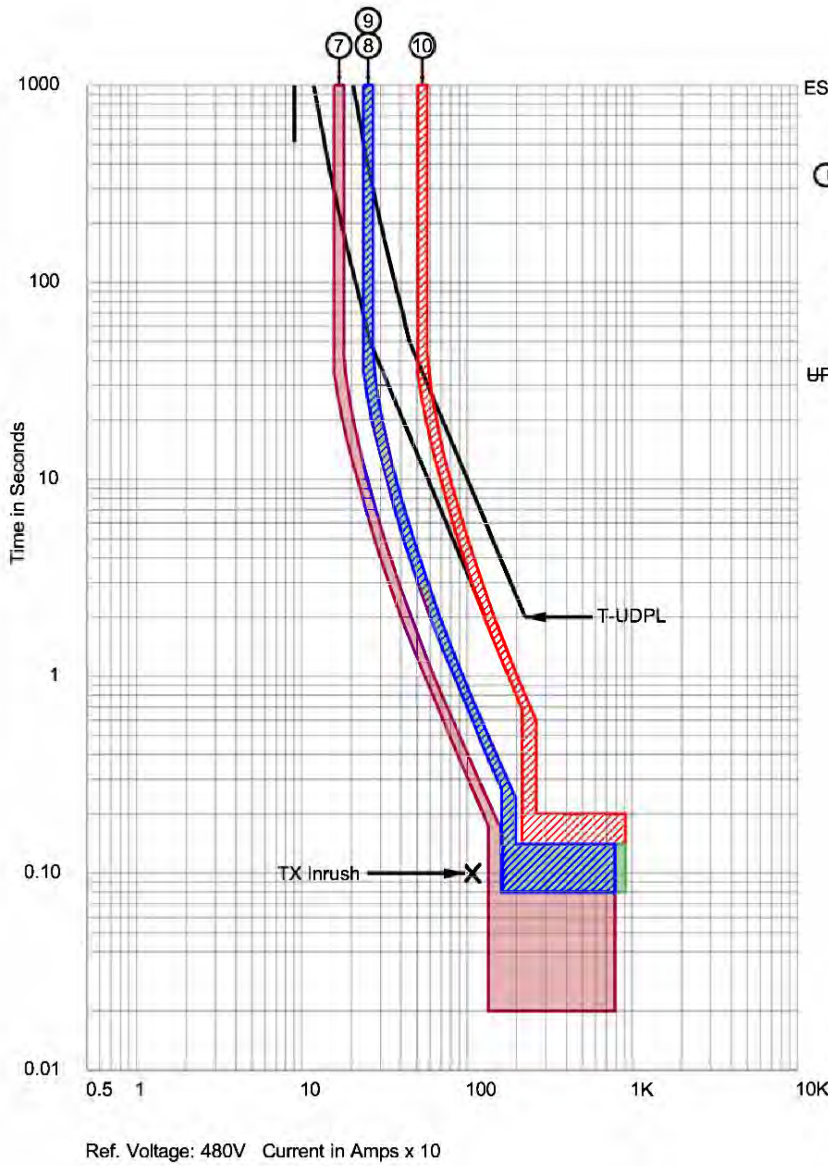
480V CPDS Type Basic TCC-2 Plot

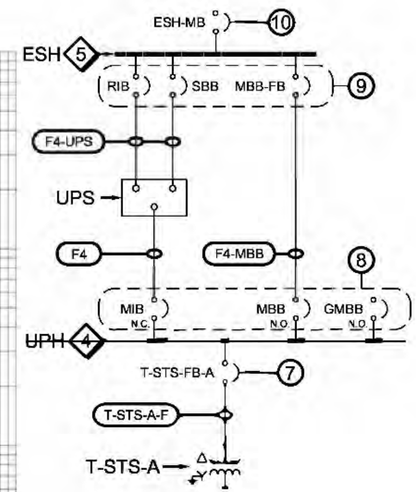
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
10	ESH-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
9	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
8	UPH-MIB	PG, 250A Sensor, ML5.0 LSI
	UPH-MBB	LTPU (A) = 0.9, LTD = 0.5
	UPH-GMBB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
7	T-STS-FB-A	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	ESH	Isc 3P RMS Sym (kA)	8.63	9.14	-
	QE2 Switchboard	Iarc fault (kA)	6.56	6.96	-
	480V	Energy (Cal/cm-sq)	2.92	3.11	-
	1200A Min. Bus Rating				
4	UPH	Isc 3P RMS Sym (kA)	7.50	7.87	-
	I-Line Dist. Panelboard	Iarc fault (kA)	5.66	5.95	-
	480V	Energy (Cal/cm-sq)	1.75	1.85	-
	600A Min. Bus Rating				





480V CPDS Type Basic: TCC-2

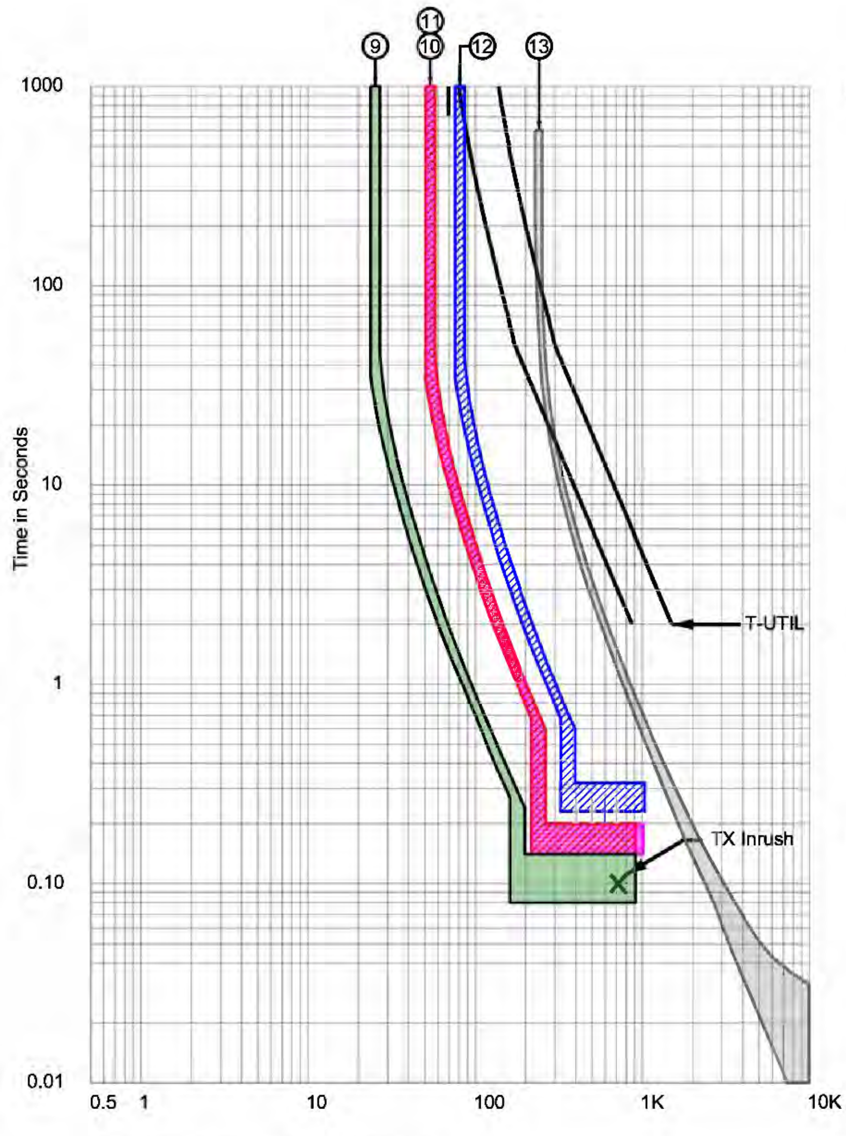
480V CPDS Type Basic TCC-3 Plot

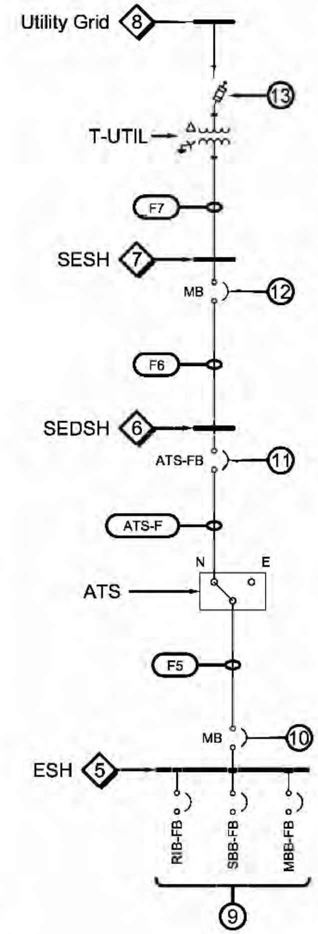
○ TCC Device

No.	Device Name	Device Type / Trip Unit Settings
13	T-UTIL-F	13.8 kV, E-Rated Fuse
		Type: S&C, SM-4, 15E-200E
		Slow Speed, 40A
		TCC No.: 119-4
12	SESH-MB	PG, 800A Sensor, ML5.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 5, STD = 0.3 (I^s T Off)
		INST = 15
11	ATS-FB	PG, 600A Sensor, ML5.0 LSI
10	ESH-MB	LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
9	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UPH-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

◇ Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
8	Utility Grid Connection	SCA (MVA)	100	500	-
7	SESH	Isc 3P RMS Sym (kA)	9.68	10.33	-
	QE2 Switchboard	Iarc fault (kA)	6.48	6.93	-
	480Y/277V	Energy (Cal/cm-sq)	27.3	24.9	-
	1200A Min. Bus Rating				
6	SEDSH	Isc 3P RMS Sym (kA)	9.47	10.09	-
	I-Line Dist. Panelboard	Iarc fault (kA)	7.22	7.72	-
	480V	Energy (Cal/cm-sq)	5.17	5.55	-
	1200A Min. Bus Rating				
5	ESH	Isc 3P RMS Sym (kA)	8.63	9.14	-
	I-Line Dist. Panelboard	Iarc fault (kA)	6.56	6.96	-
	480V	Energy (Cal/cm-sq)	2.92	3.11	-
	1200A Min. Bus Rating				





480V CPDS Type Basic: TCC-3

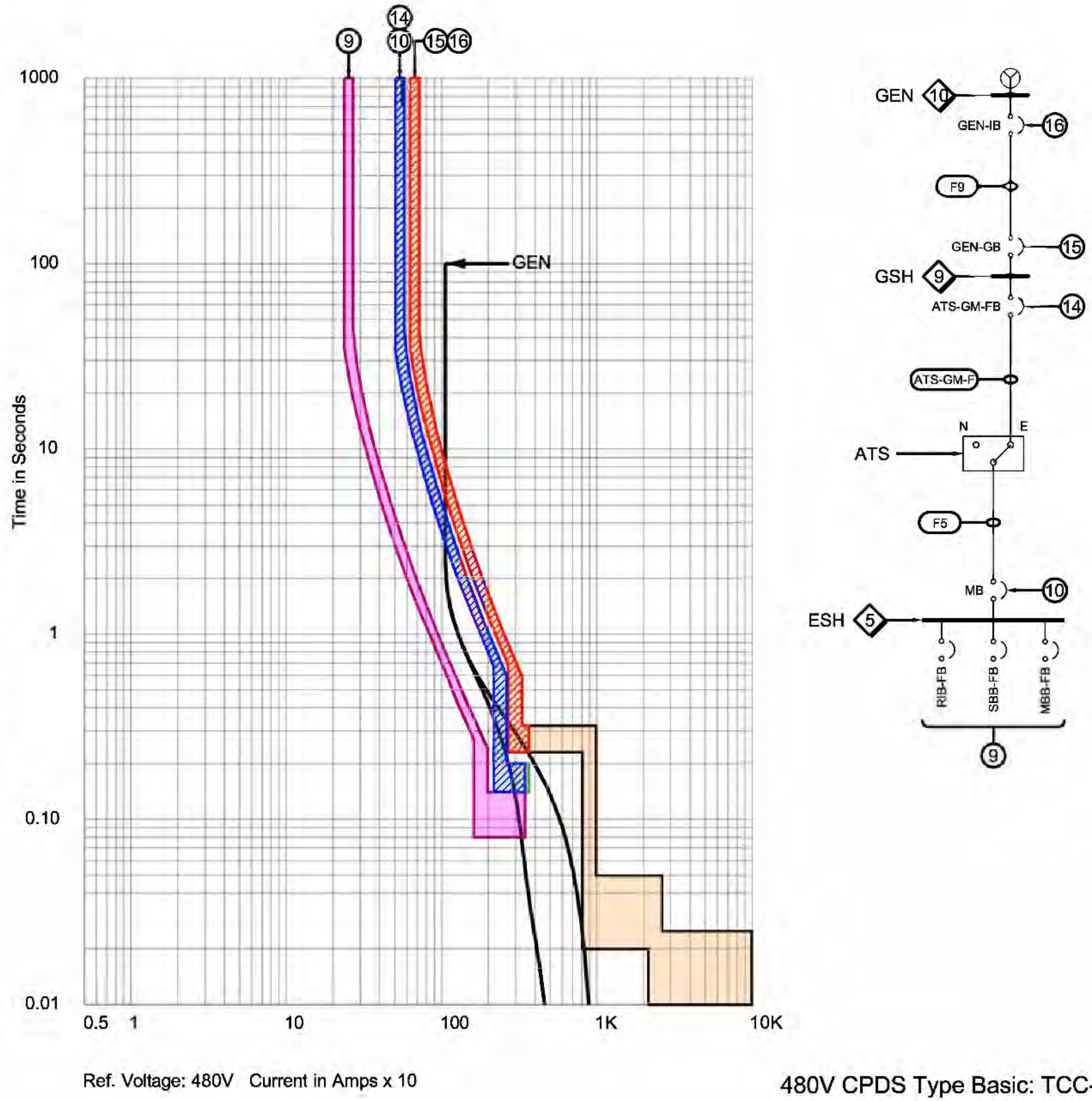
480V CPDS Type Basic TCC-4 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
16	GEN-IB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 1.0, LTD = 0.5
		STPU = 5, STD = 0.3 (I^s T Off)
		INST = 15
15	GEN-GB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 1.0, LTD = 0.5
		STPU = 5, STD = 0.3 (I^s T Off)
		INST = OFF
14	ATS-GM-FB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
10	ESH-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
9	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UPH-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis Parameter	Min.	Max.	E/G
10	Generator Output	Isc 3P RMS Sym (kA)	-	-	3.75
9	GSH	Isc 3P RMS Sym (kA)	-	-	3.64
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.32
	480Y/277V	Energy (Cal/cm-sq)	-	-	5.95
	800A Min. Bus Rating				
5	ESH	Isc 3P RMS Sym (kA)	-	-	3.46
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.20
	480V	Energy (Cal/cm-sq)	-	-	3.99
	600A Min. Bus Rating				



480V CPDS Type Basic: TCC-4

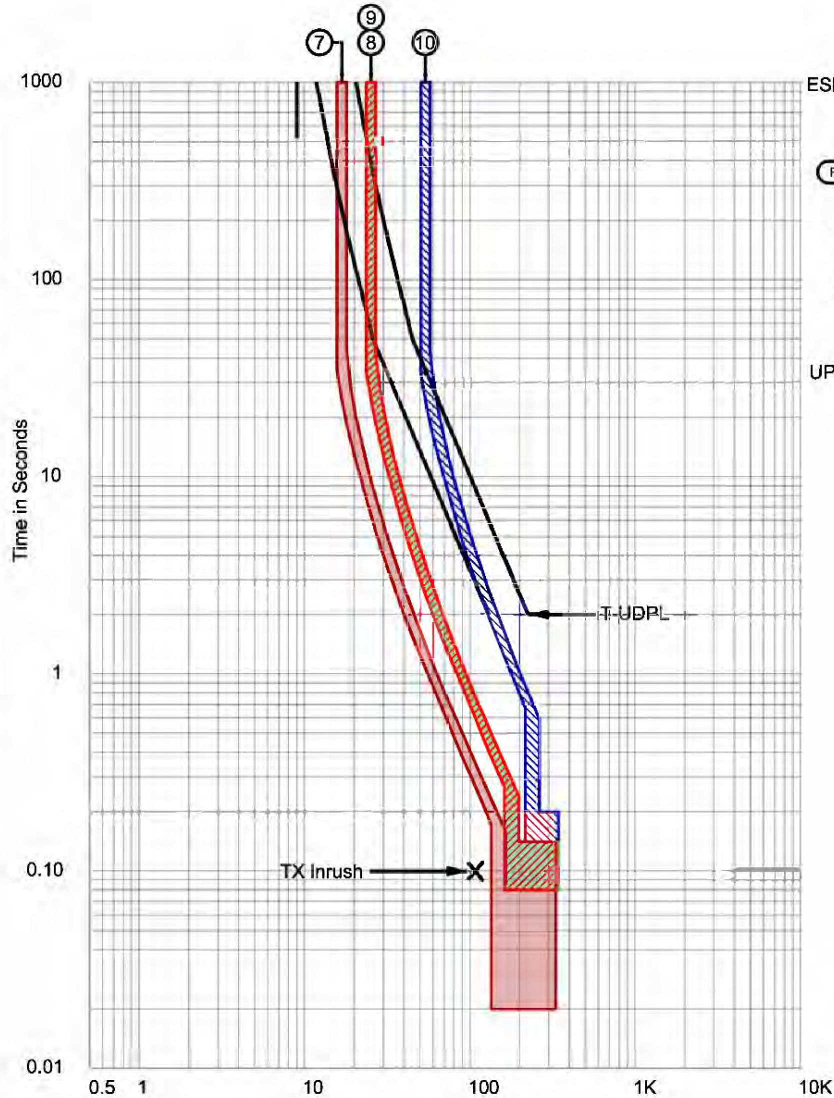
480V CPDS Type Basic TCC-5 Plot

TCC Device

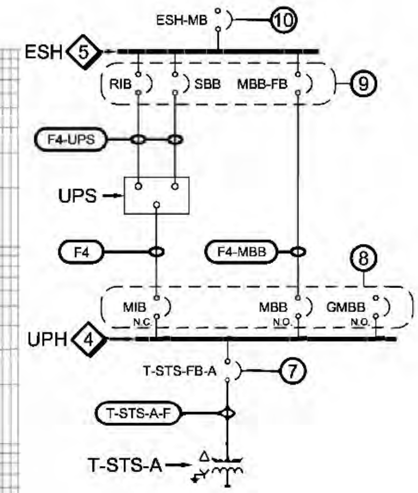
No.	Device Name	Device Type / Trip Unit Settings
10	ESH-MB	PG, 600A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 5, STD = 0.2 (I^s T Off)
		INST = OFF
9	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.9, LTD = 0.5
	UDP-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
8	UPH-MIB	PG, 250A Sensor, ML5.0 LSI
	UPH-MBB	LTPU (A) = 0.9, LTD = 0.5
	UPH-GMBB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
7	T-STS-FB-A	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	ESH	Isc 3P RMS Sym (kA)	-	-	3.46
	QE2 Switchboard	Iarc fault (kA)	-	-	2.20
	480V	Energy (Cal/cm-sq)	-	-	3.99
	1200A Min. Bus Rating				
4	UPH	Isc 3P RMS Sym (kA)	-	-	3.29
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	2.38
	480V	Energy (Cal/cm-sq)	-	-	0.70
	600A Min. Bus Rating				



Ref. Voltage: 480V Current in Amps x 10



480V CPDS Type Basic: TCC-5

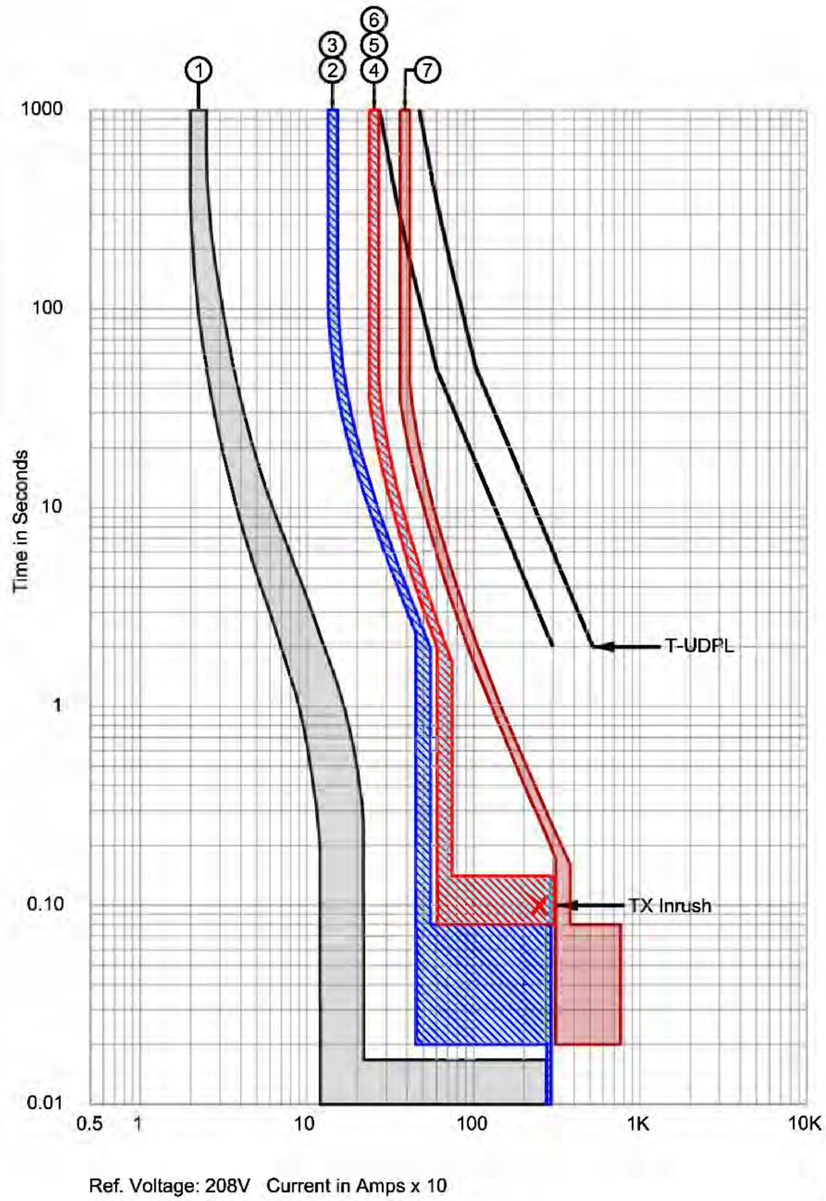
480V CPDS Type Basic TCC-6 Plot

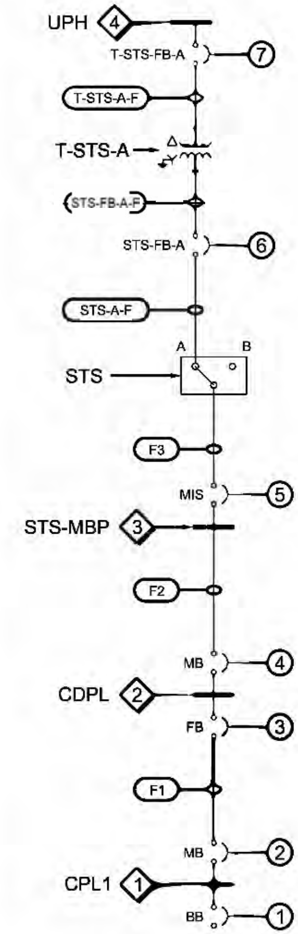
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
7	T-STS-FB-A	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 0.5
		STPU = 10, STD = 0.0 (I^t T Off)
		INST = OFF
6	STS-FB-A	PG, 250A Sensor, ML5.0 LSI
5	STS-MBP-MIS	LTPU (A) = 0.9, LTD = 0.5
4	CDPL-MB	STPU = 3, STD = 0.1 (I^t T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
		LTPU (A) = 125A, LTD = 1
		STPU = 4, STD = 0.0 (I^t T Off)
		INST = 12
1	CPL1-BB	QO, 20A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis: Parameter	Min.	Max.	E/G
4	UPH	Isc 3P RMS Sym (kA)	-	-	3.29
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	2.38
	480V	Energy (Cal/cm-sq)	-	-	0.70
	800A Min. Bus Rating				
3	STS-MBP	Isc 3P RMS Sym (kA)	-	-	2.98
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	1.22
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.37
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	-	-	2.91
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	1.19
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.36
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	-	-	2.72
	NQOB Panelboard	Iarc fault (kA)	-	-	1.11
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.19
	125A Min. Bus Rating				





480V CPDS Type Basic: TCC-6

13. Coordination Example – 480V CPDS Type 1. System configuration includes following power distribution elements:

a. Power distribution paths (dual circuit path A/B):

(1) Commercial utility bus

(2) Generator bus

(3) Essential bus

(4) Normal bus

(5) Conditioned and critical power buses

(6) Fire life safety (FLS) bus

(7) Maintenance bus.

b. System power distribution buses:

(1) SESHA/SESHB: commercial utility service disconnecting means

(2) SEDSH: facility path A main 480V normal power distribution point

(3) ESHA/ESHB: 480V essential power distribution points

(4) GSHB: 480V generator power distribution point

(5) NDPH: 480V normal power distribution point

(6) USHA: 480V conditioned power source

(7) UDPLA: 208V conditioned power distribution point

(8) CDPL1: 208V critical power distribution point

(9) CPL1: 208Y/120V conditioned power branch circuit panelboard.

c. Power sources:

(1) T-UTIL: commercial utility transformer:

(a) Voltage classification: 13.8kV primary to 480Y/277V secondary, 60 Hz

(b) Rating: 750kVA, 5.75% nominal impedance

(c) Type: oil/air cooled, pad mounted.

