System Controls & Instrumentation, Ltd

11218 IH-10 E.
Converse, TX 78109
Phone: 210-661-9901
Fax: 210-666-5575

1108 Quail Hollow
Laredo, TX 78045
Phone: 956-725-1239
Fax: 956-726-1774

TECL # 18461

RESUBMITTAL Data for:

SAWS Leon Creek

Short Circuit & Overcurrent Device
Coordination Analysis

SQUARE D by Schneider Electric

Schneider Electric Engineering Services, LLC

2365 Harrodsburg Road, Suite B325
Lexington, KY 40504
(859) 296-3646

DATE: July 12, 2011

TO: Danny Burt / Dothan Field Office

FROM: Shibani Mishra / Schneider Electric Engineering Services, LLC

SUBJECT: SAWS-Leon Creek WRC
San Antonio, TX
F.O.# 25827923
Project# 10660

Dear Danny,

Electronic copies of the report for a Schneider Electric Engineering Services, LLC analysis performed for this site are being sent to your attention.

I appreciate the opportunity to have worked with you on this project. If you have questions, concerns, or require further assistance, please do not hesitate to contact me.

Regards,

Shibani Mishra

Leon Creek Water Recycling Center Improvements Phase II
Short Circuit Study-Resubmittal
Review Comments

1. Please evaluate based on short circuit ratings of the equipment buses as well as the protective devices. The bus rating may be lower than the device ratings.
2. From 5kV Motor Control Center submittal #43, the fuse is rated 9R and the CT ratio is 400:5. This is the latest MCC submittal received and does not match the proposed in this submittal and it is not understood why.
3. Please coordinate with Owner to gain access to equipment and include ratings in study.
4. Contract drawings and feeder sizes are based on 600AT. Please coordinate breaker settings with feeder and transformer.
5. This issue does not seem resolved. As stated previously, it appears that both 500kVA transformers AEL-XFMR-01A and AEL-XFMR-01B are contributing to the available short circuit at buses AEL-PDP-11A, AEL-PDP-11B, and AEL-PDP-12. As stated previously, the key interlock prevents this condition. Please revise.
6. Per specifications and MCC submittal the overload relay is Trip Class 20, please revise.
7. Please coordinate breaker with full load current of proposed pump. Contract drawings show a 100A breaker.
8. Please coordinate with CPS for actual impedance values for service transformers.
9. Please include MCC feeder cables. Coordinate size, length, etc. with contractor.
10. Transformer secondary conductors may be an unlimited length when in compliance with Article 240.21.C.4. Per specification section 16460.2.10 fuses shall be furnished by the manufacturer based on the results of the short circuit and coordination study. The manufacturer shall furnish the protective device of the appropriate characteristics that shall be the most suitable for the proper protection and coordination of the system.
11. Coordinate motor starting characteristics with motor manufacturer.

Leon Creek Water Recycling Center Improvements Phase II
Specification 16040
Manufacturer's Services
1.08A C, D, E, F,G, H, and I

SQD Responses to Study Review Comments
Dated July 8th, 2011

1. We evaluate the limiting factor (bus,breaker, or otherwise) in our studies. If the bus of the panel had a lesser rating, it would have been noted in the analysis.
2. Per the as built drawings we supplied a 12R fuse and a 250:5 CT
3. Access to the existing SWB-1 was requested to SAWS and denied to SCI and the GC.
4. We have revised to 600AT as confirmed and per the As Built drawings.
5. Updated SC calculation, panels AEL-PDP-11A and 11B are fed from AEL-XFMR-01A only, with AEL-XFMR-01B out of service.
6. Overload relay with trip Class 20 used.
7. The motor was confirmed to be 60HP. We supplied a MCP 150A. We size our MCP's based on NEC tables. The 150A MCP is good for 30-100HP. The 100A MCP stops at 50HP. Refer to Section 3.2.3 on setting Inst on MCPs
8. CPS provided a range for the %Z of 5.32 – 6.18. We are using 5.32 for worst case scenario.
9. Included.
10. Violations have been removed.
11. 60AT FA breakers to be supplied to remove the overlap.