(2) GEN-B1: standby diesel-engine generator:

(a) Voltage classification: 480Y/120V, 60 Hz

(b) Rating: 600kW, 0.8 power factor.

(3) UPS: uninterruptible power source.

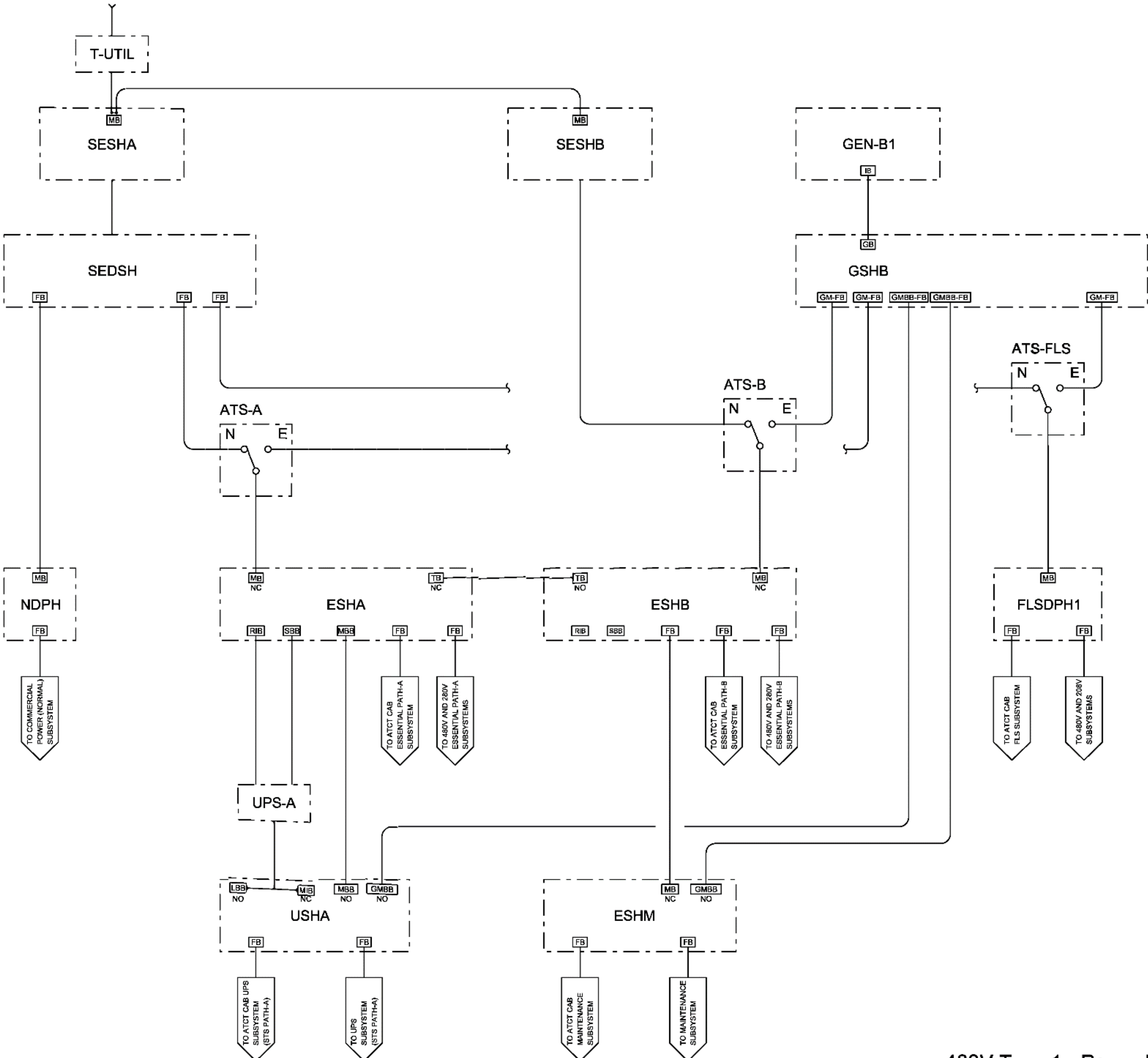
d. Power transfer switches:

(1) ATS-A/ATS-B: essential power automatic transfer switch

(2) ATS-FLS: fire life safety automatic transfer switch

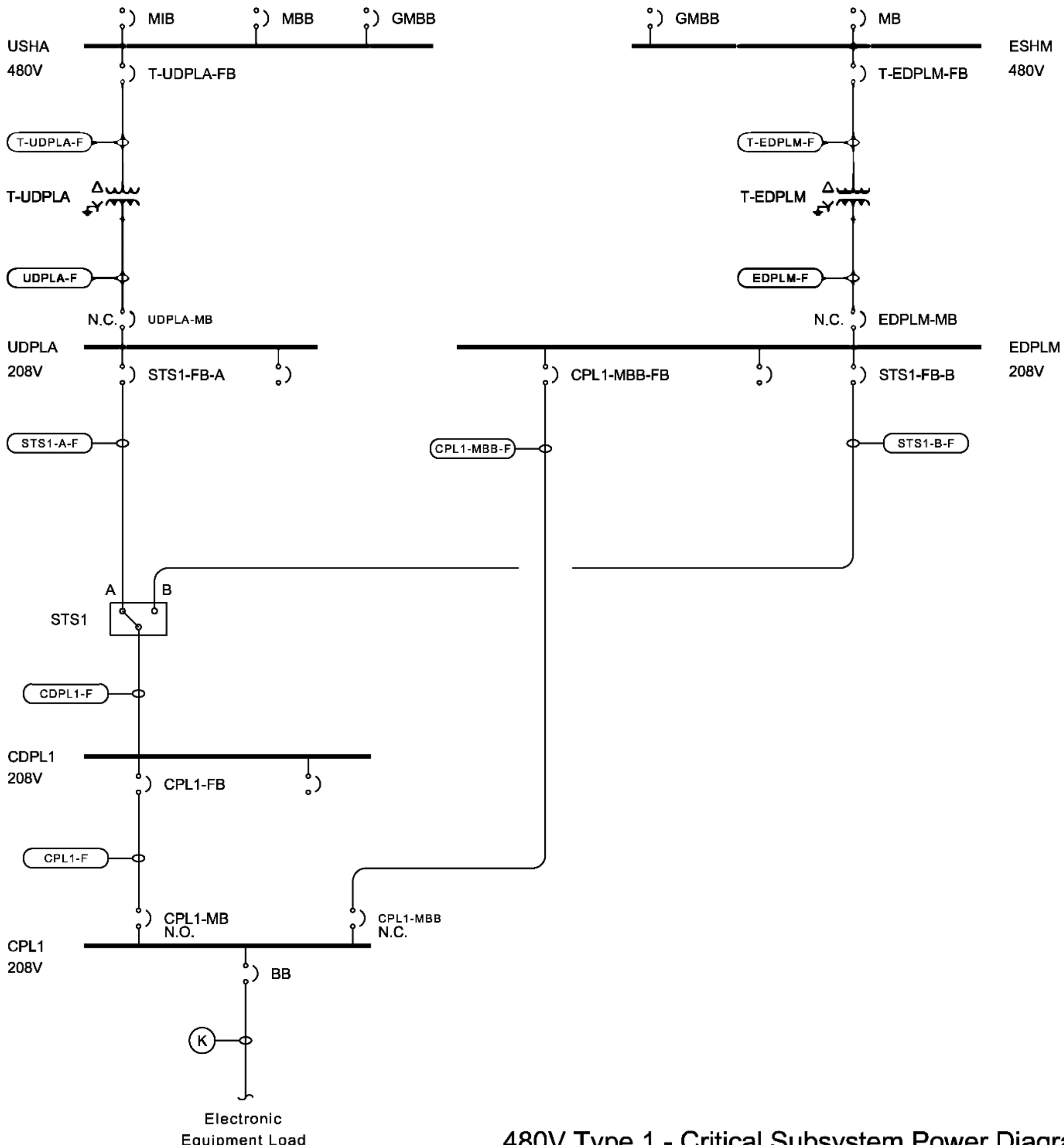
(3) STS1: critical power static transfer switch.

480V CPDS Type 1 Power Diagram 1



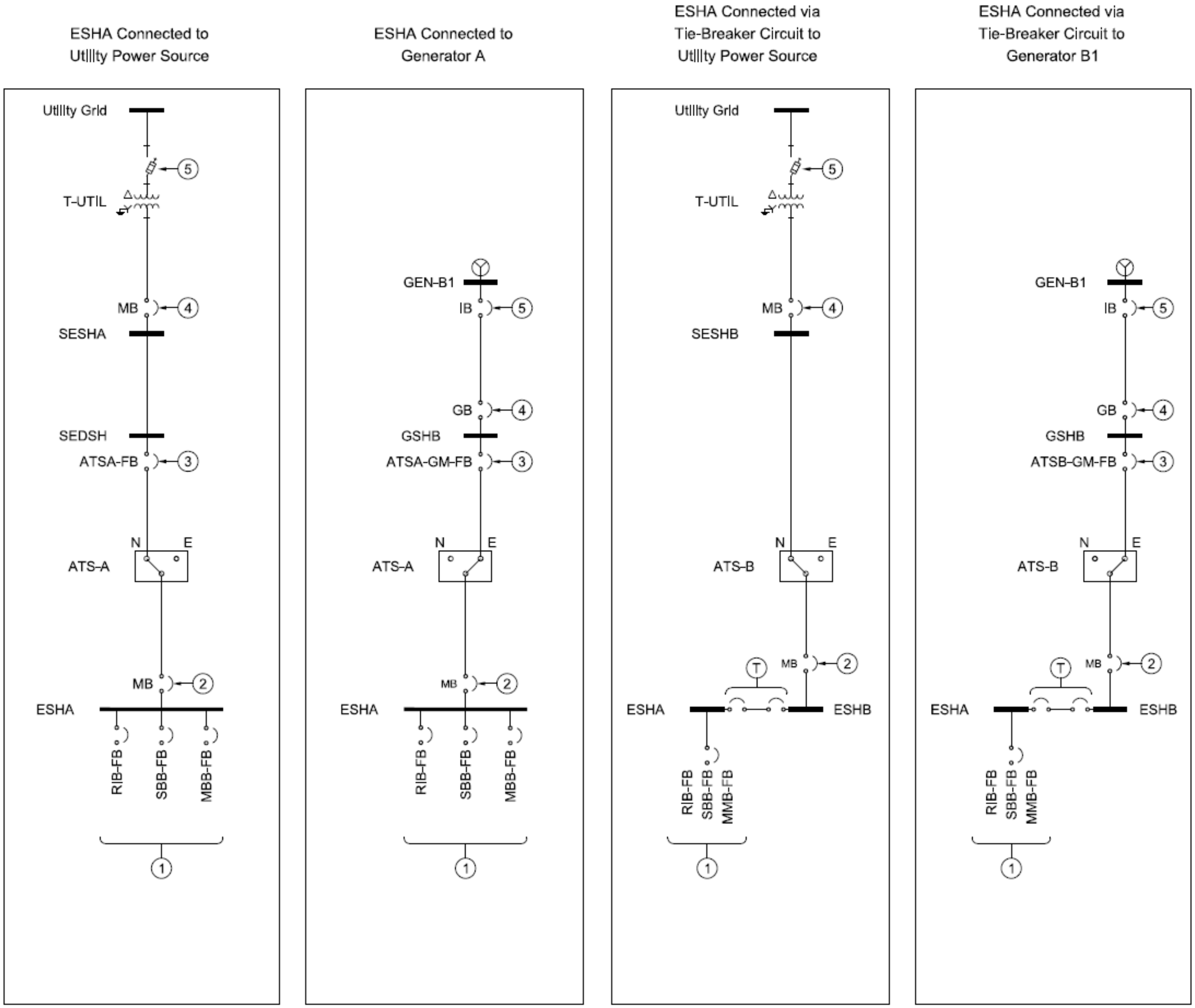
480V Type 1 - Power Diagram

480V CPDS Type 1 Critical Subsystem Power Diagram 2



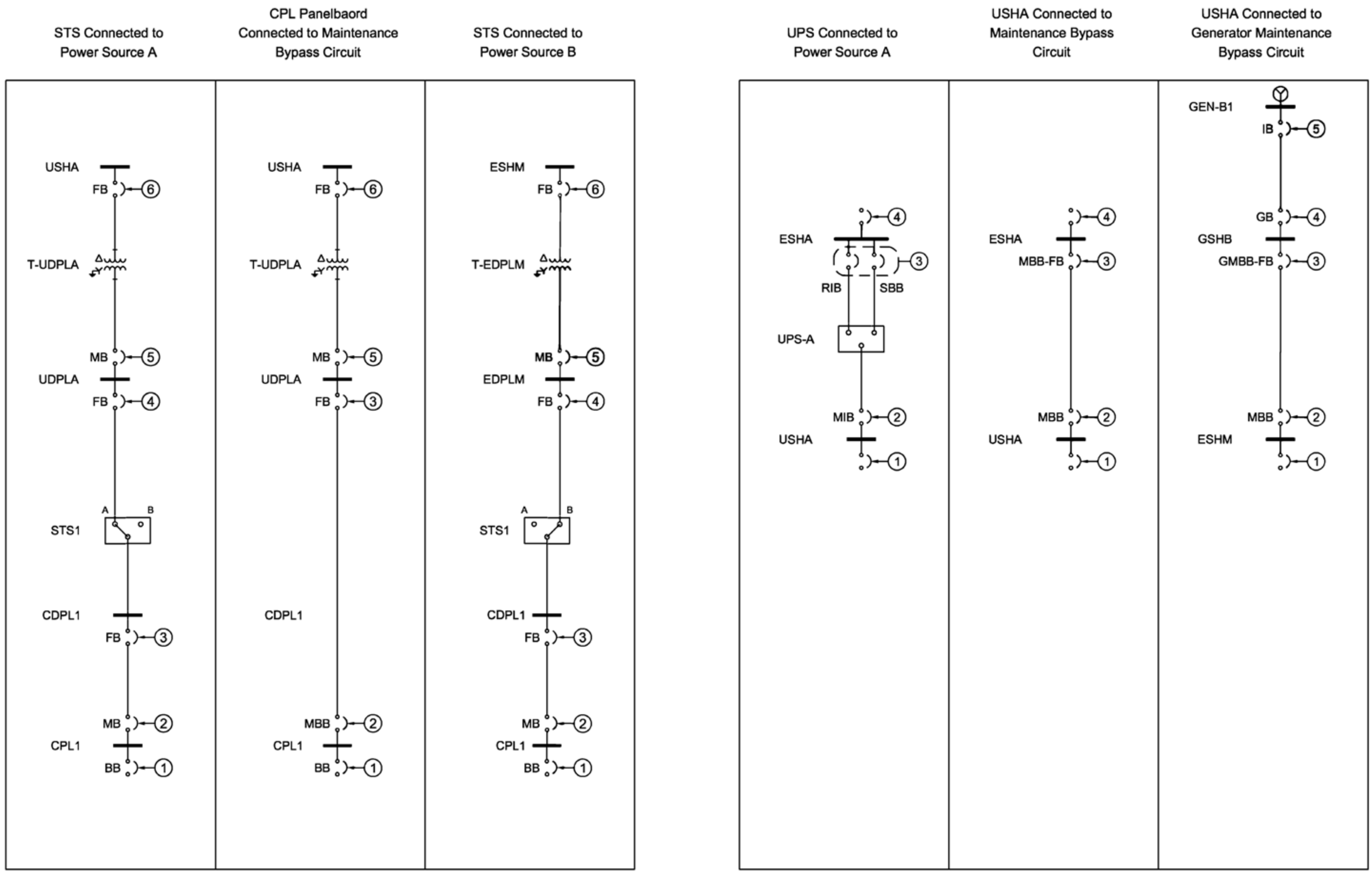
480V Type 1 - Critical Subsystem Power Diagram

480V CPDS Type 1 Maintenance Path Power Diagram 3



480V Type 1 - Maintenance Path Power Diagrams

480V CPDS Type 1 Maintenance Path Power Diagram 4



480V Type 1 - Maintenance Path Power Diagrams

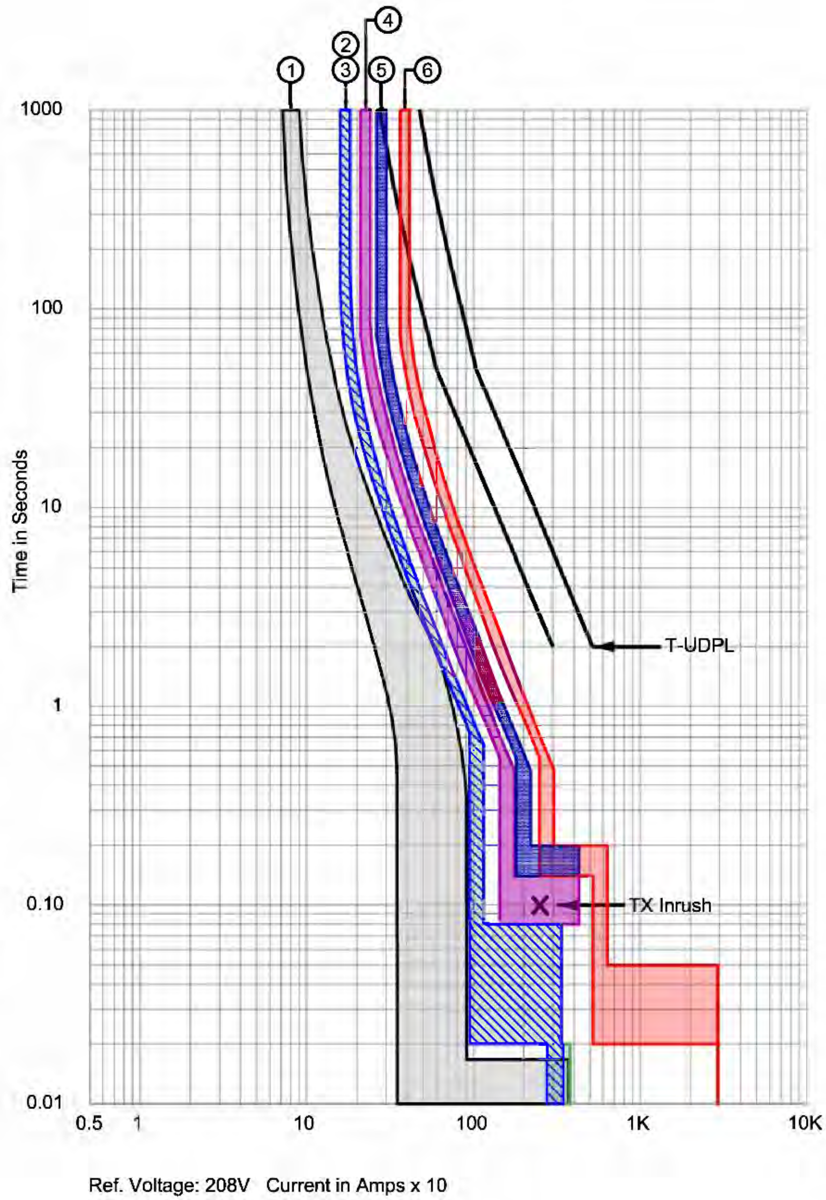
480V CPDS Type 1 TCC-1 Plot

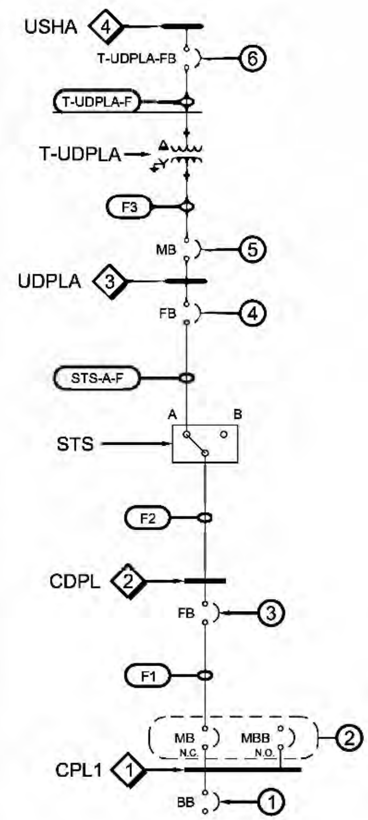
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
4	USHA	Isc 3P RMS Sym (kA)	12.40	13.49	-
	I-Line Dist Panelboard	Iarc fault (kA)	9.53	10.39	-
	480V	Energy (Cal/cm-sq)	3.04	3.33	-
	600A Min. Bus Rating				
3	UDPLA	Isc 3P RMS Sym (kA)	4.20	4.24	-
	I-Line Dist Panelboard	Iarc fault (kA)	1.53	1.55	-
	208Y/120V	Energy (Cal/cm-sq)	3.39	3.35	-
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	3.72	3.75	-
	I-Line Dist Panelboard	Iarc fault (kA)	1.34	1.36	-
	208Y/120V	Energy (Cal/cm-sq)	2.44	2.42	-
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	3.39	3.42	-
	NQOB Panelboard	Iarc fault (kA)	1.41	1.42	-
	208Y/120V	Energy (Cal/cm-sq)	0.24	0.25	-
	150A Min. Bus Rating				





480V CPDS Type 1: TCC-1

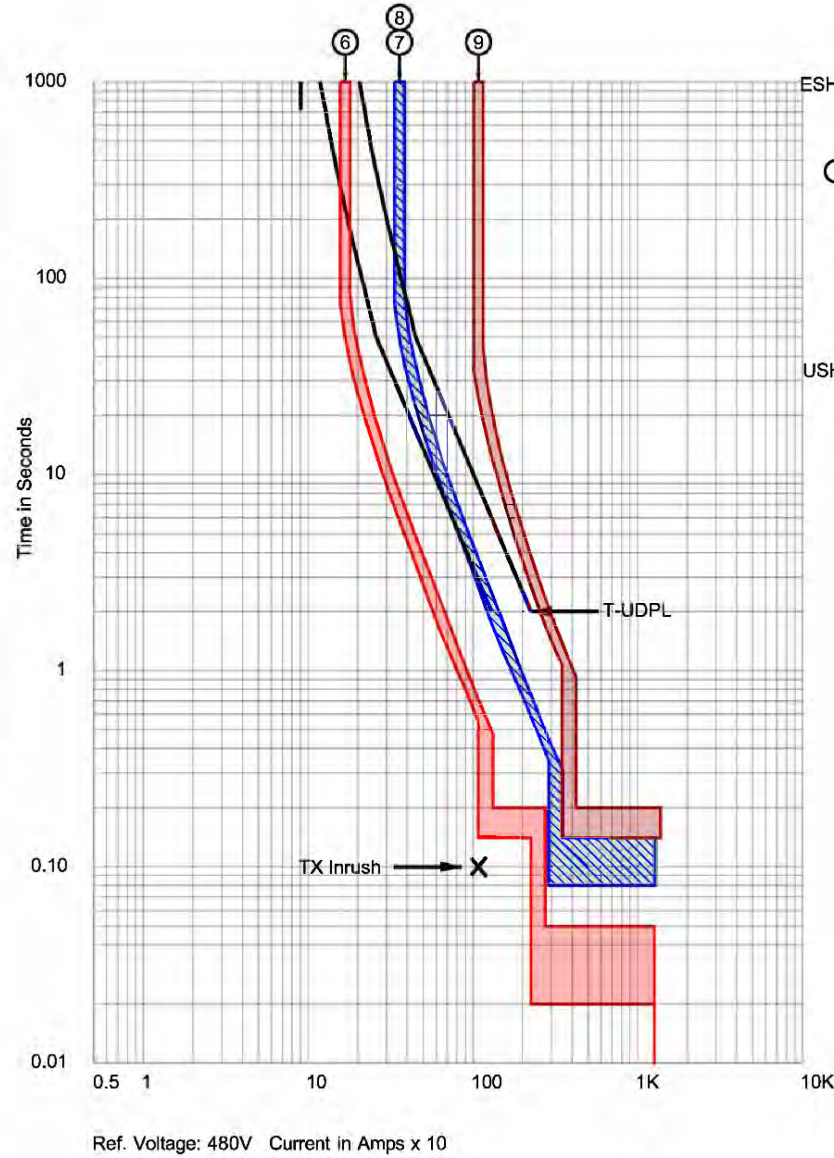
480V CPDS Type 1 TCC-2 Plot

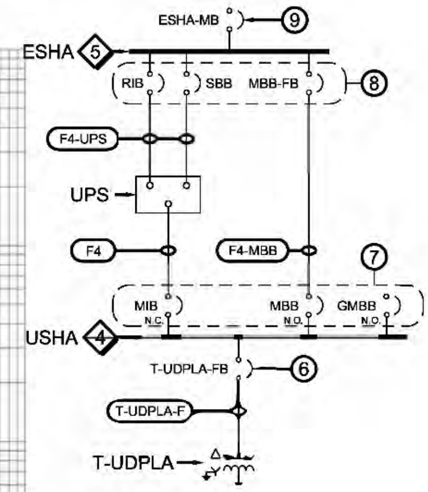
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
9	ESHA-MB	PG, 1200A Sensor, ML6.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 4, STD = 0.2 (I^t T Off)
		INST = 15
8	UPS-RIB-FB	PG, 400A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 10, STD = 0.1 (I^t T Off)
		INST = OFF
7	USHA-MIB	PG, 250A Sensor, ML5.0 LSI
	USHA-MBB	LTPU (A) = 0.8, LTD = 1
	USHA-GMBB	STPU = 8, STD = 0.1 (I^t T Off)
		INST = OFF
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^t T Off)
		INST = 10

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis Parameter	Min.	Max.	E/G
5	ESHA	Isc 3P RMS Sym (kA)	12.61	13.75	-
	QE2 Switchboard	Iarc fault (kA)	9.70	10.59	-
	480V	Energy (Cal/cm-sq)	4.42	4.85	-
	1200A Min. Bus Rating				
4	USHA	Isc 3P RMS Sym (kA)	12.40	13.49	-
	I-Line Dist. Panelboard	Iarc fault (kA)	9.53	10.39	-
	480V	Energy (Cal/cm-sq)	3.04	3.33	-
	800A Min. Bus Rating				





480V CPDS Type 1: TCC-2

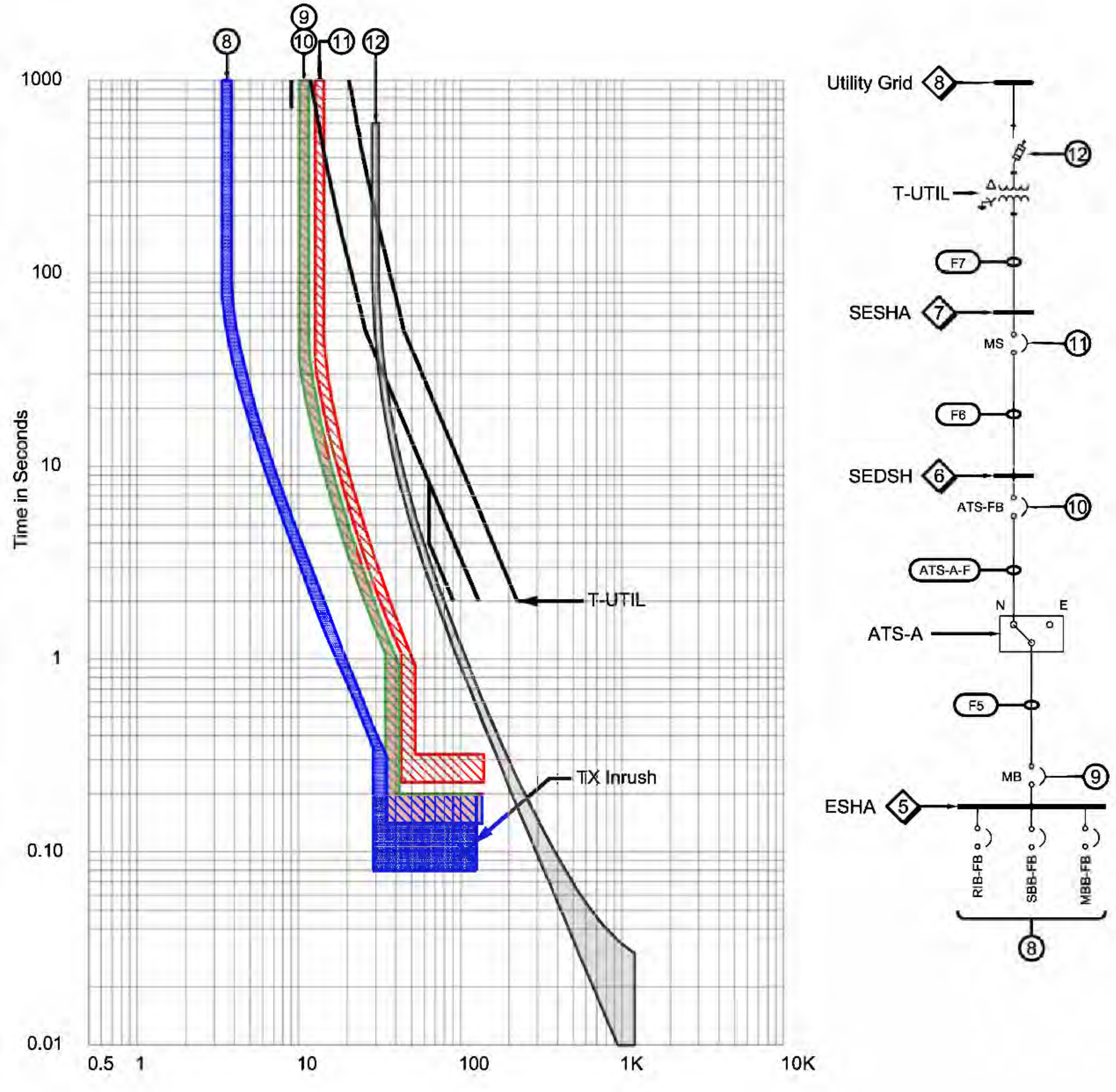
480V CPDS Type 1 TCC-3 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
12	T-UTIL-F	14.4 kV, E-Rated Fuse
		Type: S&C, SM-4, 50E
		Slow Speed, 50A
		TCC No.: 119-4
11	SESHA-MB	RJ, 1200A Sensor, ML6.0 LSI
		LTPU (A) = 1, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 15
10	ATS-A-FB	PG, 1200A Sensor, ML6.0 LSI
9	ESHA-MB	LTPU (A) = 0.8, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
8	Utility Grid Connection	SCA (MVA)	100	500	-
7	SESHA	Isc 3P RMS Sym (kA)	13.96	15.37	-
	QE2 Switchboard	Iarc fault (kA)	9.43	10.39	-
	480V	Energy (Cal/cm-sq)	29.9	26.9	-
	1200A Min. Bus Rating				
6	SEDSH	Isc 3P RMS Sym (kA)	13.67	15.01	-
	QE2 Switchboard	Iarc fault (kA)	10.53	11.57	-
	480V	Energy (Cal/cm-sq)	7.72	8.54	-
	1200A Min. Bus Rating				
5	ESHA	Isc 3P RMS Sym (kA)	12.61	13.75	-
	QE2 Switchboard	Iarc fault (kA)	9.70	10.59	-
	480V	Energy (Cal/cm-sq)	4.42	4.85	-
	1200A Min. Bus Rating				



Ref. Voltage: 480V Current in Amps x 100

480V CPDS Type 1: TCC-3

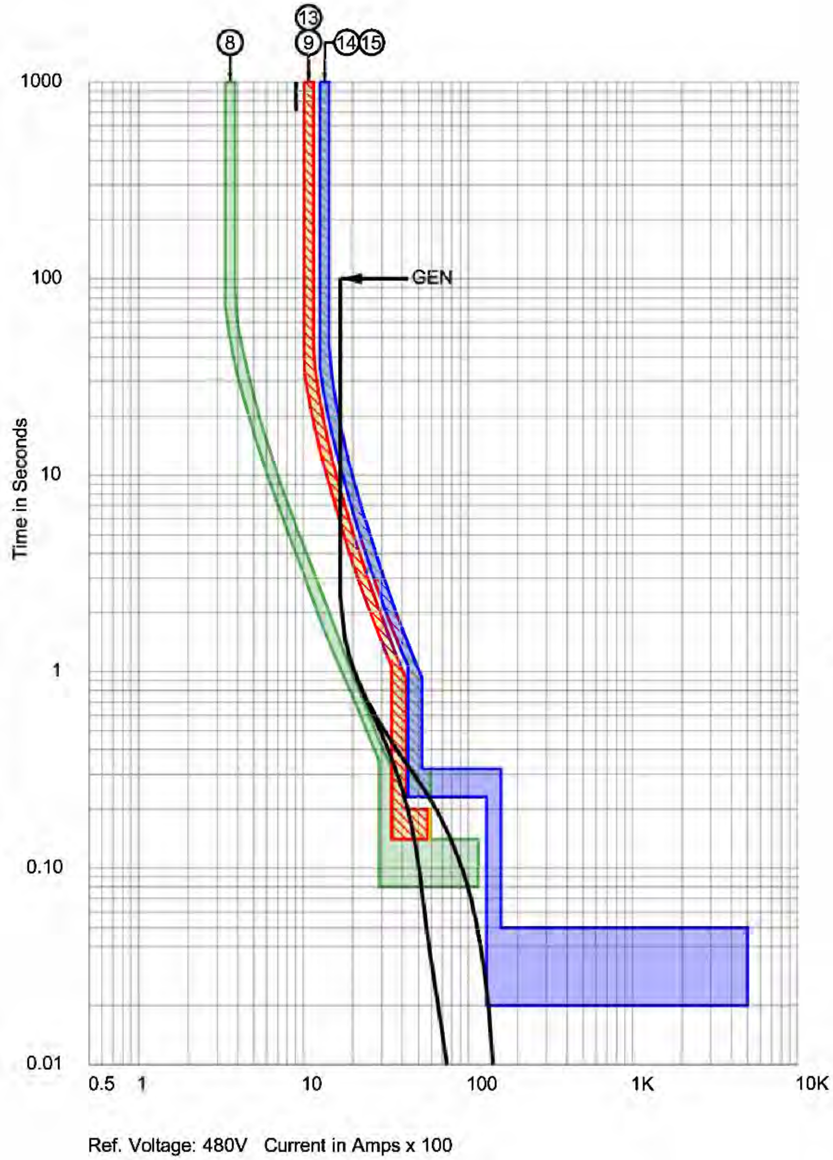
480V CPDS Type 1 TCC-4 Plot

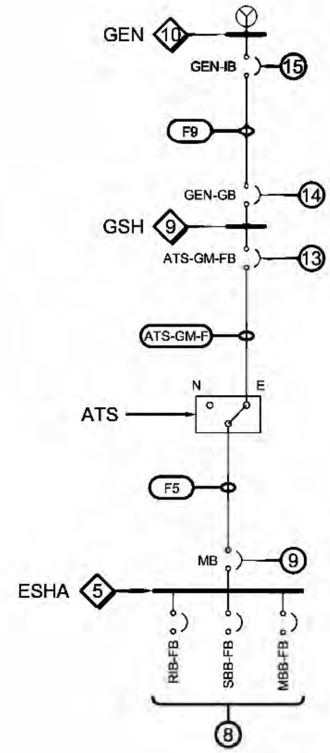
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
15	GEN-IB	RG, 1200A Sensor, ML6.0 LSI
		LTPU (A) = 1, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 12
14	GEN-GB	RG, 1200A Sensor, ML6.0 LSI
		LTPU (A) = 1, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 15
13	ATS-GM-FB	PG, 1200A Sensor, ML6.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
9	ESHA-MB	PG, 1200A Sensor, ML6.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis Parameter	Min.	Max.	E/G
10	Generator Output	Isc 3P RMS Sym (kA)	-	-	6.0
9	GSHA	Isc 3P RMS Sym (kA)	-	-	5.91
	QE2 Switchboard	Iarc fault (kA)	-	-	3.87
	480Y/277V	Energy (Cal/cm-sq)	-	-	15.2
	1200A Min. Bus Rating				
5	ESHA	Isc 3P RMS Sym (kA)	-	-	5.66
	QE2 Switchboard	Iarc fault (kA)	-	-	3.70
	480V	Energy (Cal/cm-sq)	-	-	9.82
	1200A Min. Bus Rating				





480V CPDS Type 1: TCC-4

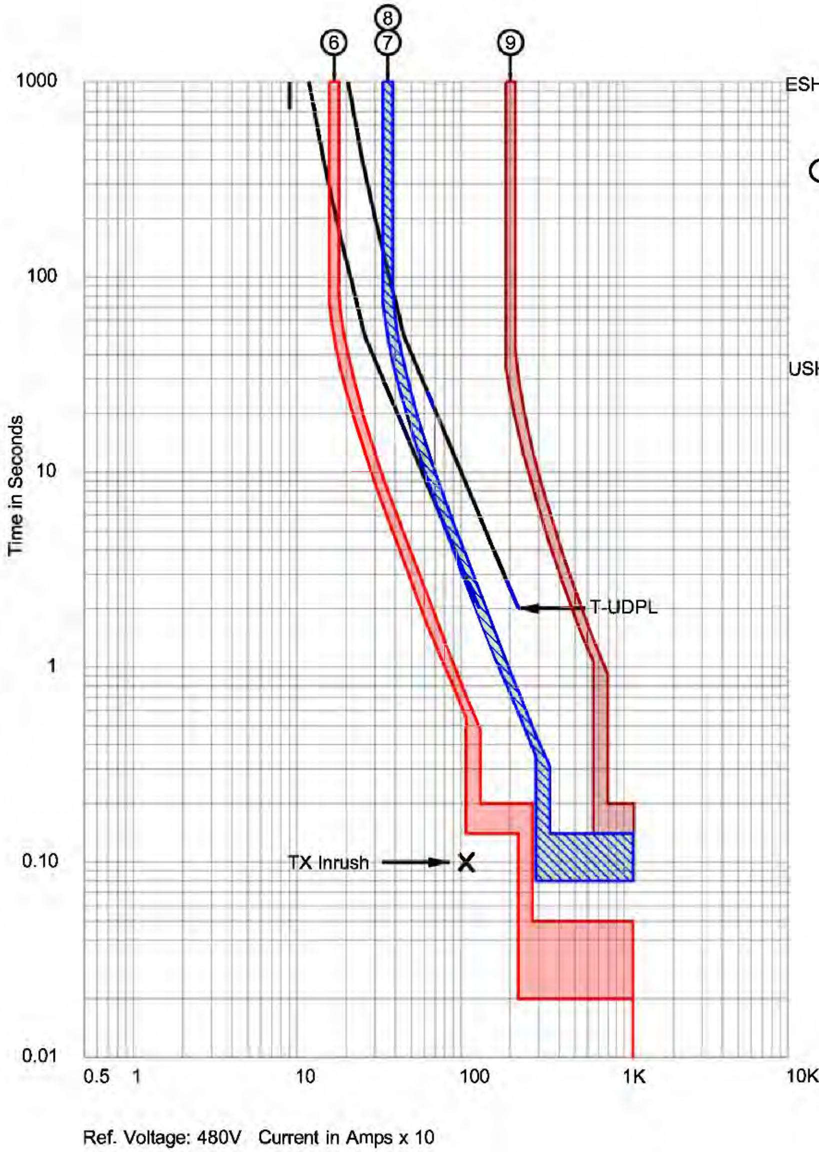
480V CPDS Type 1 TCC-5 Plot

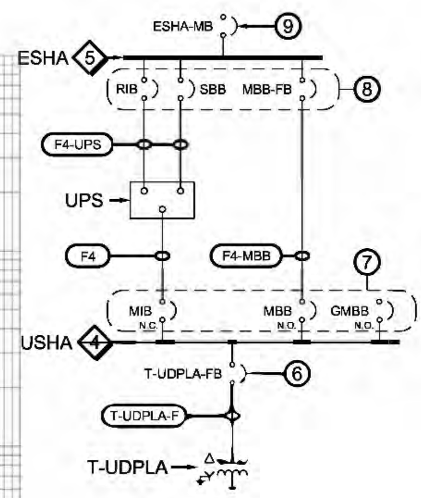
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
9	ESHA-MB	PG, 1200A Sensor, ML6.0 LSI
		LTPU (A) = 0.8, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
7	USHA-MIB	PG, 250A Sensor, ML5.0 LSI
	USHA-MBB	LTPU (A) = 0.8, LTD = 1
	USHA-GMBB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	ESHA	Isc 3P RMS Sym (kA)	-	-	5.66
	QE2 Switchboard	Iarc fault (kA)	-	-	3.70
	480V	Energy (Cal/cm-sq)	-	-	9.82
	1200A Min. Bus Rating				
4	USHA	Isc 3P RMS Sym (kA)	-	-	5.62
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	4.19
	480V	Energy (Cal/cm-sq)	-	-	1.27
	600A Min. Bus Rating				





480V CPDS Type 1: TCC-5

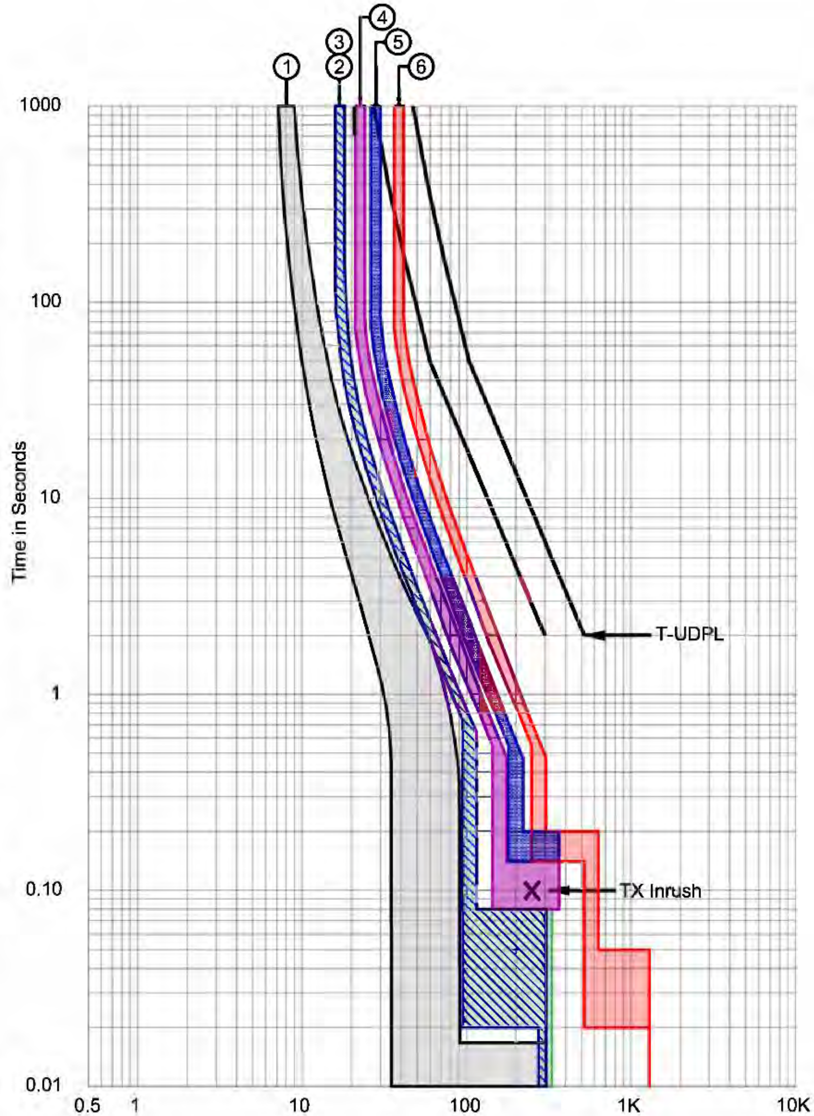
480V CPDS Type 1 TCC-6 Plot

TCC Device

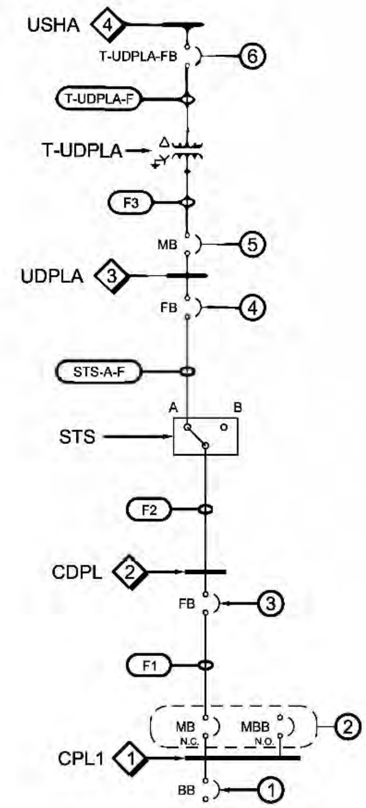
No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis Parameter	Min.	Max.	E/G
4	USHA	Isc 3P RMS Sym (kA)	-	-	5.62
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	4.19
	480V	Energy (Cal/cm-sq)	-	-	1.27
	600A Min. Bus Rating				
3	UDPLA	Isc 3P RMS Sym (kA)	-	-	3.67
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	1.32
	208Y/120V	Energy (Cal/cm-sq)	-	-	4.02
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	-	-	3.30
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	1.18
	208Y/120V	Energy (Cal/cm-sq)	-	-	2.79
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	-	-	3.05
	NQOB Panelboard	Iarc fault (kA)	-	-	1.08
	208Y/120V	Energy (Cal/cm-sq)	-	-	1.69
	150A Min. Bus Rating				



Ref. Voltage: 208V Current in Amps x 10



480V CPDS Type 1: TCC-6

14. Coordination Example – 480V CPDS Type 2. System configuration includes following power distribution elements:

a. Power distribution paths (dual circuit paths A/B):

(1) Commercial utility bus

(2) Generator bus

(3) Essential bus

(4) Normal bus

(5) Conditioned and critical power buses

(6) Fire life safety (FLS) bus

(7) Maintenance bus.

b. System power distribution buses:

(1) SESHA/SESHB: commercial utility service disconnecting means

(2) SEDSH: facility path A main 480V normal power distribution point

(3) ESHA/ESHB: 480V essential power distribution points

(4) GSHA/GSHB: 480V generator power distribution point

(5) NDPH: 480V normal power distribution point

(6) USHA/USHB: 480V conditioned power source

(7) UDPLA: 208V conditioned power distribution point

(8) CDPL1: 208V critical power distribution point

(9) CPL1: 208Y/120V conditioned power branch circuit panelboard.

c. Power sources:

(1) T-UTIL: Power paths A/B commercial utility transformers:

(a) Voltage classification: 13.8kV primary to 480Y/277V secondary, 60 Hz

(b) Rating: 1500kVA, 5.75% nominal impedance

(c) Type: oil/air cooled, pad mounted.

(2) GEN-A1/GEN-B1: standby diesel-engine generator

(a) Voltage classification: 480Y/120V, 60 Hz

(b) Rating: 1250kW, 0.8 power factor.

(3) UPS-A/UPS-B: uninterruptible power source.