Notes: The report hereby included addresses Paragraph C, D, E (in regards to the recommended/proposed motor protective relay settings – see Appendix D Setpoint File for Multilin SR469 Relays), F, G, H (Settings have been uploaded by SQD Field Technicians, and I. The remainder of Section E can not be performed until the flicker limit has been obtained from CPS – Requests have been made for this information.

Regards,
Danny Burt
Project Services Manager
Square D Company

SQUARE D
by Schneider Electric

Schneider Electric Engineering Services, LLC

2365 Harrodsburg Road, Suite B325
Lexington, KY 40504
(859) 296-3646

SHORT-CIRCUIT & OVERCURRENT DEVICE COORDINATION ANALYSES

SAWS-Leon Creek WRC
San Antonio, TX

Prepared by
Antony C. Parsons, Ph.D.,P.E.,
&
Shibani Mishra
Schneider Electric Engineering Services, LLC
Firm F#10107

Schneider Electric Engineering Services, LLC Job Numbers	-	January 21, 2011
Q2C: 25827923	Rev. 1	June 17, 2011
Project: 10660	Rev. 2	July 11, 2011
	Rev. 3	-

ELECTRICAL CONTRACTOR — SAWS Leon Creek WRC

DISTRIBUTOR — Graybar Elect. Co.

SQUARE D FIELD ENGINEER — Luis Chaparro/San Antonio

FILE: Saws Leon Creek

STATE OF TEXAS
ANTONY C. PARSONS
90251
LICENSED
PROFESSIONAL ENGINEER

P.E.
7-12-11

The following power systems engineering report was prepared by Schneider Electric Engineering Services, LLC utilizing industry-accepted standards, practices, methodologies, and analysis tools. Data used in this analysis was acquired by Schneider Electric Engineering Services, LLC and provided by others, through onsite discovery, published information, equipment nameplates, manufacturer ratings, testing, analysis, or other means. Schneider Electric Engineering Services, LLC assumes no responsibility for inaccuracies in data provided by others. The study is intended for use by qualified individuals to facilitate the installation, operation, maintenance, and safety of the electrical power system depicted. Modification of equipment, changes to system configuration, adjustment of protective device settings, or failure to properly maintain equipment may invalidate these results.

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

1.1 Introduction

This report documents the results of a Schneider Electric Engineering Services, LLC analysis for the SAWS-Leon Creek WRC in San Antonio, TX. All studies were performed using the Power*Tools for Windows Software, version 6.5.1.4.

System one-line description was obtained from the project design drawings. Cable and Utility data was supplied by the contractor. Square D equipment details were obtained from factory records. Abbreviations and trademarks referenced throughout this report are also listed in an appendix.

The system short-circuit analysis evaluates the adequacy of the distribution equipment shown on the enclosed one-line diagrams to withstand or to interrupt the calculated maximum available short-circuit current at its location.

The overcurrent device time-current coordination analysis determines the suggested settings and, where appropriate, the ampere ratings and types for the electrical power system protective devices to achieve the desired system protection and electrical service continuity goals.

This report supersedes and invalidates results from any study, performed by Schneider Electric Engineering Services, LLC or any other entity, for the scope of equipment being reviewed.

Electrical system changes within the facility or in the utility system can have a significant impact on the results of this power system analysis, which is a “snapshot” of as-found system conditions. As such, it is recommended that this analysis be re-evaluated on a regular basis, not to exceed 5 years, to account for electrical system changes. Failure to properly maintain equipment may invalidate these results.

1.2 Scope of Work

The scope of this study is limited to that equipment shown on the study one-line diagrams located in the back of the report and present in the bill of material. Unless specifically required by job specifications, branch circuit utilization equipment, as defined per NEC Article 100, was not included in this study (this may consist of small equipment, 100A and less, such as: safety switches, industrial control panels, and enclosed starters/drives). Note that the existing generator feeding HEL-ATS-01 has not been evaluated. Additional generator breaker and submittal data will be required if emergency side evaluation is required for HEL-ATS-01.

1.3 Results and Recommendations

Short-circuit:

The results of the short-circuit analysis show that the equipment considered in the study is adequately rated for the projected fault current levels.

For further discussion regarding these results, please refer to the Short Circuit Analysis Results and Recommendations section.