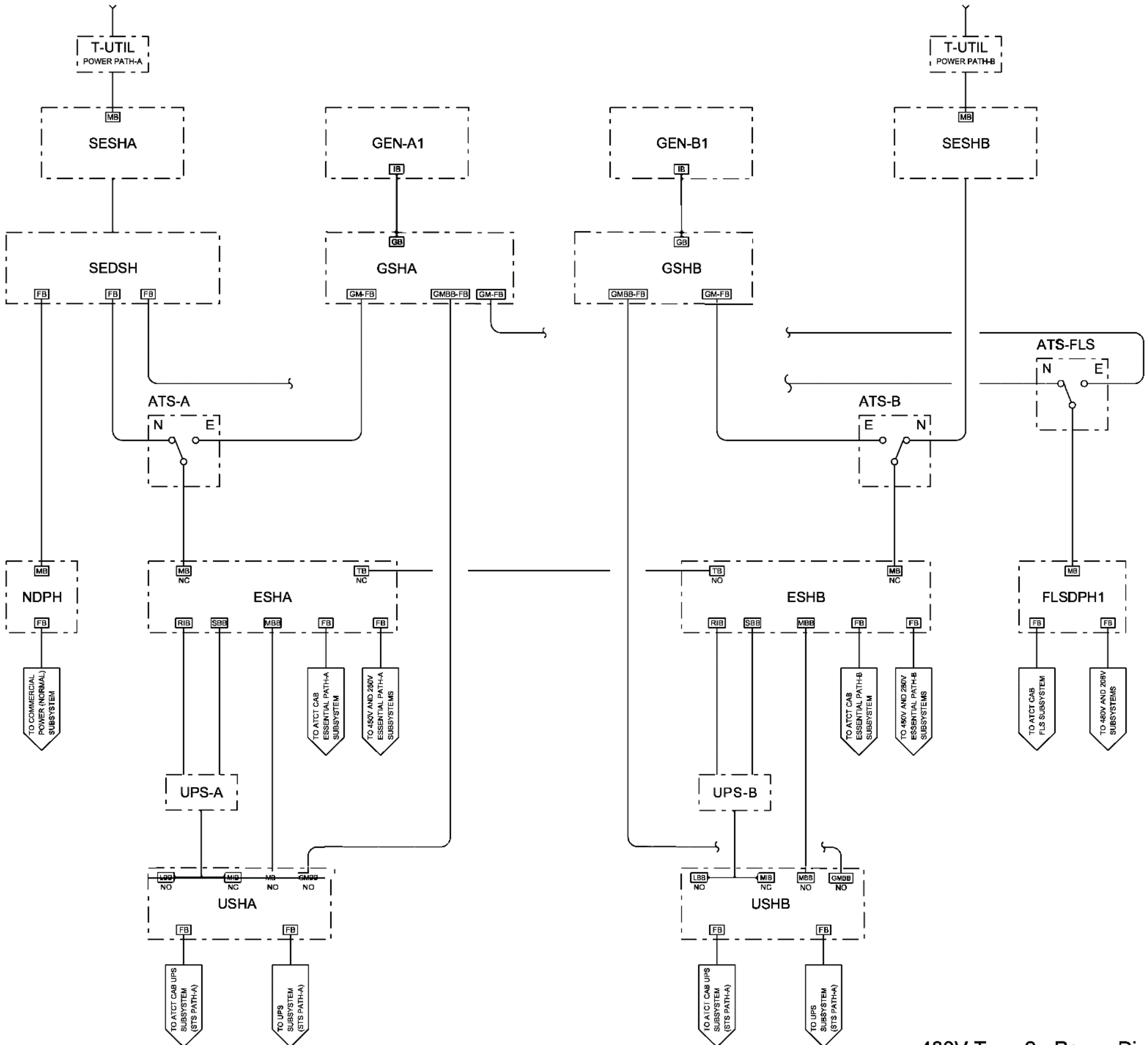
d. Power transfer switches:

(1) ATS-A/ATS-B: essential power automatic transfer switch

(2) ATS-FLS: fire life safety automatic transfer switch

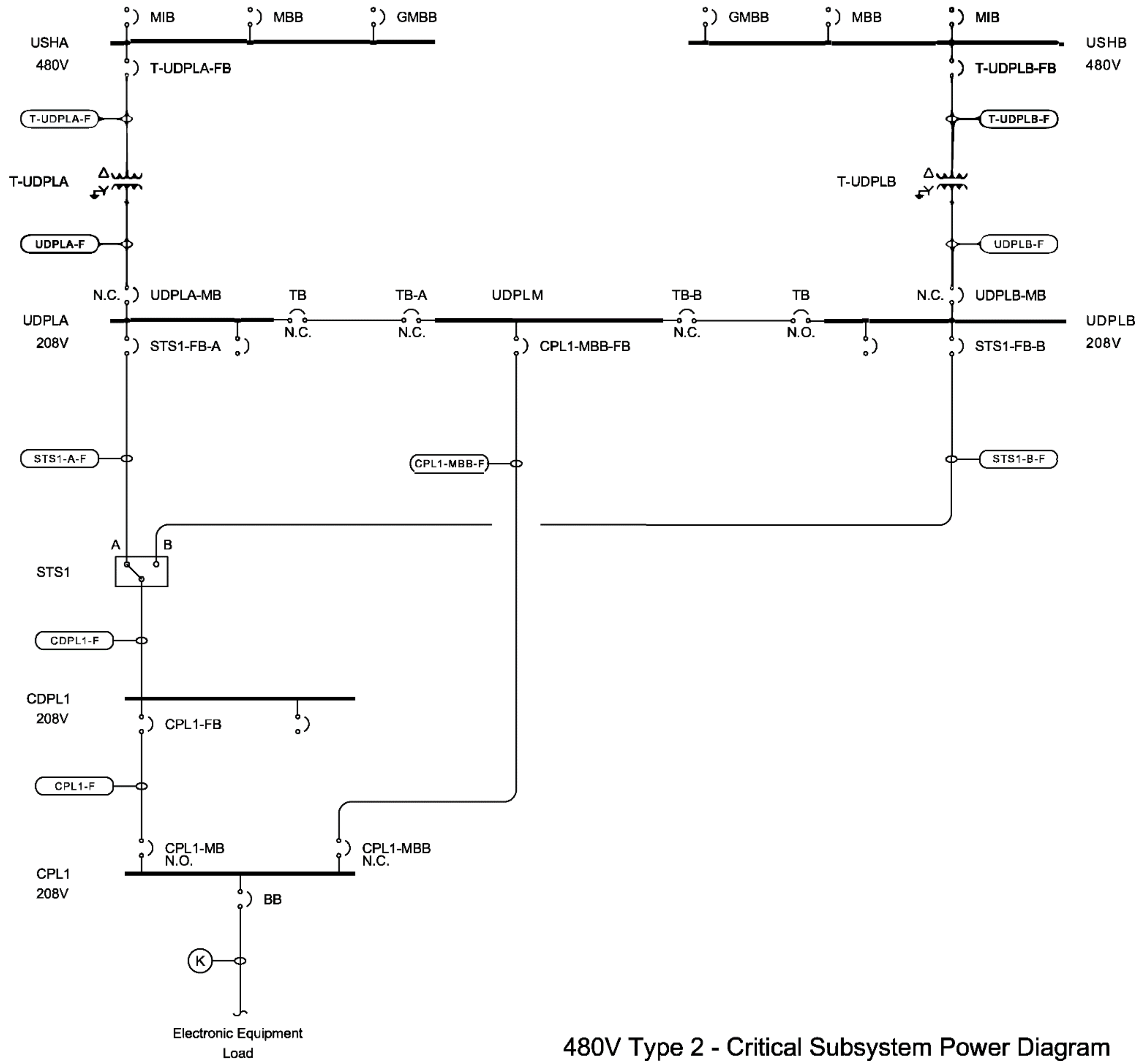
(3) STS1: critical power static transfer switch.

480V CPDS Type 2 Power Diagram 1



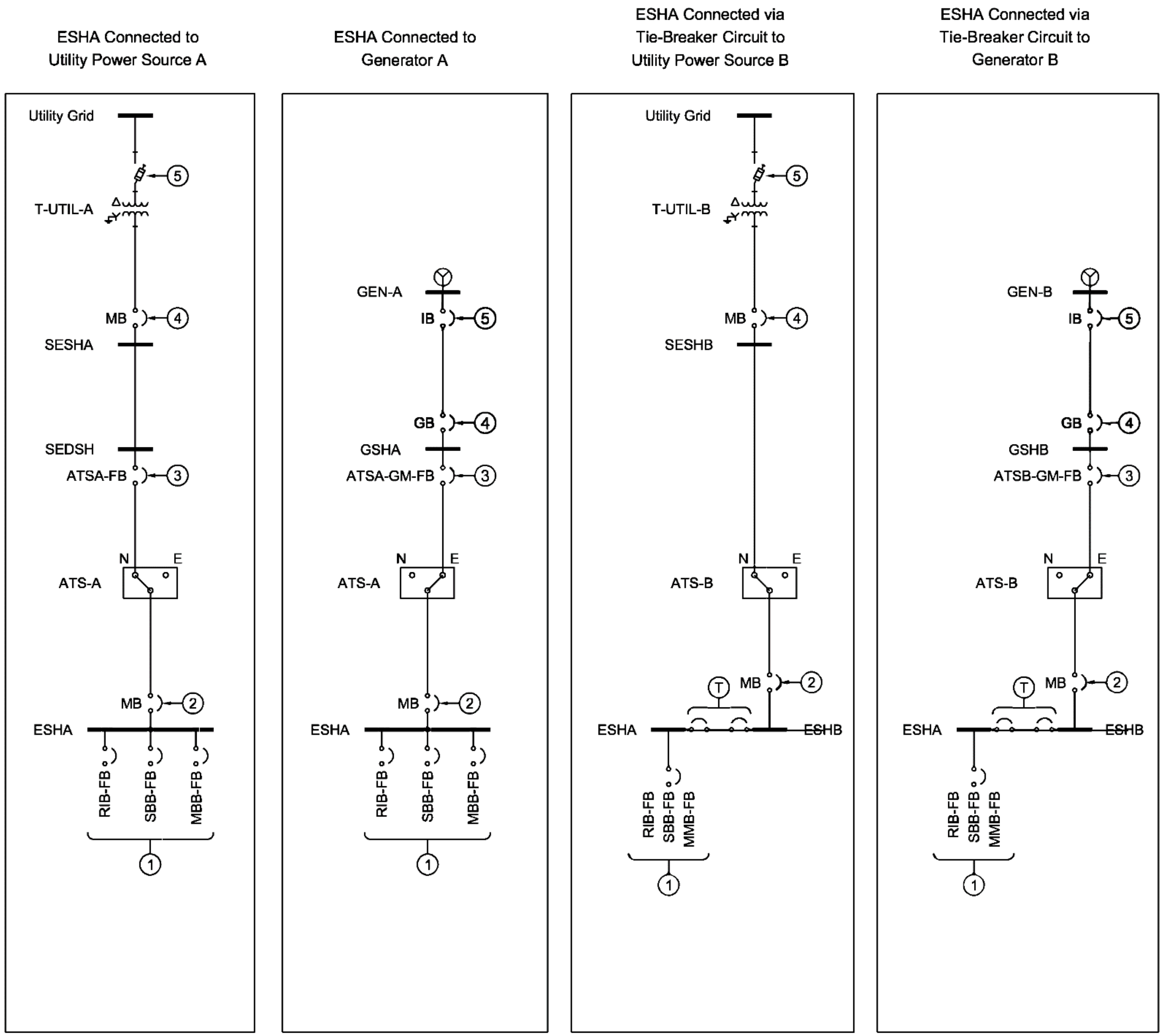
480V Type 2 - Power Diagram

480V CPDS Type 2 Critical Subsystem Power Diagram 2



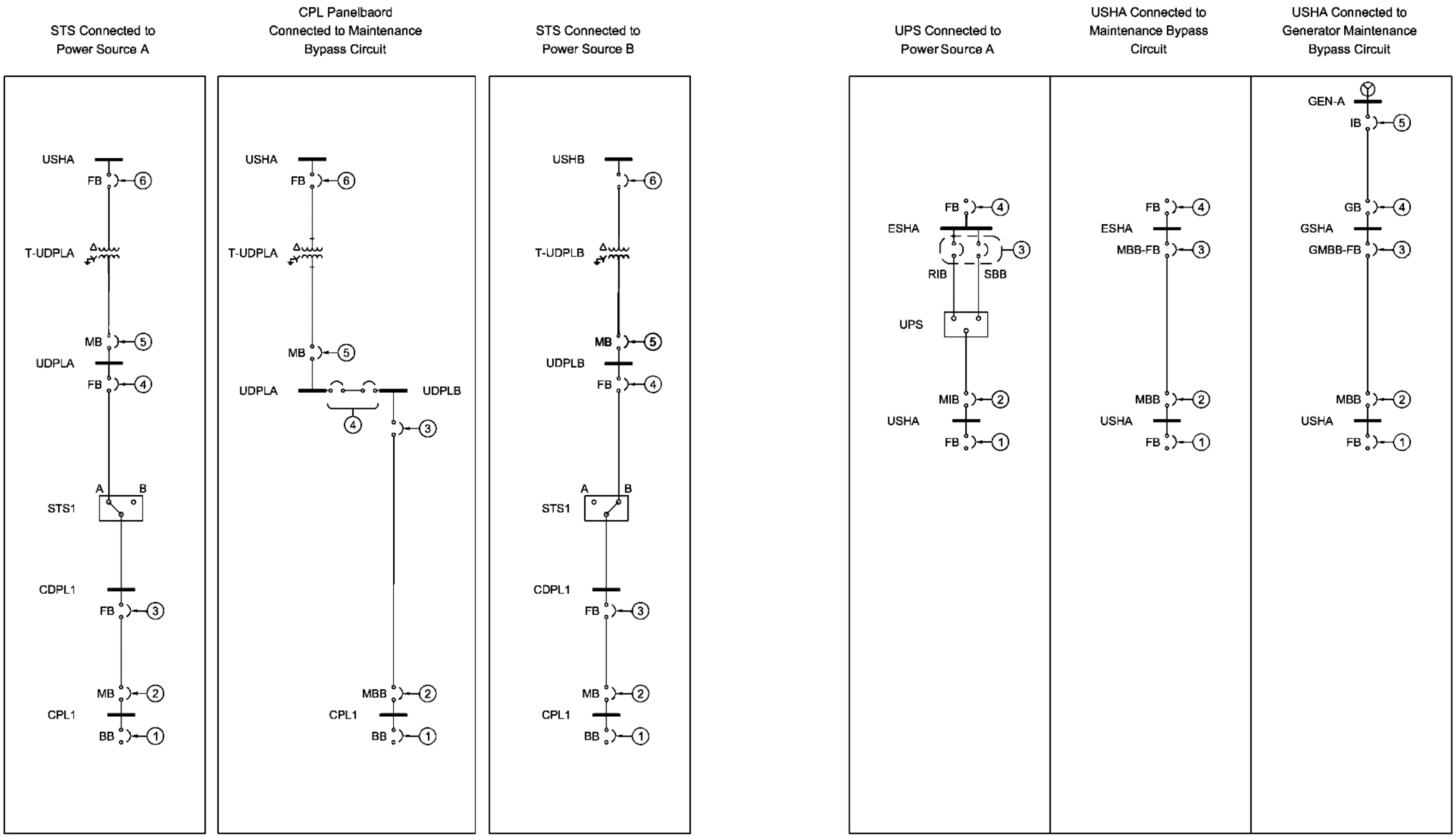
480V Type 2 - Critical Subsystem Power Diagram

480V CPDS Type 2 Maintenance Path Power Diagram 3



480V Type 2 - Maintenance Path Power Diagrams

480V CPDS Type 2 Maintenance Path Power Diagram 4



480V Type 2 - Maintenance Path Power Diagrams

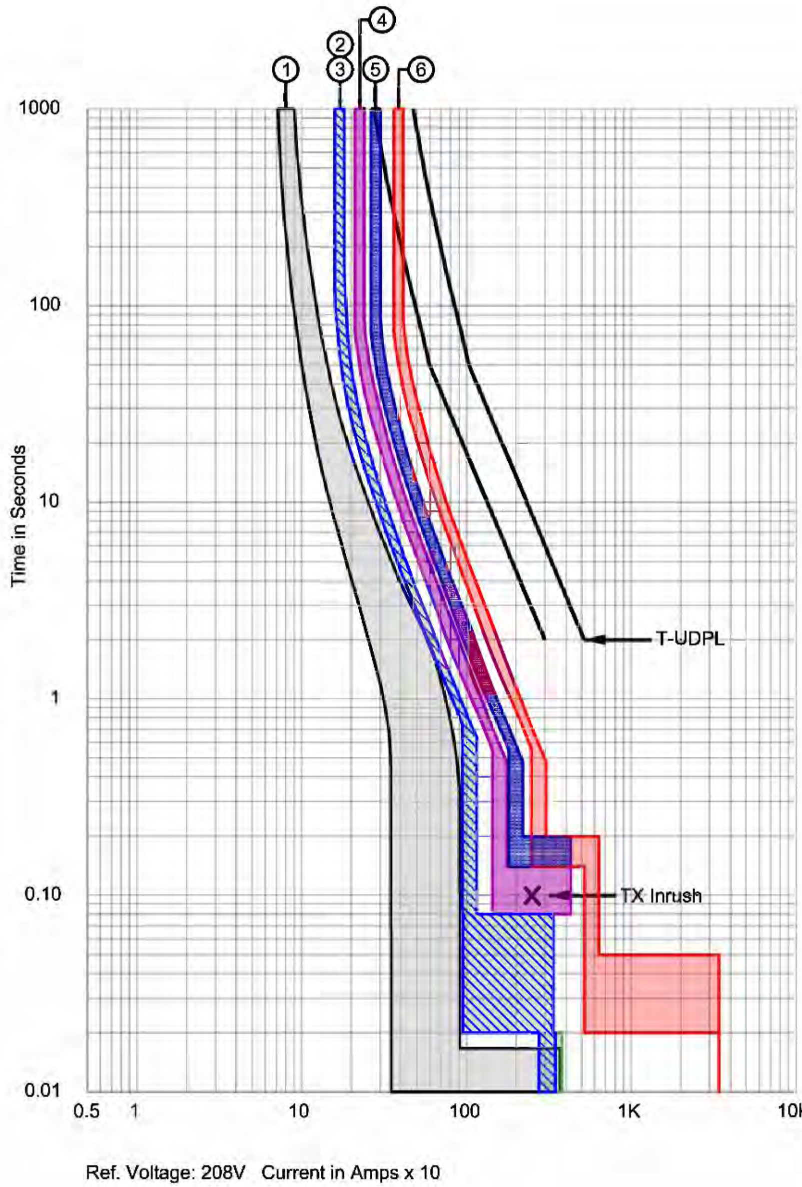
480V CPDS Type 2 TCC-1 Plot

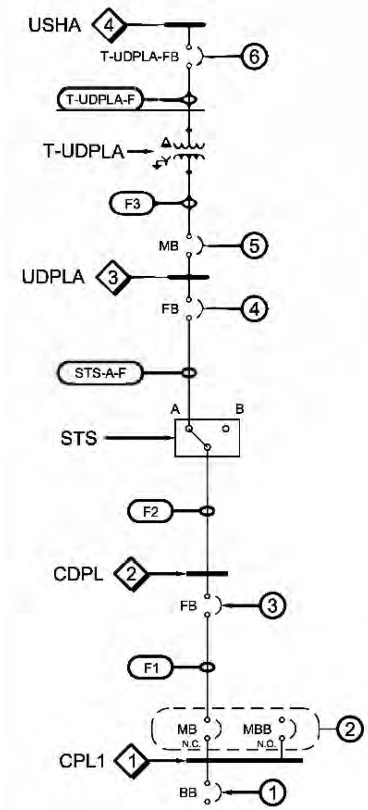
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
4	USHA	Isc 3P RMS Sym (kA)	20.21	23.31	-
	I-Line Dist Panelboard	Iarc fault (kA)	15.48	17.68	-
	480V	Energy (Cal/cm-sq)	5.10	5.88	-
	600A Min. Bus Rating				
3	UDPLA	Isc 3P RMS Sym (kA)	4.43	4.48	-
	I-Line Dist Panelboard	Iarc fault (kA)	1.62	1.64	-
	208Y/120V	Energy (Cal/cm-sq)	3.19	3.16	-
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	3.90	3.94	-
	I-Line Dist Panelboard	Iarc fault (kA)	1.41	1.43	-
	208Y/120V	Energy (Cal/cm-sq)	2.32	2.29	-
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	3.54	3.57	-
	NQOB Panelboard	Iarc fault (kA)	1.48	1.49	-
	208Y/120V	Energy (Cal/cm-sq)	0.26	0.26	-
	150A Min. Bus Rating				





480V CPDS Type 2: TCC-1

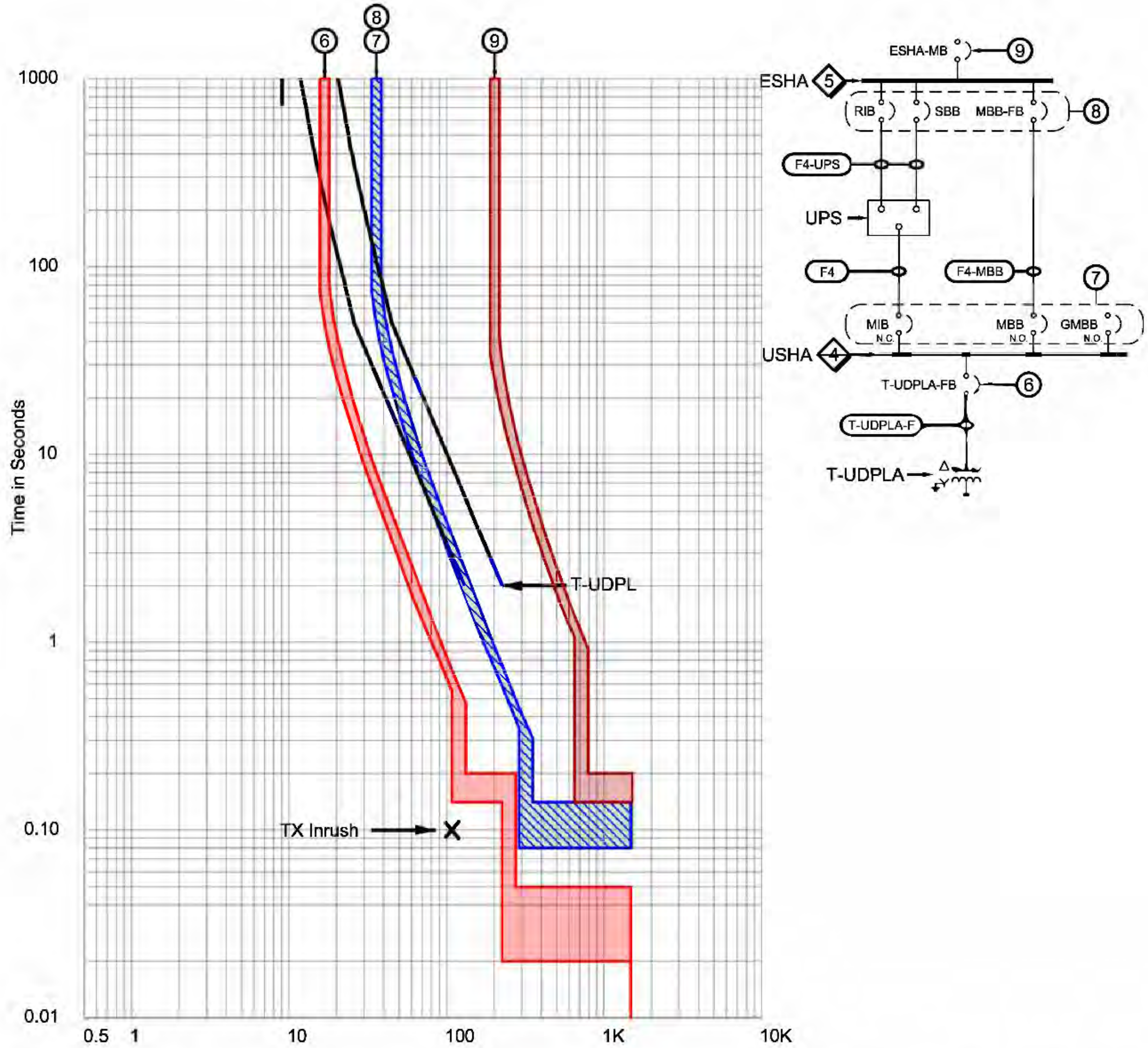
480V CPDS Type 2 TCC-2 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
9	ESHA-MB	RJ, 2000A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 400A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 10, STD = 0.1 (I^s T Off)
		INST = OFF
7	USHA-MIB	PG, 250A Sensor, ML5.0 LSI
	USHA-MBB	LTPU (A) = 0.8, LTD = 1
	USHA-GMBB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	ESHA	Isc 3P RMS Sym (kA)	20.79	24.08	-
	QE2 Switchboard	Iarc fault (kA)	15.90	18.21	-
	480V	Energy (Cal/cm-sq)	7.49	8.67	-
	2500A Min. Bus Rating				
4	USHA	Isc 3P RMS Sym (kA)	20.21	23.31	-
	I-Line Dist. Panelboard	Iarc fault (kA)	15.48	17.68	-
	480V	Energy (Cal/cm-sq)	5.10	5.88	-
	800A Min. Bus Rating				



Ref. Voltage: 480V Current in Amps x 10

480V CPDS Type 2: TCC-2

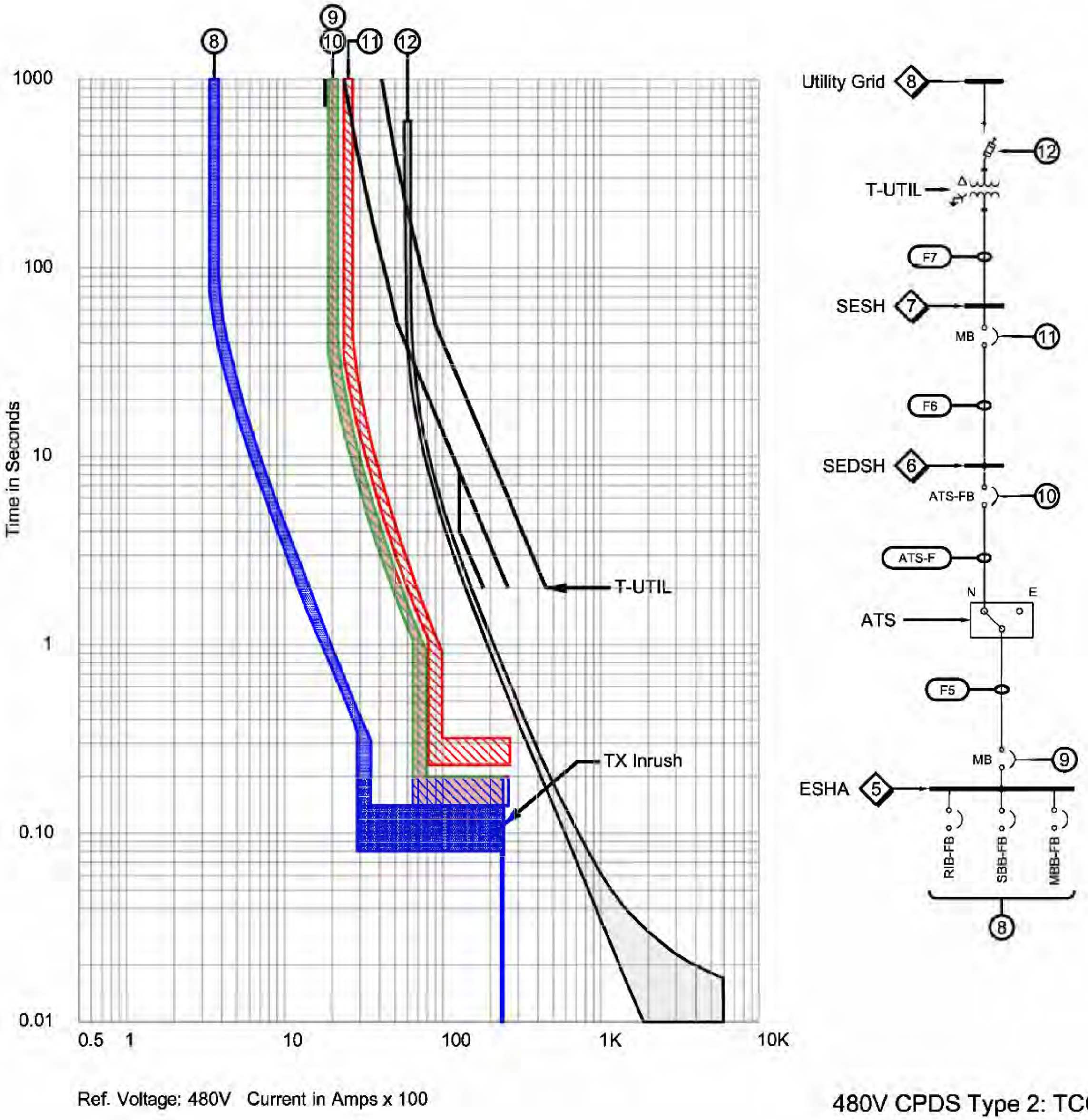
480V CPDS Type 2 TCC-3 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
12	T-UTIL-F	14.4 kV, E-Rated Fuse
		Type: S&C, SM-4, 100E
		Slow Speed, 100A
		TCC No.: 119-4
11	SESH-MB	RJ, 2500A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 15
10	ATS-FB	RJ, 2000A Sensor, ML6.0 LSI
9	ESH-MB	LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
8	Utility Grid Connection	SCA (MVA)	100	500	-
7	SESH	Isc 3P RMS Sym (kA)	22.56	26.51	-
	QE2 Switchboard	Iarc fault (kA)	15.05	17.39	-
	480V	Energy (Cal/cm-sq)	71.7	63.2	-
	2500A Min. Bus Rating				
6	SEDSH	Isc 3P RMS Sym (kA)	22.19	25.99	-
	QE2 Switchboard	Iarc fault (kA)	16.90	19.49	-
	480V	Energy (Cal/cm-sq)	12.8	14.9	-
	2500A Min. Bus Rating				
5	ESHA	Isc 3P RMS Sym (kA)	20.79	24.08	-
	QE2 Switchboard	Iarc fault (kA)	15.90	18.21	-
	480V	Energy (Cal/cm-sq)	7.49	8.67	-
	2500A Min. Bus Rating				



480V CPDS Type 2: TCC-3

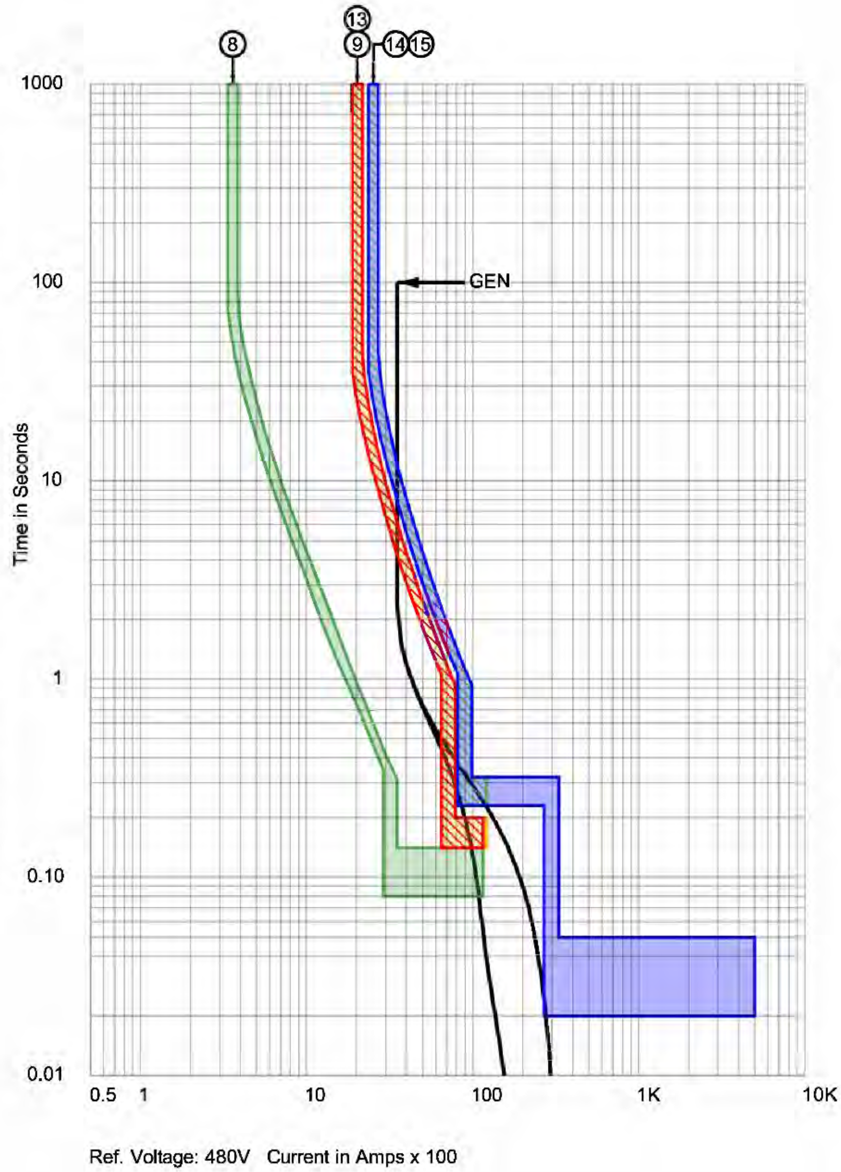
480V CPDS Type 2 TCC-4 Plot

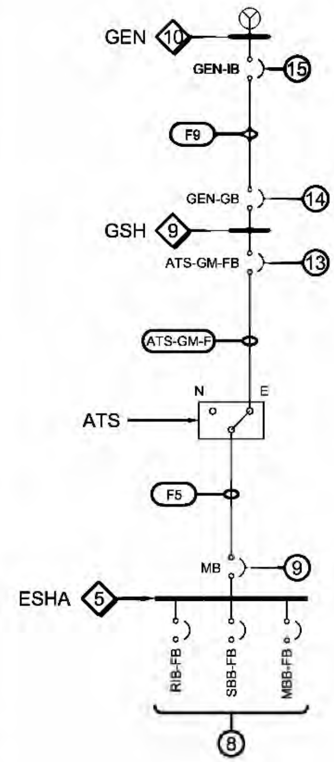
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
15	GEN-IB	RG, 2500A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 12
14	GEN-GB	RG, 2500A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 15
13	ATS-GM-FB	RJ, 2000A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
9	ESHA-MB	RJ, 2000A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
10	Generator Output	Isc 3P RMS Sym (kA)	-	-	12.5
9	GSHA	Isc 3P RMS Sym (kA)	-	-	12.30
	QE2 Switchboard	Iarc fault (kA)	-	-	8.29
	480Y/277V	Energy (Cal/cm-sq)	-	-	25.4
	2500A Min. Bus Rating				
5	ESHA	Isc 3P RMS Sym (kA)	-	-	11.77
	QE2 Switchboard	Iarc fault (kA)	-	-	9.04
	480V	Energy (Cal/cm-sq)	-	-	4.11
	2500A Min. Bus Rating				





480V CPDS Type 2: TCC-4

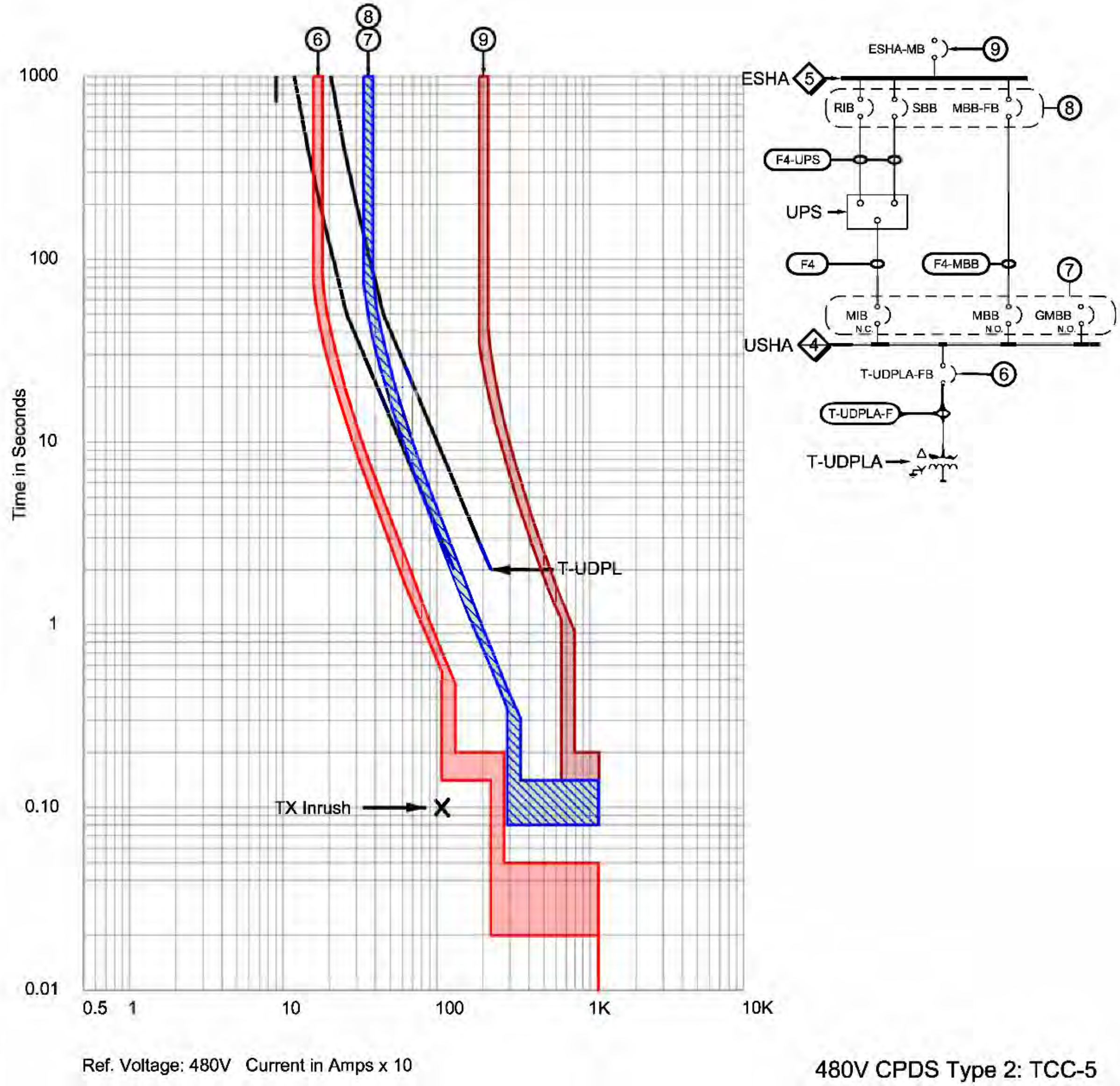
480V CPDS Type 2 TCC-5 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
9	ESHA-MB	RJ, 2000A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
7	USHA-MIB	PG, 250A Sensor, ML5.0 LSI
	USHA-MBB	LTPU (A) = 0.8, LTD = 1
	USHA-GMBB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	ESHA	Isc 3P RMS Sym (kA)	-	-	11.77
	QE2 Switchboard	Iarc fault (kA)	-	-	9.04
	480V	Energy (Cal/cm-sq)	-	-	4.11
	2500A Min. Bus Rating				
4	USHA	Isc 3P RMS Sym (kA)	-	-	11.59
	I-Line Dist. Panelboard	Iarc fault (kA)	-	-	8.90
	480V	Energy (Cal/cm-sq)	-	-	2.83
	600A Min. Bus Rating				



480V CPDS Type 2: TCC-5

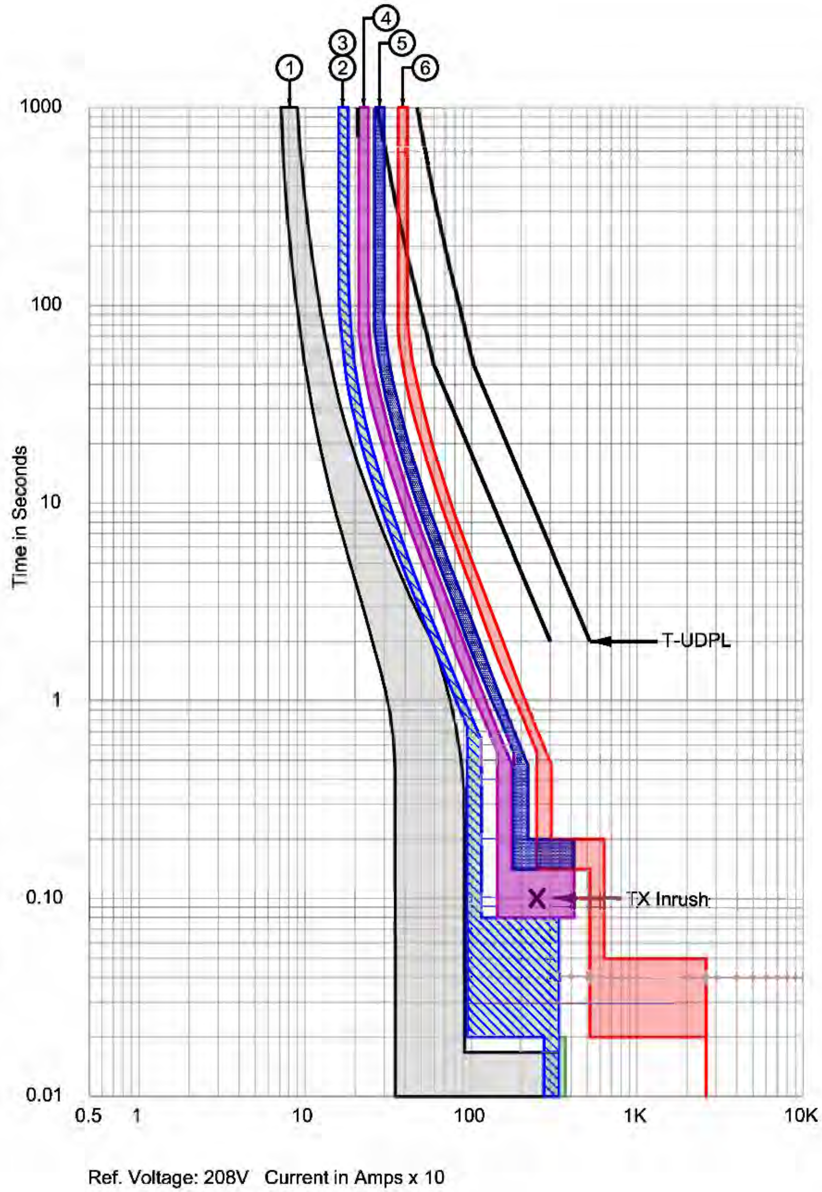
480V CPDS Type 2 TCC-6 Plot

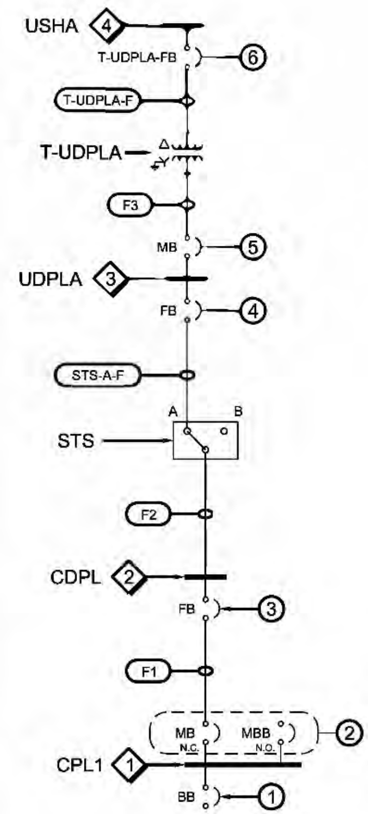
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis Parameter	Min.	Max.	E/G
4	USHA	Isc 3P RMS Sym (kA)	-	-	11.59
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	8.90
	480V	Energy (Cal/cm-sq)	-	-	2.83
	600A Min. Bus Rating				
3	UDPLA	Isc 3P RMS Sym (kA)	-	-	4.20
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	1.53
	208Y/120V	Energy (Cal/cm-sq)	-	-	3.39
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	-	-	3.72
	I-Line Dist Panelboard	Iarc fault (kA)	-	-	1.34
	208Y/120V	Energy (Cal/cm-sq)	-	-	2.44
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	-	-	3.40
	NQOB Panelboard	Iarc fault (kA)	-	-	1.41
	208Y/120V	Energy (Cal/cm-sq)	-	-	0.24
	150A Min. Bus Rating				





480V CPDS Type 2: TCC-6

15. Arc-Flash Risk Assessment Example – 480V CPDS Type 2. This section provides arc-flash calculation results based upon the calculated values of fault current calculations from the short-circuit analysis and the associated protective device fault clearing times determined by the protective device coordination analysis.

The objective of an AFRA analysis is to determine the incident energy potentially present during an arc flash event. The incident energy magnitude is calculated based on the available fault current, the clearing time of associated system protection, and the physical parameters of the system location. Associated with this calculation is the determination of additional arc flash and electrical shock hazard information to comply with NFPA 70E equipment arc flash warning labeling requirements.

The AFRA process involves determination of the worst-case power system short-circuit condition. The worst-case condition is used to characterize potential magnitude of arc flash hazards at distribution points in the power system. The design process must determine appropriate levels of max/min short circuit conditions to coordinate with realistic power system capabilities and operating modes in absence of known data. The AFRA examples use following short-circuit scenarios for power source SCA contributions:

a. *S1: Minimum utility SCA contribution, 100MVA with value 16 for X/R

b. *S2: Maximum utility SCA contribution, 500MVA with value 16 for X/R

c. *S3: Generator power source.

16. AFRA TCC Plots. TCC plots, are included in this section, to illustrate the AFRA calculation results. Refer to Appendix F, power study report example, for the AFRA tabulation format to be included in power study reports.

a. TCC-1: CPL1 critical power panelboard:

(1) Protection scheme includes the panel main and upstream feeder circuit breakers. Selective coordination between the main/feeder and panel downstream branch devices is achieved by using electronic trip type main/feeder devices (Schneider Electric PowerPact JD/FD frame mission critical series).

Informative Note: The TCC plot does not accurately depict the mission critical series characteristics in the instantaneous tripping region. Refer to manufacturer’s published selectivity tables for proper breaker pairing combinations to achieve total selectivity.

(2) The maximum calculated arcing fault current falls within the main/feeder devices short time tripping region and may be cleared using lowest time delay setting (no delay). The main/feeder device trip settings are set to overlap. The upstream feeder device provides backup protection for the panel main breaker.

(3) Incident energy is < 1.2 cal/cm2

b. TCC-2: CDPL critical power bus:

(1) Protection scheme includes the upstream feeder circuit breaker and downstream branch feeder breakers. Selective coordination is achieved by using electronic trip type devices.

The upstream device breaker type is selected to achieve selectivity with the downstream device using manufacturer's recommended breaker pairing combinations for selective coordination.

(2) The maximum calculated arcing fault current falls within the upstream device short time I2T tripping region resulting in extended fault cleared time.

(3) Incident energy is >1.2 cal/cm2 and < 8 cal/cm2

(4) TCC-2A plot shows reduction of incident energy may be possible by adjusting the upstream feeder device short time pickup settings. This adjustment results in minor coordination overlap with the downstream device and may affect system selectivity discrimination.

Informative Note: The system's protection scheme mandatory requirement for the critical and NEC fire life safety power buses is total selective coordination. Reduction of incident energy by adjusting breaker settings as shown in TCC-2A may be desirable for parts of the power system that do not affect discrimination selectivity for system critical and NEC fire life safety power buses.

c. TCC-3: UDPLA condition power distribution panelboard:

(1) Protection scheme includes the upstream feeder circuit breaker and downstream branch feeder breakers. Selective coordination is achieved by using electronic trip type devices. The upstream device breaker type is selected to achieve selectivity with the downstream device using manufacturer's recommended breaker pairing combinations for selective coordination.

(2) The maximum calculated arcing fault current falls within the upstream device short time I2T tripping region resulting in extended fault cleared time.

(3) Incident energy is >1.2 cal/cm2 and < 8 cal/cm2

(4) TCC-3A plot shows reduction of incident energy may be possible by adjusting the upstream feeder device short time pickup settings.

d. TCC-4: USHA conditioned power bus:

(1) Protection scheme includes the upstream feeder circuit breaker and downstream branch feeder breakers. Selective coordination is achieved by using electronic trip type devices and coordinating the short pickup and delay settings to coordinate. The breaker type pairing combinations must be selected in accordance with the device manufacturer's recommended breaker pairing combinations for selective coordination.

(2) The maximum calculated arcing fault current falls within the upstream device short time delay tripping region.

(3) Incident energy is >1.2 cal/cm2 and < 8 cal/cm2

e. TCC-5: ESHA essential power bus:

(1) Protection scheme includes the upstream feeder circuit breaker and downstream branch feeder breakers. Selective coordination is achieved by using electronic trip type devices and coordinating the short pickup and delay settings to coordinate. The breaker type pairing combinations must be selected in accordance with the device manufacturer's recommended breaker pairing combinations for selective coordination.

(2) The maximum calculated arcing fault current falls within the upstream device short time delay tripping region.

(3) Incident energy is >8 cal/cm2

f. TCC-6: SEDSH normal power bus:

(1) Protection scheme includes the upstream feeder circuit breaker and downstream branch feeder breakers. Selective coordination is achieved by using electronic trip type devices and coordinating the short pickup and delay settings to coordinate. The breaker type pairing combinations must be selected in accordance with the device manufacturer's recommended breaker pairing combinations for selective coordination.

(2) The maximum calculated arcing fault current falls within the upstream device short time delay tripping region.

(3) Incident energy is >8 cal/cm2

(4) The design must be based upon realistic estimates for system demand load and power source capacity requirements to avoid oversizing the distribution system. Table G-3, AFRA tabulation shows effect of the utility power source transformer capacity rating can have on system incident energy values when applied to this CPDS Type 2 example configuration.

480V CPDS Type 2 AFRA TCC-1 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

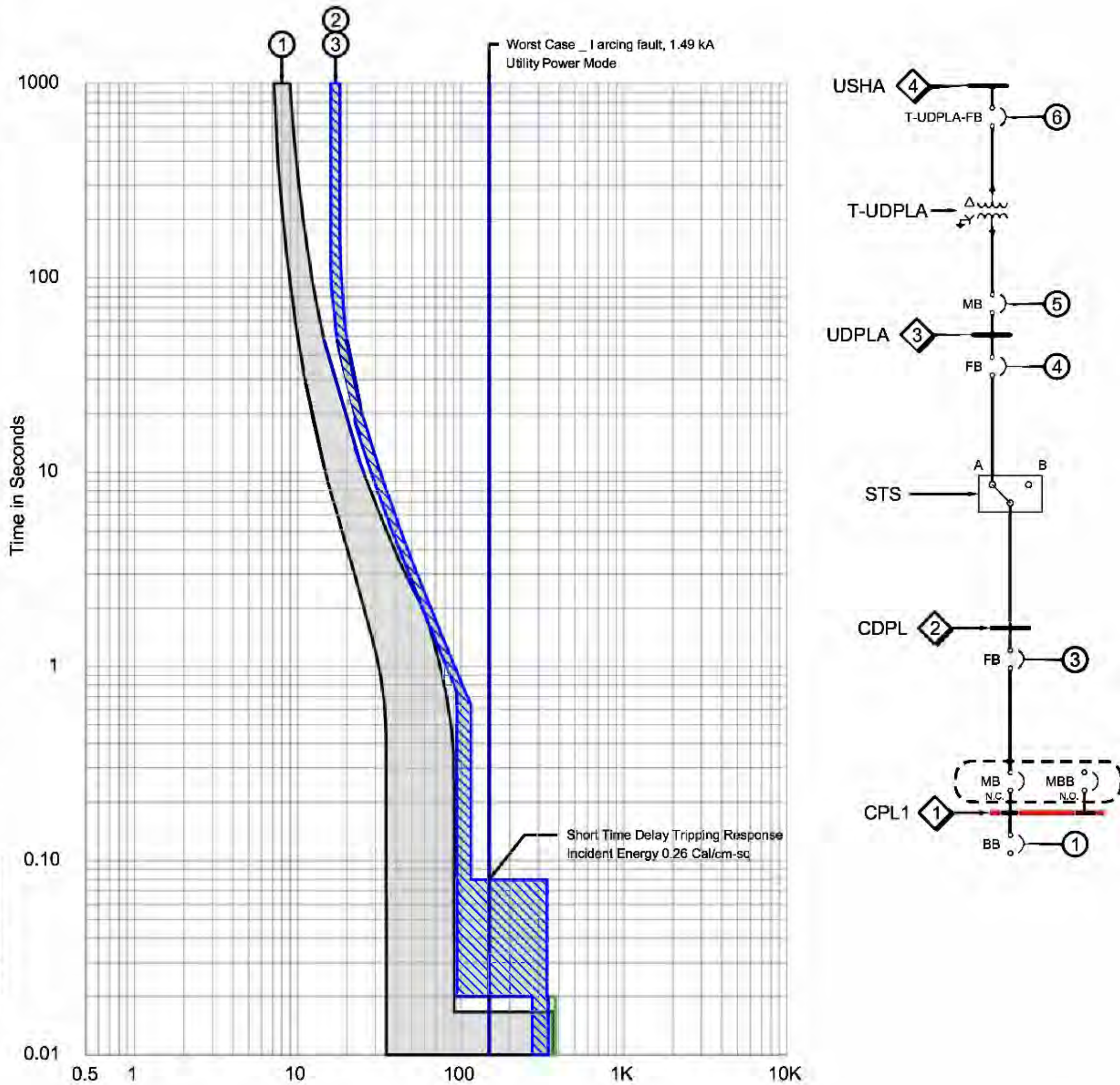
Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
4	USHA	Isc 3P RMS Sym (kA)	20.21	23.31	11.59
	I-Line Dist Panelboard	Iarc fault (kA)	15.48	17.68	8.90
	480V	Energy (Cal/cm-sq)	5.10	5.88	2.83
	600A Min. Bus Rating				
3	UDPLA	Isc 3P RMS Sym (kA)	4.43	4.48	4.20
	I-Line Dist Panelboard	Iarc fault (kA)	1.62	1.64	1.53
	208Y/120V	Energy (Cal/cm-sq)	3.19	3.16	3.39
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	3.90	3.94	3.72
	I-Line Dist Panelboard	Iarc fault (kA)	1.41	1.43	1.34
	208Y/120V	Energy (Cal/cm-sq)	2.32	2.29	2.44
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	3.54	3.57	3.40
	NQOB Panelboard	Iarc fault (kA)	1.48	1.49	1.41
	208Y/120V	Energy (Cal/cm-sq)	0.26	0.26	0.24
	150A Min. Bus Rating				

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
CPL1	CPL1-MB	0.208	3.57	1.49	3.57	1.49	0.26	(*N3) (*S3)	-
CPL1	CPL1-FB	0.208	3.57	1.49	3.57	1.49	0.26	(*S1) (*N22 - CPL1-MB)	25

(*N3) - Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)



Ref. Voltage: 208V Current in Amps x 10
Bus: CPL1

480V CPDS Type 2 AFRA: TCC-1

480V CPDS Type 2 AFRA TCC-2 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

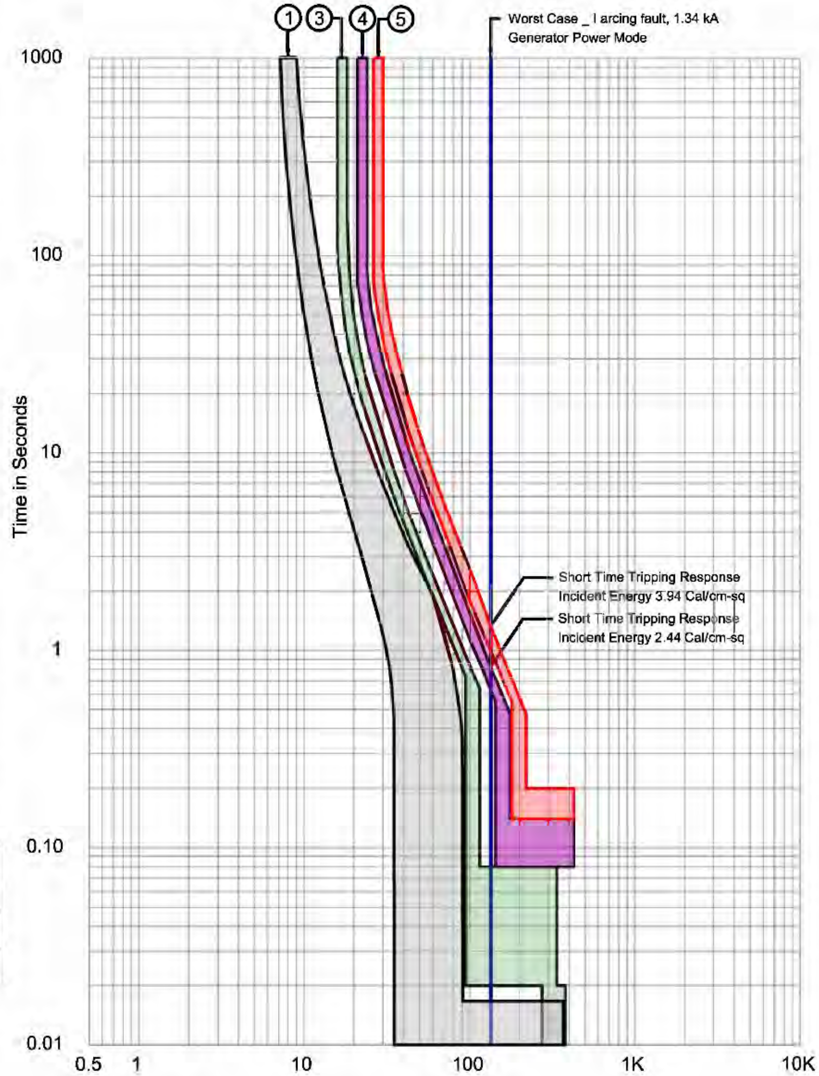
Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
4	USHA	Isc 3P RMS Sym (kA)	20.21	23.31	11.59
	I-Line Dist Panelboard	Iarc fault (kA)	15.48	17.68	8.90
	480V	Energy (Cal/cm-sq)	5.10	5.88	2.83
	600A Min. Bus Rating				
3	UDPLA	Isc 3P RMS Sym (kA)	4.43	4.48	4.20
	I-Line Dist Panelboard	Iarc fault (kA)	1.62	1.64	1.53
	208Y/120V	Energy (Cal/cm-sq)	3.19	3.16	3.39
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	3.90	3.94	3.72
	I-Line Dist Panelboard	Iarc fault (kA)	1.41	1.43	1.34
	208Y/120V	Energy (Cal/cm-sq)	2.32	2.29	2.44
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	3.54	3.57	3.40
	NQOB Panelboard	Iarc fault (kA)	1.48	1.49	1.41
	208Y/120V	Energy (Cal/cm-sq)	0.26	0.26	0.24
	150A Min. Bus Rating				

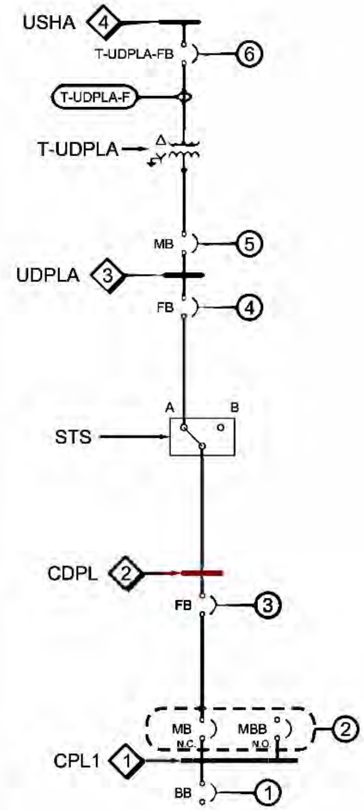
Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
CDPL	STS-A-FB	0.208	3.72	1.34	3.72	1.34	2.44	(*N3) (*S3)	50
CDPL	UDPLA-MB	0.208	3.72	1.34	3.72	1.34	3.94	(*N3) (*S3) (*N22 - STS-A-FB)	50

(*N3) - Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)



Ref. Voltage: 208V Current in Amps x 10
Bus: CDPL



480V CPDS Type 2 AFRA: TCC-2

480V CPDS Type 2 AFRA TCC-2A Plot

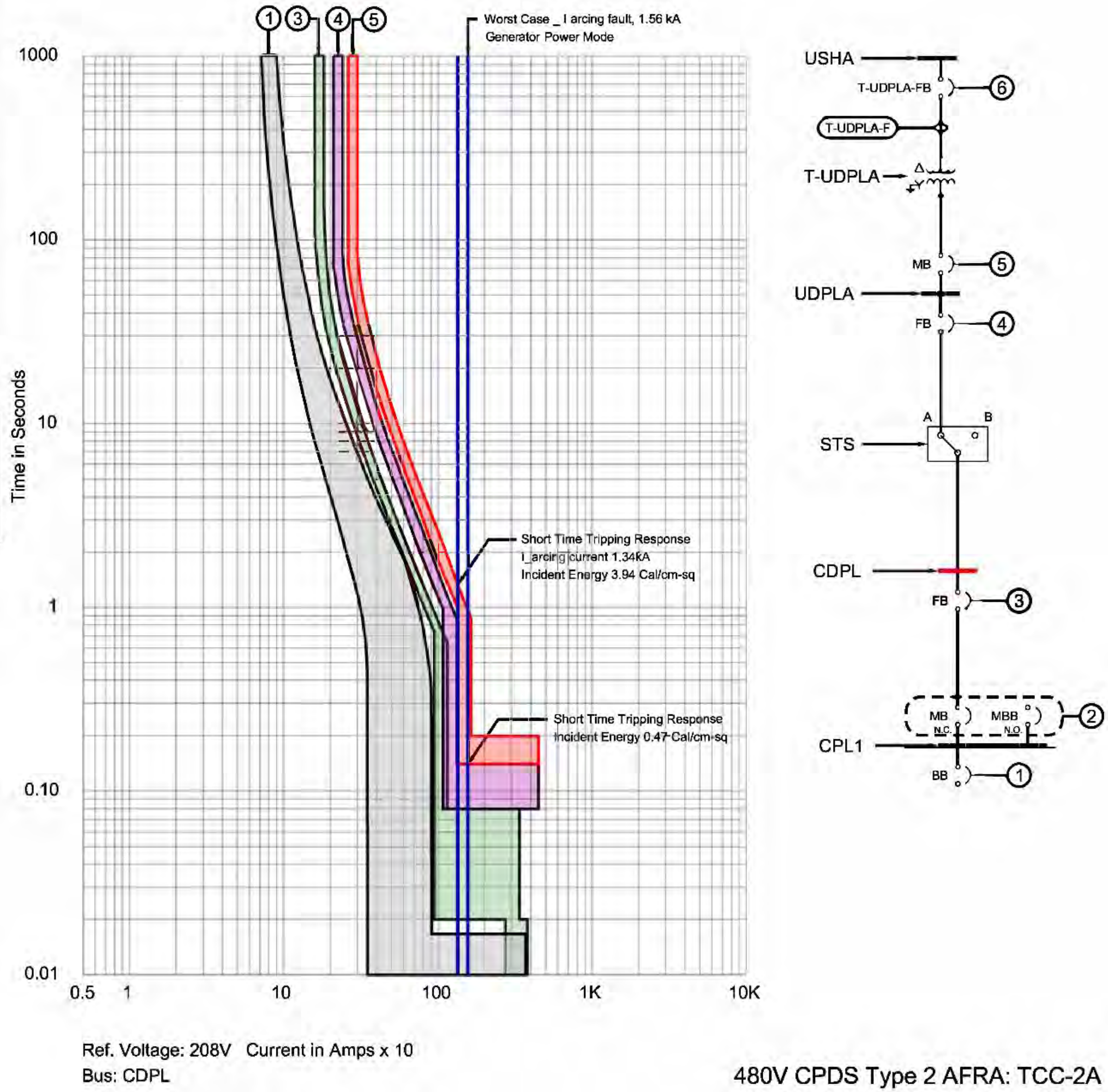
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = .45, LTD = 1
		STPU = 6, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 6, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 6, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
CDPL	STS-A-FB	0.208	3.72	1.56	3.72	1.56	0.47	(*N3) (*S3)	50
CDPL	UDPLA-MB	0.208	3.72	1.34	3.72	1.34	3.94	(*N3) (*S3) (*N22 - STS-A-FB)	50

(*N3) - Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)



480V CPDS Type 2 AFRA: TCC-2A

480V CPDS Type 2 AFRA TCC-3 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^t T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 8, STD = 0.2 (I^t T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 8, STD = 0.1 (I^t T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^t T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

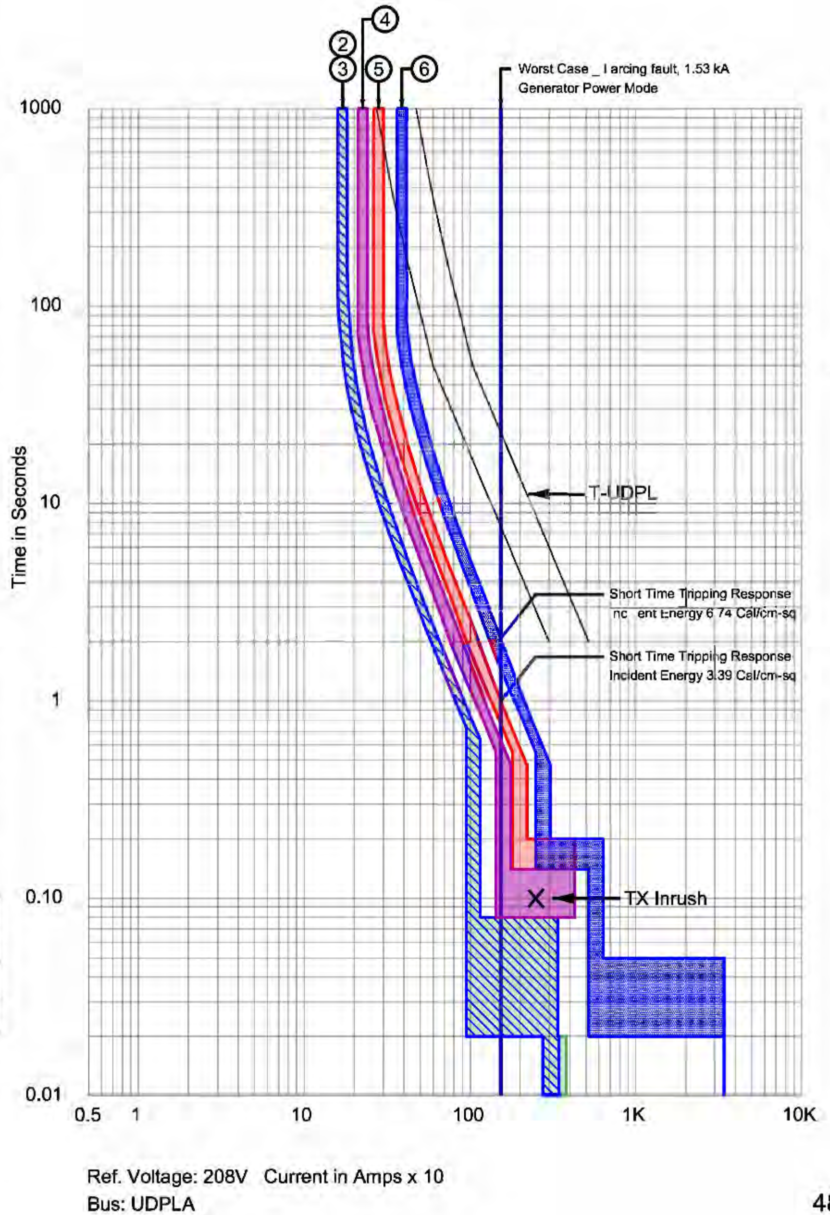
Distribution Bus

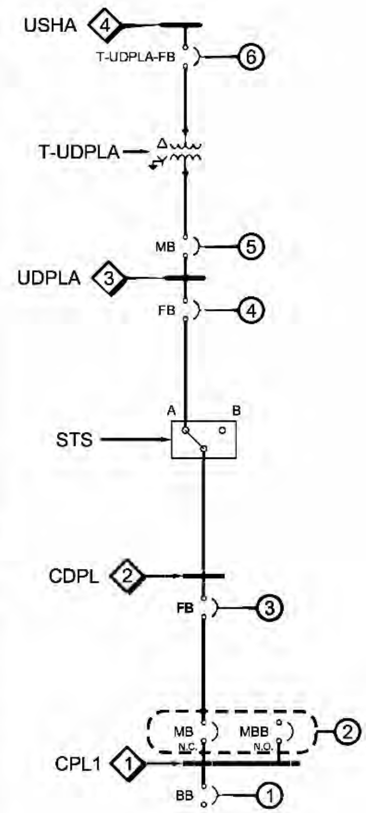
No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
4	USHA	Isc 3P RMS Sym (kA)	20.21	23.31	11.59
	I-Line Dist Panelboard	Iarc fault (kA)	15.48	17.68	8.90
	480V	Energy (Cal/cm-sq)	5.10	5.88	2.83
	600A Min. Bus Rating				
3	UDPLA	Isc 3P RMS Sym (kA)	4.43	4.48	4.20
	I-Line Dist Panelboard	Iarc fault (kA)	1.62	1.64	1.53
	208Y/120V	Energy (Cal/cm-sq)	3.19	3.16	3.39
	400A Min. Bus Rating				
2	CDPL	Isc 3P RMS Sym (kA)	3.90	3.94	3.72
	I-Line Dist Panelboard	Iarc fault (kA)	1.41	1.43	1.34
	208Y/120V	Energy (Cal/cm-sq)	2.32	2.29	2.44
	400A Min. Bus Rating				
1	CPL1	Isc 3P RMS Sym (kA)	3.54	3.57	3.40
	NQOB Panelboard	Iarc fault (kA)	1.48	1.49	1.41
	208Y/120V	Energy (Cal/cm-sq)	0.26	0.26	0.24
	150A Min. Bus Rating				

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
UDPLA	UDPLA-MB	0.208	4.20	1.53	4.20	1.53	3.39	(*N3) (*S3)	-
UDPLA	T-UDPLA-FB	0.208	4.20	1.53	4.20	1.53	6.74	(*N3) (*N9) (*S3) (*N22 - UDPLA-MB)	65

(*N3) - Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)





480V CPDS Type 2 AFRA: TCC-3

480V CPDS Type 2 AFRA TCC-3A Plot

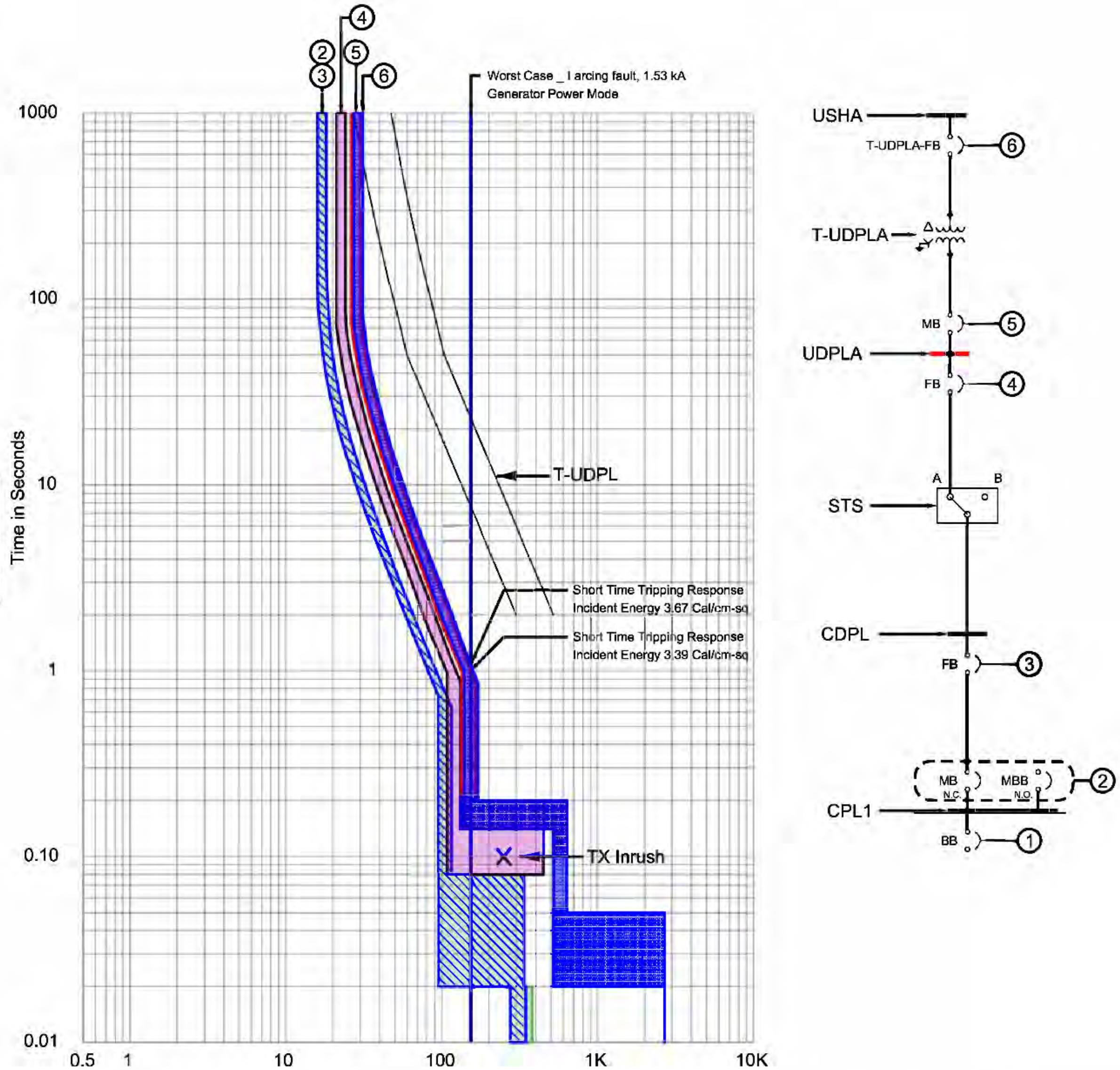
TCC Device

No.	Device Name	Device Type / Trip Unit Settings
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.45, LTD = 1
		STPU = 6, STD = 0.2 (I^s T Off)
		INST = 10
5	UDPLA-MB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 1, LTD = 1
		STPU = 6, STD = 0.2 (I^s T Off)
		INST = OFF
4	STS-A-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.8, LTD = 1
		STPU = 6, STD = 0.1 (I^s T Off)
		INST = OFF
3	CPL1-FB	JD, 250A Sensor, ML5.2 LSI
2	CPL1-MB	Mission Critical Series
	CPL1-MBB	LTPU (A) = 150A, LTD = 1
		STPU = 7, STD = 0.0 (I^s T Off)
		INST = 12
1	CPL1-BB	QO, 70A/1P, T/M

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	ProtDev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
UDPLA	UDPLA-MB	0.208	4.20	1.53	4.20	1.53	3.39	(*N3) (*S3)	-
UDPLA	T-UDPLA-FB	0.208	4.20	1.53	4.20	1.53	3.67	(*N3) (*N9) (*S3) (*N22 - UDPLA-MB)	65

(*N3) - Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)



Ref. Voltage: 208V   Current in Amps x 10
Bus: UDPLA

480V CPDS Type 2 AFRA: TCC-3A

480V CPDS Type 2 AFRA TCC-4 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
9	ESHA-MB	RJ, 2000A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 400A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 10, STD = 0.1 (I^s T Off)
		INST = OFF
7	USHA-MIB	PG, 250A Sensor, ML5.0 LSI
	USHA-MBB	LTPU (A) = 0.8, LTD = 1
	USHA-GMBB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF
6	T-UDPLA-FB	PG, 250A Sensor, ML5.0 LSI
		LTPU (A) = 0.6, LTD = 1
		STPU = 8, STD = 0.2 (I^s T Off)
		INST = 10

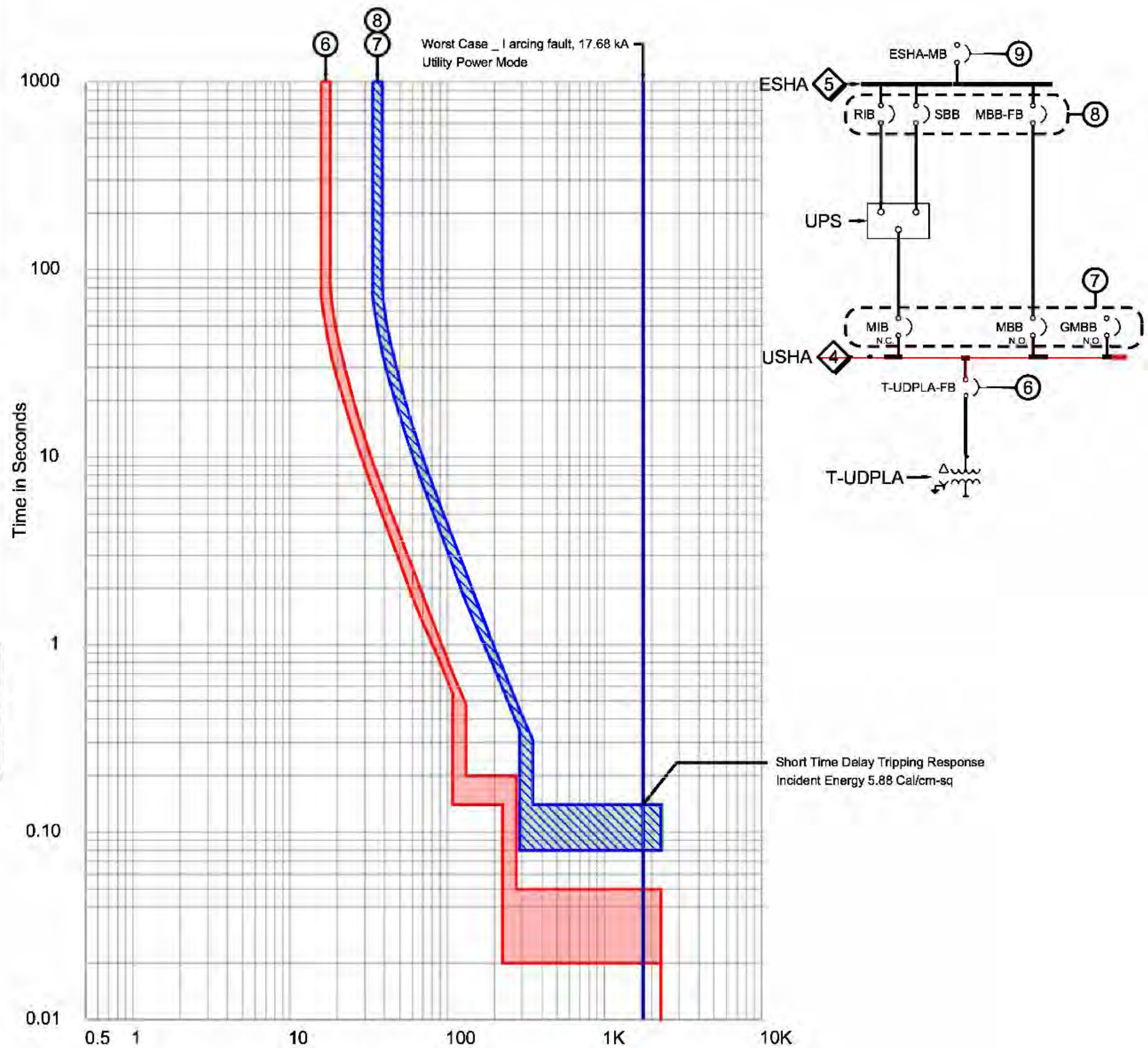
Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
5	ESHA	Isc 3P RMS Sym (kA)	20.79	24.08	11.77
	QE2 Switchboard	Iarc fault (kA)	15.90	18.21	9.04
	480V	Energy (Cal/cm-sq)	7.49	8.67	4.11
	2500A Min. Bus Rating				
4	USHA	Isc 3P RMS Sym (kA)	20.21	23.31	11.59
	I-Line Dist. Panelboard	Iarc fault (kA)	15.48	17.68	8.90
	480V	Energy (Cal/cm-sq)	5.10	5.88	2.83
	800A Min. Bus Rating				

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
USHA	USHA-MBB	0.480	23.31	17.68	23.31	17.68	5.88	(*N3) (*S3)	-
USHA	USHA -MBB-FB	0.480	23.31	17.68	23.31	17.68	5.88	(*S1) (*N22 - USHA-MBB)	15

(*N3) - Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, Include Ind. Motors for 5.0 Cycles, mis-coordination checked)



Ref. Voltage: 480V Current in Amps x 10
Bus: USHA

480V CPDS Type 2 AFRA: TCC-4

480V CPDS Type 2 AFRA TCC-5 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
12	T-UTIL-F	14.4 kV, E-Rated Fuse
		Type: S&C, SM-4, 100E
		Slow Speed, 100A
		TCC No.: 119-4
11	SESH-MB	RJ, 2500A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.3 (I^t T Off)
		INST = 15
10	ATS-FB	RJ, 2000A Sensor, ML6.0 LSI
9	ESH-MB	LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^t T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^t T Off)
		INST = OFF

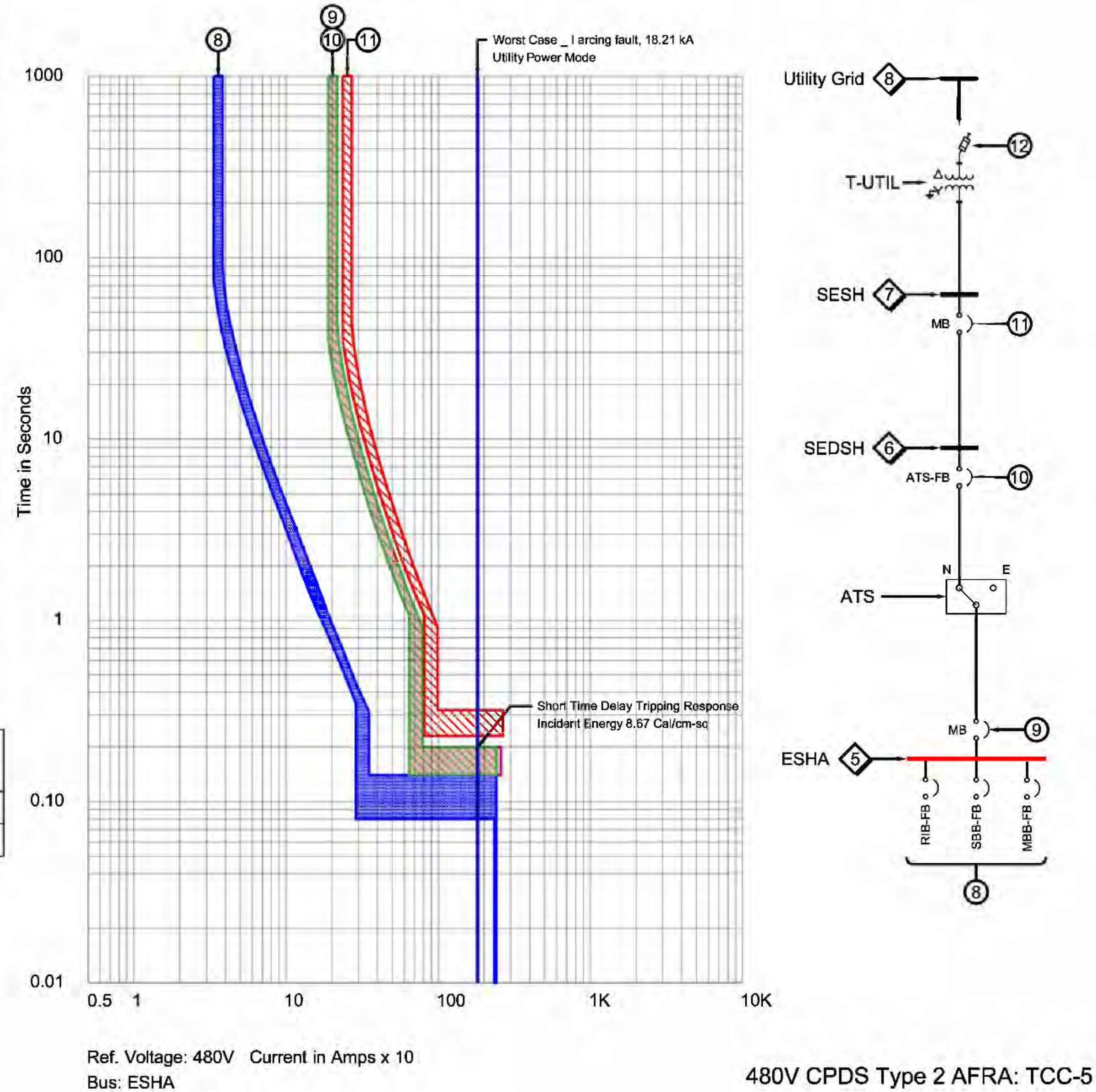
Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
8	Utility Grid Connection	SCA (MVA)	100	500	-
7	SESH	Isc 3P RMS Sym (kA)	22.56	26.51	-
	QE2 Switchboard	Iarc fault (kA)	15.05	17.39	-
	480V	Energy (Cal/cm-sq)	71.7	63.2	-
	2500A Min. Bus Rating				
6	SEDSH	Isc 3P RMS Sym (kA)	22.19	25.99	-
	QE2 Switchboard	Iarc fault (kA)	16.90	19.49	-
	480V	Energy (Cal/cm-sq)	12.8	14.9	-
	2500A Min. Bus Rating				
5	ESHA	Isc 3P RMS Sym (kA)	20.79	24.08	11.77
	QE2 Switchboard	Iarc fault (kA)	15.90	18.21	9.04
	480V	Energy (Cal/cm-sq)	7.49	8.67	4.11
	2500A Min. Bus Rating				

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
ESHA	ESHA-MB	0.480	24.08	18.21	24.08	18.21	8.67	(*S3)	-
ESHA	ATS-A-FB	0.480	24.08	18.21	24.08	18.21	8.67	(*S3) (*N22 - ESHA-MB)	15

(*N3) - Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)



480V CPDS Type 2 AFRA TCC-6 Plot

TCC Device

No.	Device Name	Device Type / Trip Unit Settings
12	T-UTIL-F	14.4 kV, E-Rated Fuse
		Type: S&C, SM-4, 100E
		Slow Speed, 100A
		TCC No.: 119-4
11	SESH-MB	RJ, 2500A Sensor, ML6.0 LSI
		LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.3 (I^s T Off)
		INST = 15
10	ATS-FB	RJ, 2000A Sensor, ML6.0 LSI
9	ESH-MB	LTPU (A) = 0.9, LTD = 0.5
		STPU = 4, STD = 0.2 (I^s T Off)
		INST = 15
8	UPS-RIB-FB	PG, 250A Sensor, ML5.0 LSI
	UPS-SBB-FB	LTPU (A) = 0.8, LTD = 1
	USHA-MBB-FB	STPU = 8, STD = 0.1 (I^s T Off)
		INST = OFF

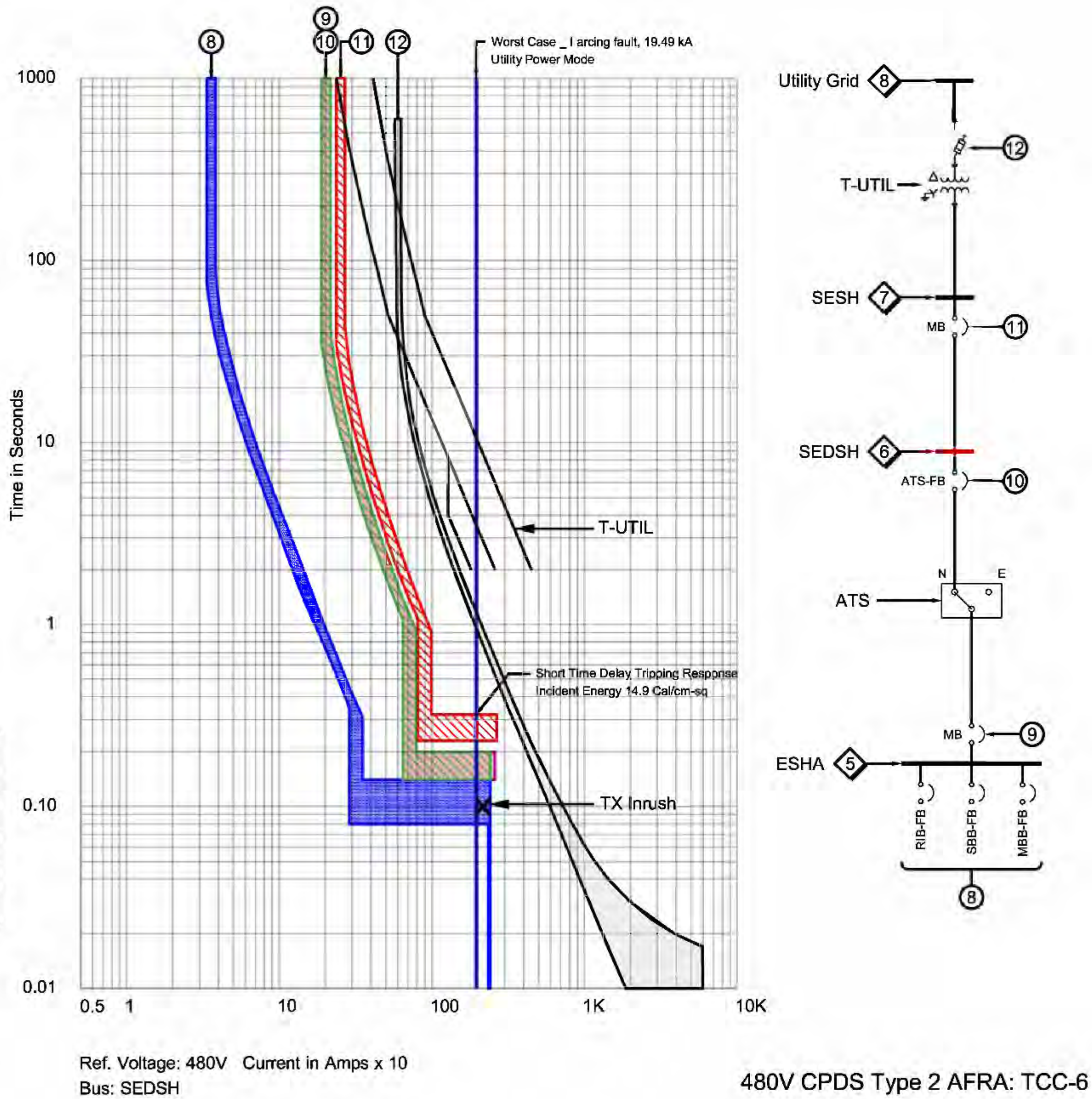
Distribution Bus

No.	Bus Name / Equipment Type	Short-Circuit Analysis			
		Parameter	Min.	Max.	E/G
8	Utility Grid Connection	SCA (MVA)	100	500	-
7	SESH	Isc 3P RMS Sym (kA)	22.56	26.51	-
	QE2 Switchboard	Iarc fault (kA)	15.05	17.39	-
	480V	Energy (Cal/cm-sq)	71.7	63.2	-
	2500A Min. Bus Rating				
6	SEDSH	Isc 3P RMS Sym (kA)	22.19	25.99	-
	QE2 Switchboard	Iarc fault (kA)	16.90	19.49	-
	480V	Energy (Cal/cm-sq)	12.8	14.9	-
	2500A Min. Bus Rating				
5	ESHA	Isc 3P RMS Sym (kA)	20.79	24.08	11.77
	QE2 Switchboard	Iarc fault (kA)	15.90	18.21	9.04
	480V	Energy (Cal/cm-sq)	7.49	8.67	4.11
	2500A Min. Bus Rating				

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	ProtDev Bolted Fault (kA)	ProtDev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
SEDSH	SESHA-MB	0.480	25.99	19.49	25.99	19.49	14.9	(*S3)	25
SEDSH	T-UTIL-F	0.480	25.99	17.09	25.99	17.09	84.4	(*N2) (*N9) (*S3) (*N22 - T-UTIL-F)	-
SESHA	T-UTIL-F	0.480	26.51	17.39	26.51	17.39	63.2	(*N3) (*S3)	-
SESHA	MaxTripTime @ 2.0 s	0.480	26.51	19.84	26.51	19.84	95.10	(*N2) (*N9) (*S3) (*N22 - T-UTIL-F)	-

(*N2) < 80% Cleared Fault Threshold
(*N3) – Arcing Current Low Tolerances Used
(*N9) - Max Arcing Duration Reached
(*N22) - Main Device failed, use upstream device
(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA
(*S2) - Short Circuit (Min) Scenario, 100 MVA Utility SCA
(*S3) - Short Circuit Scenario, Generator Power Source

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)



480V CPDS Type 2 AFRA: TCC-6

Table G-3: AFRA Example 480V CPDS Type 2 - Utility Power Source Capacities

Utility Transformer Capacity: 500 kVA

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
SESHA	T-UTIL-F	0.480	10.33	7.91	10.33	7.91	34.4	(*N9)	100
SEDSH	SESHA-MB	0.480	10.09	7.72	10.09	7.72	5.55		25
ESHA	ESHA-MB	0.480	9.79	7.48	9.79	7.48	3.36	(*N3)	
USHA	USHA-MBB	0.480	9.66	7.37	9.66	7.37	2.31		

Utility Transformer Capacity: 750 kVA

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
SESHA	T-UTIL-F	0.480	15.68	10.60	15.68	10.68	38.5	(*N3)	100
SEDSH	SESHA-MB	0.480	15.40	11.87	15.40	11.87	8.77		25
ESHA	ESHA-MB	0.480	14.71	11.34	14.71	11.34	5.22		
USHA	USHA-MBB	0.480	14.42	11.11	14.42	11.11	3.58		

Utility Transformer Capacity: 1000 kVA

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
SESHA	T-UTIL-F	0.480	17.94	12.10	17.94	12.10	56.8	(*N3)	100
SEDSH	SESHA-MB	0.480	17.58	11.86	17.58	11.86	8.89	(*N3)	25
ESHA	ESHA-MB	0.480	16.69	12.86	16.69	12.86	5.97		
USHA	USHA-MBB	0.480	16.31	12.57	16.31	12.57	4.08		

Utility Transformer Capacity: 1500 kVA

Bus Name	Protective Device Name	Bus kV	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Dev Bolted Fault (kA)	Prot Dev Arcing Fault (kA)	Incident Energy (cal/cm2)	Notes (*N)	Cable Length From Trip Device (ft)
SESHA	T-UTIL-F	0.480	26.51	17.39	26.51	17.39	63.2	(*N3)	100
SEDSH	SESHA-MB	0.480	25.99	19.49	25.99	19.49	14.9		25
ESHA	ESHA-MB	0.480	24.08	18.21	24.08	18.21	8.67		
USHA	USHA-MBB	0.480	23.31	17.68	23.31	17.68	5.88		

(*N3) - Arcing Current Low Tolerances Used

(*N9) - Max Arcing Duration Reached

(*S1) - Short Circuit (Max) Scenario, 500 MVA Utility SCA

IEEE 1584 2018 Bus Report
Comprehensive Fault (80% Cleared Fault Threshold, include Ind. Motors for 5.0 Cycles, mis-coordination checked)

Appendix H. Circuit Breaker Trip Unit Settings

1. Overview. Appendix H provides a general overview of circuit breaker adjustment settings and common tripping characteristics. The TCC graphics are illustrative and intended to describe, in general terms, the effects of typical device adjustment settings. The adjustments, pickups, and delays shown on the curves are not representative of the actual adjustments, pickups, and delays setting for field equipment. Manufacturer published TCC curves for specific circuit breaker devices shall be used when setting circuit breakers in the field.

Contents includes the following circuit breaker devices:

a. Thermal Magnetic with Adjustable Trip Unit Settings

b. Electronic (Solid-State) Trip Unit Protection Modes and Settings.

2. Thermal Magnetic Circuit Breaker, with Adjustable Settings.

Figure H-1. Typical Thermal Magnetic Device Trip Unit TCC

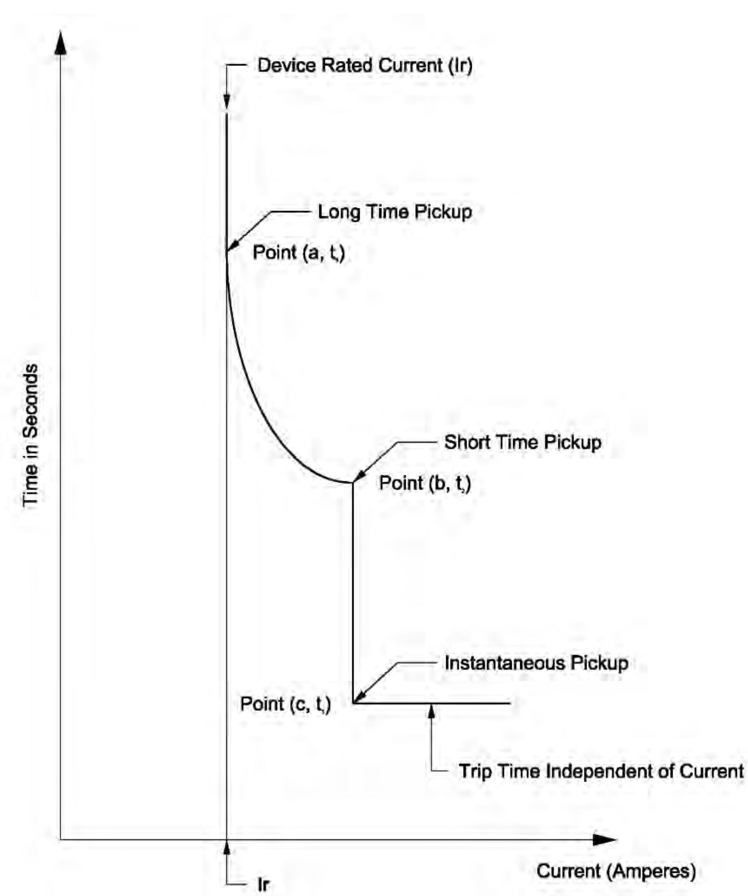


Figure H-2. Thermal-Magnetic Device with Adjustable Long-Time Pick-up Setting

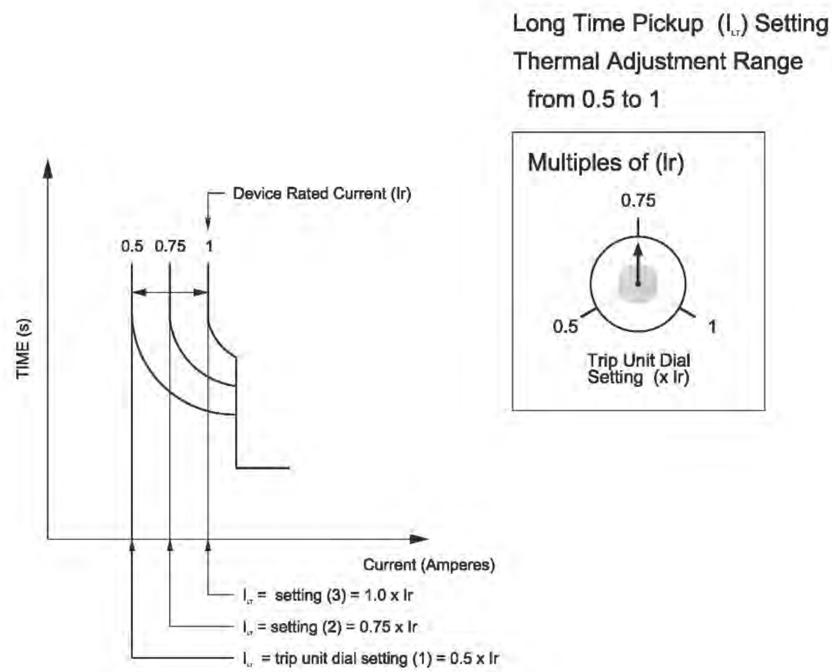
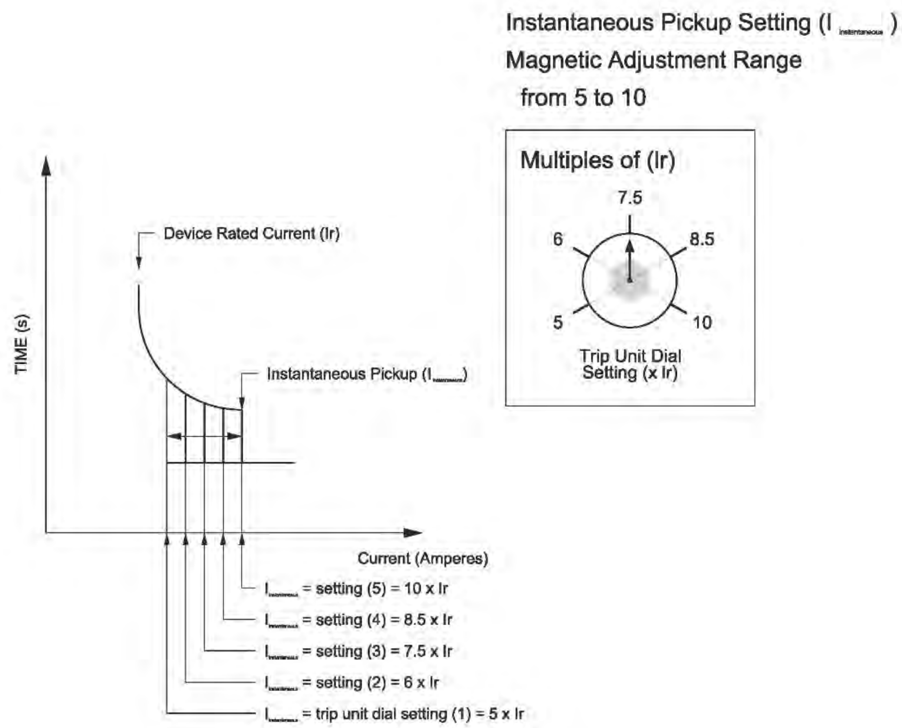
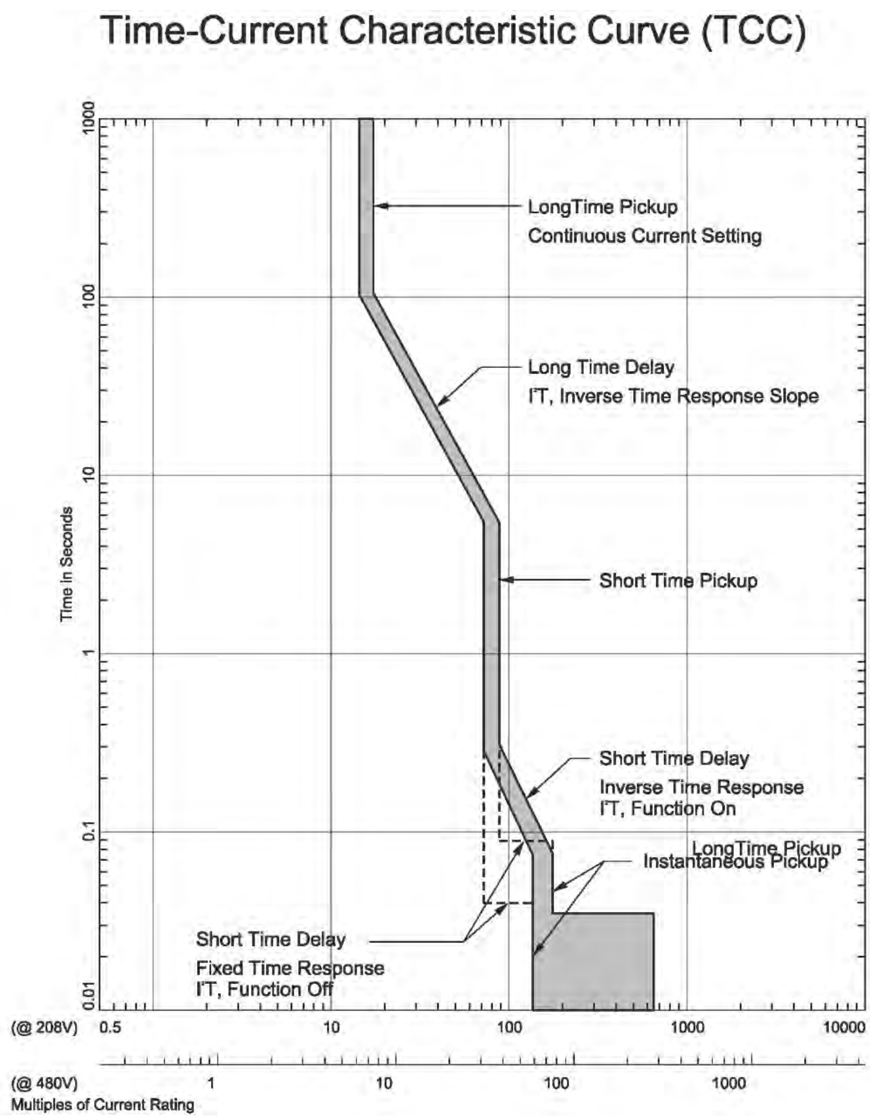


Figure H-3. Thermal-Magnetic Device with Adjustable Instantaneous Pick-up Setting



3. Electronic (Solid-State) Trip Unit Protection Modes and Settings.

Figure H-4. Typical Electronic Trip Unit, TCC Protection Modes



4. Long-Time Protection. Long-time protection is I^2T, Inverse Definite Minimum Time (IDMT) dependent. Circuit breaker devices typically include functions, such as the following:

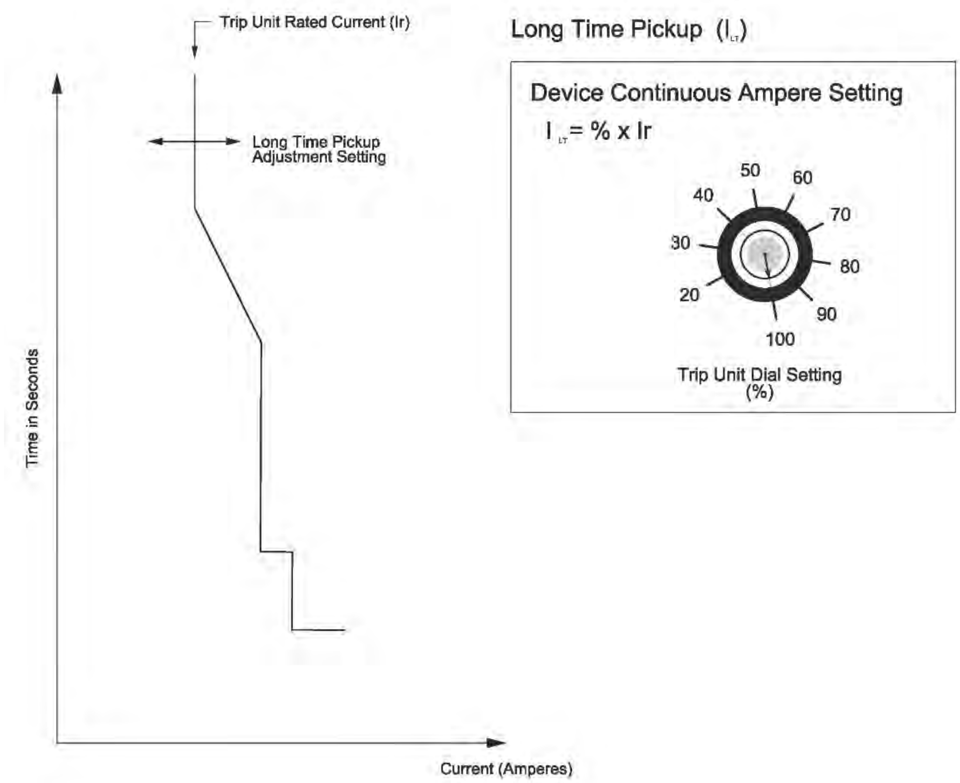
a. Incorporates a thermal image function

b. Is set with the Ir pickup and the tr trip time delay (Long-time Pickup Or pickup).

Long-Time Pickup Setting (Ir pickup)

This is the magnitude of current that a circuit breaker can carry without tripping. Ir is a percentage of the circuit breaker nominal rating (In). Adjustment of this setting will vary the continuous current from about 20% to 100% of the circuit breaker nominal rating (In).

Figure H-5. Electronic Trip Unit, Long-Time Pickup Adjustment Setting

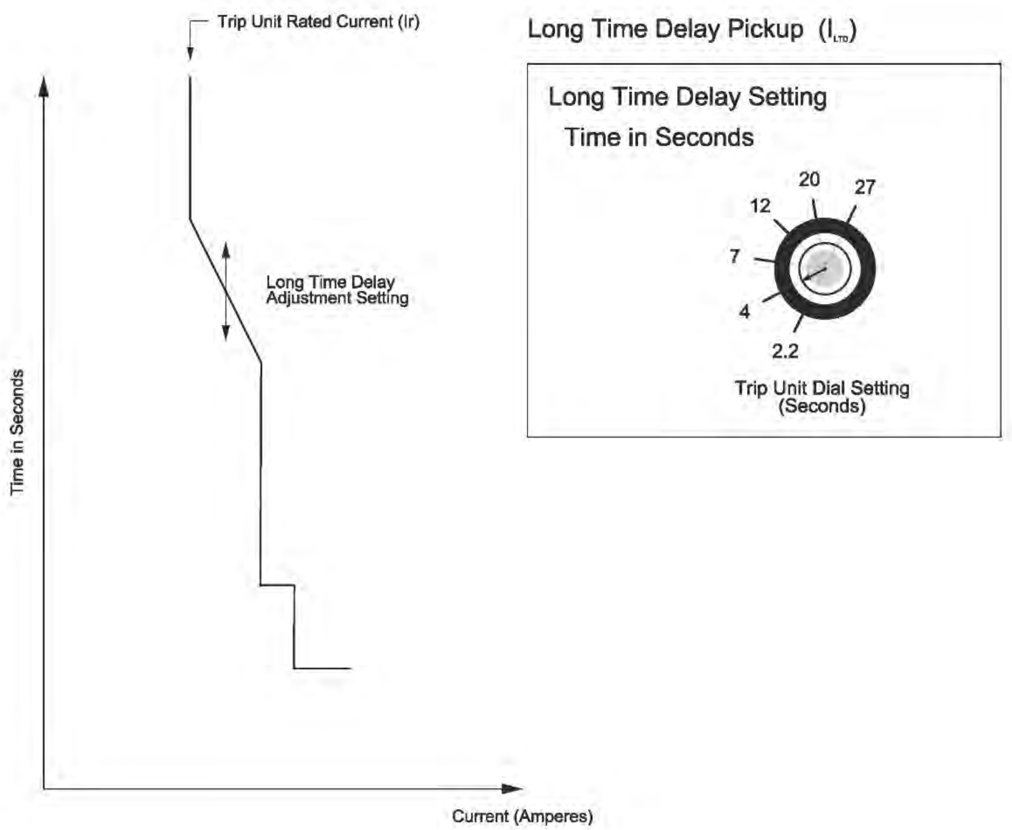


Long-time Delay (tr trip time delay)

Long-time delay causes the breaker to wait a certain amount of time to allow temporary inrush currents, such as starting a motor, to flow without tripping.

Usually, the time adjustment is on a multiple of the continuous current rating (lr). A common setting 6 x Ir as most motors draw current 6 times its full load current during starting. The setting depends on the motor driven load. The unit adjustment for this setting is seconds. The long-time delay effects the position of an I^2T slope which means that lower levels of continuous current setting will allow the circuit breaker to remain online for longer periods of time.

Figure H-6. Electronic Trip Unit, Long-Time Delay Adjustment Setting



5. Short-Time Protection. Short-time protection is definite time:

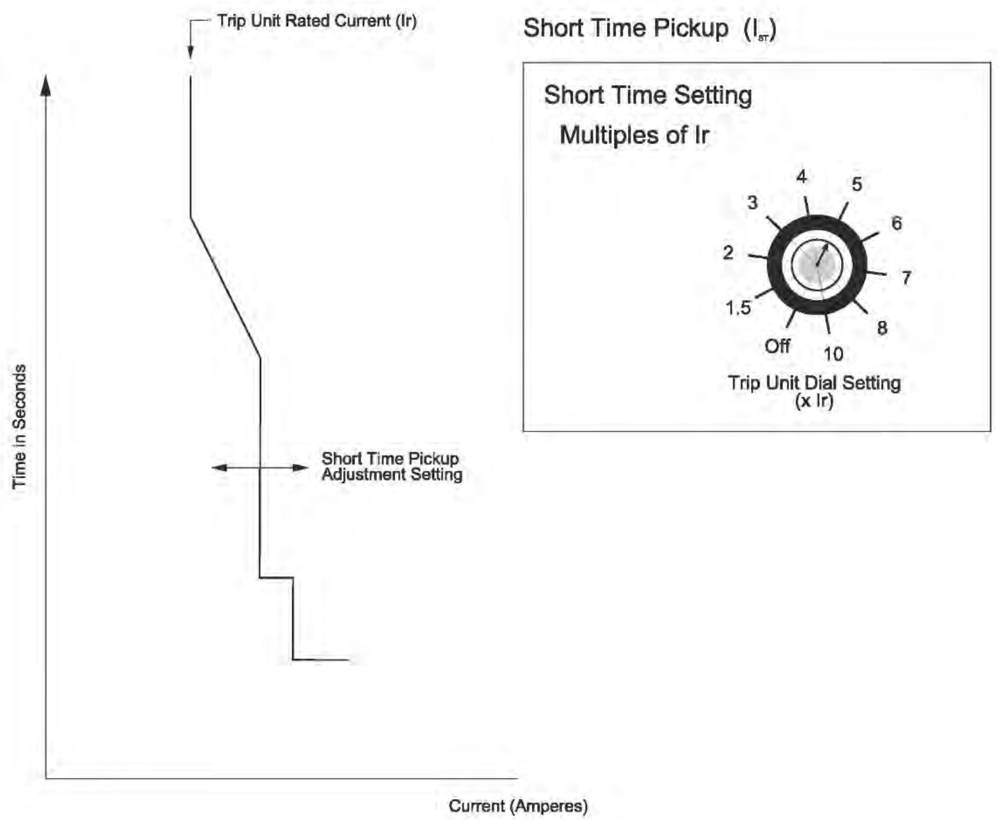
a. Incorporates the possibility of an I^2T inverse time curve function

b. Is set using the I^2T pickup and the std trip time delay.

Short-time Pickup

Short-time pickup is used for discrimination or selective tripping. The short-time pickup function determines the amount of current the circuit breaker will carry for a short period of time, allowing downstream protective devices to clear short-circuits without tripping the upstream device. If this function is set to "OFF" position, the short-time pickup and short-time delay will be disabled.

Figure H-7. Electronic Trip Unit, Short-Time Pickup Adjustment Setting



Short-time Delay

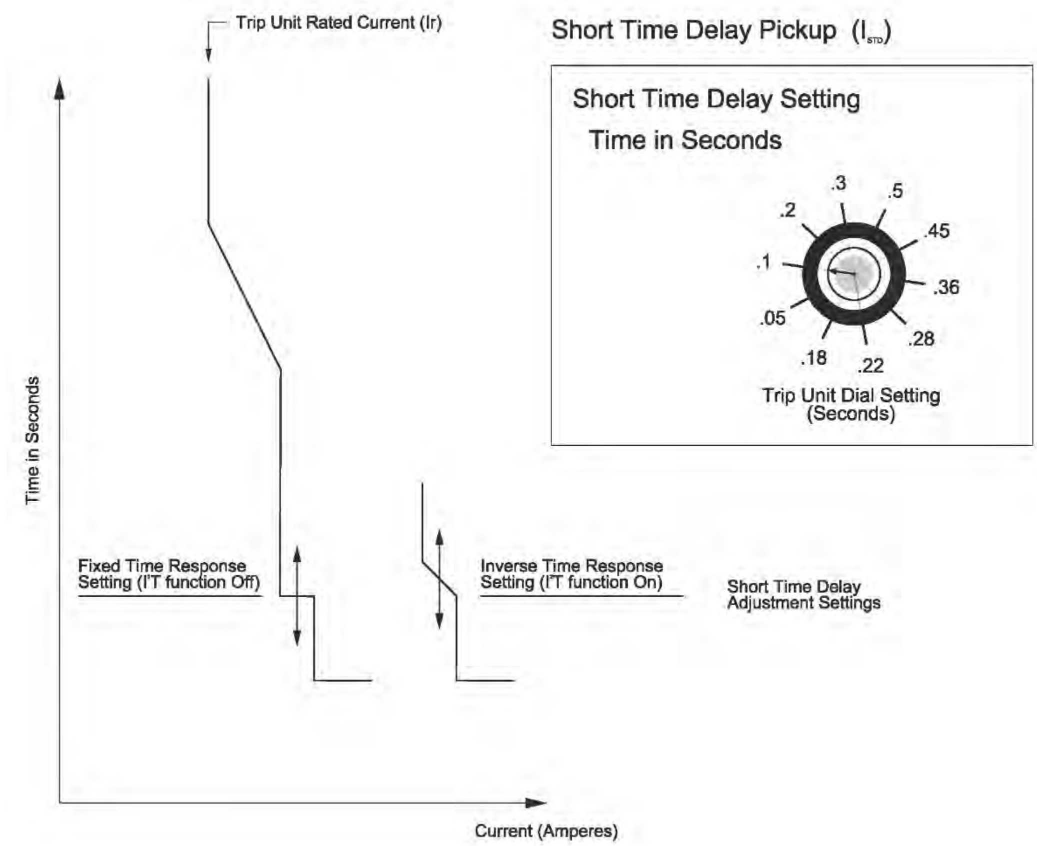
Short-time delay, used in conjunction with short-time pickup, controls the time duration before a short-time pickup trip.

There are two modes:

a. Fixed time - A fixed instantaneous trip point trips the breaker automatically and overrides any pre-programmed settings

b. I^2T ramp - The I^2T ramp mode is adjustable providing a short inverse time ramp. This allows better coordination with downstream thermal-magnetic circuit breakers and fuses.

Figure H-8. Electronic Trip Unit, Short-Time Delay Adjustment Settings

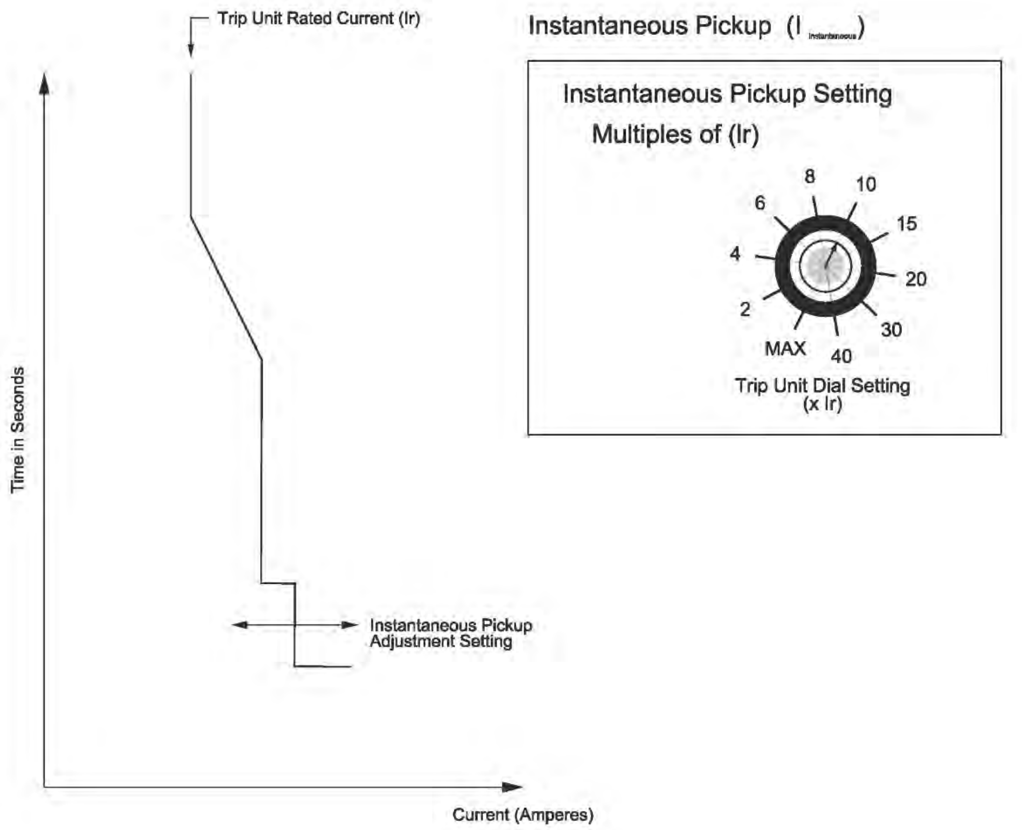


6. Instantaneous Protection. Instantaneous protection is definite time, set as **t** pickup and without time delay.

Instantaneous Pickup

Instantaneous Pickup is used to trip the circuit breaker with no intentional delay at any current between 2 and 40 times the breaker's continuous ampere setting (Ir).

Figure H-9. Electronic Trip Unit, Instantaneous Pickup Adjustment Setting



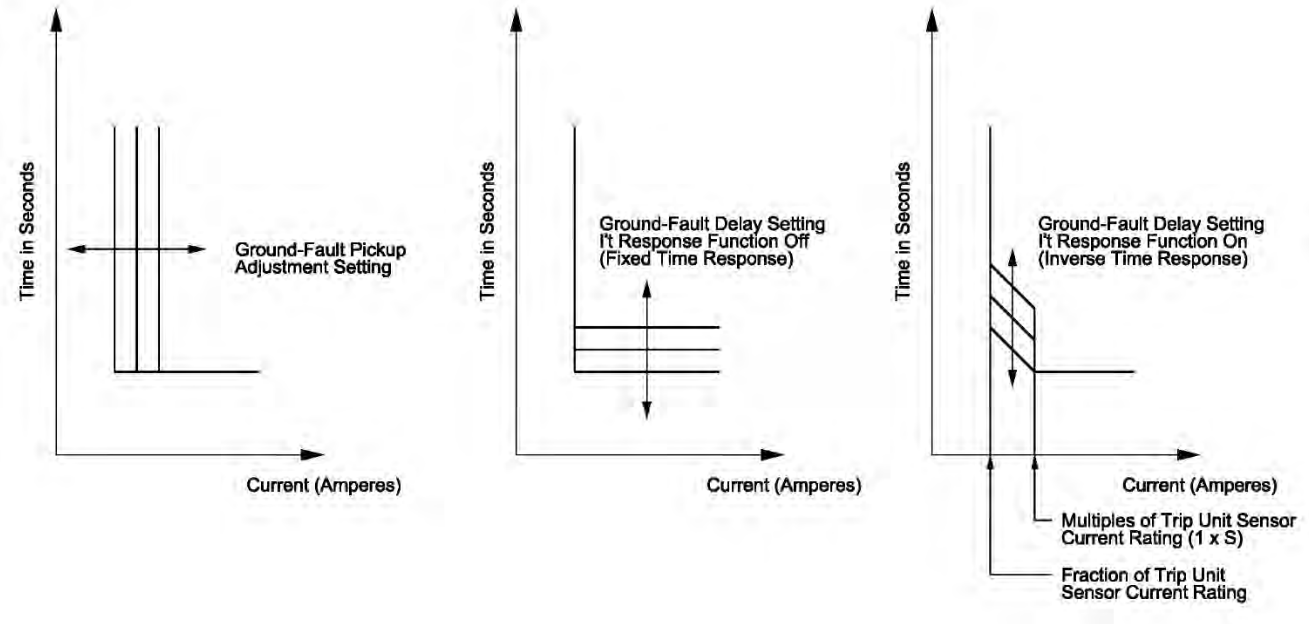
7. Ground-Fault Protection. Ground-Fault Protection (G) includes the following protection modes:

Ground-Fault Pickup and Delay

a. Ground-Fault Pickup (Ig): Sets the current level at which the circuit breaker will trip after the set ground-fault delay

b. Ground-Fault Delay (Igd): Includes an intentional time delay in the tripping of a circuit breaker when a ground fault occurs.

Figure H-10. Electronic Trip Unit, Ground-Fault Protection, Pickup and Delay Adjustment Settings



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