Coordination:

The coordination study showed that for the most part, an acceptable level of selectivity was achieved among devices in the system except for 005.tcc, 006.tcc, 007.tcc, 008.tcc, 010.tcc, 011.tcc and 013.tcc. If selective coordination according to NEC 700 is required, further analysis beyond the scope of this study will be necessary. In general, additional levels of distribution make it difficult to achieve selective coordination according to NEC 700 without oversized electrical equipment (ampacity and physical footprint). Larger equipment and changes to the cable and conduit layout may have an impact on the architectural design.

Note that the settings for motor overload relay shown on 09.tcc and 15.tcc are typical; in the field, they should actually be set per motor FLA.

The breakers and relays in the system should be set to the recommended levels. For further discussion regarding these results, please refer to the Time Current Coordination Analysis of Results and Recommendations.

Refer to <u>each</u> subsequent "Analysis of Results and Recommendations" section for further details. If these issues are addressed by equipment, conductor, or device settings changes, the power system study results may need to be re-evaluated in a revision to this study.

2 SHORT-CIRCUIT ANALYSIS

2.1 General Procedure

An electrical system short-circuit analysis is used for the following:

1) To compare the calculated maximum fault current with the interrupting ratings of overcurrent protective devices such as fuses and circuit breakers.

2) To investigate applicable short-circuit series ratings and the protection of electrical equipment by current-limiting devices.

3) To verify the adequacy of other equipment, such as switches and equipment bussing, to withstand the effects of the calculated maximum fault current levels.

4) To assist in the selection and/or determination of settings for relays, fuses and circuit breakers.

This analysis was made utilizing SKM Power Tools software. The software was programmed to calculate the maximum available three-phase, RMS symmetrical, short-circuit amperes at each piece of equipment in the system. The calculation procedures are based on recommendations included in ANSI/IEEE standards C37.13, C37.010, and C37.5.

The AFAULT module of the Power*Tools software simulates a bolted three-phase fault at each point of consideration in the system and calculates the maximum available short-circuit current at that point without any reduction due to current-limiting overcurrent devices which may be present. (However, the effects of current-limiting devices are considered when determining the adequacy of the equipment.) The calculated short-circuit values are RMS symmetrical amperes and are comparable with the RMS symmetrical short-circuit ratings of electrical equipment.

Electrical distribution equipment must be able to withstand and/or interrupt the most severe fault duty that it may be subjected to at its location in the system. In particular, NEC Section 110.9 requires circuit breakers to have a rating sufficient for interrupting the maximum available fault current present at their line side terminals. For locations where calculated fault currents exceed the ratings of the equipment, recommendations for corrective actions are provided.

Equipment short-circuit withstand and interrupting ratings are expressed in symmetrical RMS current. However, fault currents are not purely symmetrical in practice, as system inductance introduces a degree of asymmetry for at least the first few cycles of a fault. The magnitude and duration of this asymmetrical component depends on several factors, including characteristics of system components (conductors, transformers, and loads) and the exact point on the current waveform that the fault begins—the level of asymmetry even differs from phase to phase in a three-phase system. Because of the uncertainty in asymmetry for a given fault event, the capability of devices to interrupt asymmetrical fault current is based on the maximum possible asymmetrical fault current level at the point of application. The more inductive the circuit, as measured by the calculated system X/R ratio, the more asymmetrical the fault current can be. If the calculated X/R level exceeds a certain level, then the increased asymmetrical duty must be taken into account when breaker ratings are assessed.

Low-voltage circuit breakers and fuses are tested to establish their interrupting ratings based on a circuit with a fixed X/R ratio, as defined in the various product standards (UL and ANSI). For example, an ANSI low-voltage power circuit breaker is tested in a circuit with an X/R ratio of

6.591. If such a breaker is applied at a system bus with a calculated X/R ratio of 6.591 or less and the calculated RMS symmetrical fault current is within the symmetrical interrupting rating of the breaker, then it is assumed that the breaker is also able to interrupt and withstand the asymmetrical current resulting from a fault at that location. If a low voltage breaker is applied at a location with an X/R ratio greater than that of the design test circuit, the calculated fault current must be multiplied by an adjustment factor that accounts for this. This resultant “fault duty,” which is greater than the calculated fault current, is then compared to the breaker’s interrupting rating in order to determine if the breaker is adequately rated. Different classes of low-voltage breakers have different test X/R values, and each type has its own set of multiplication factors. Design test circuit power factors and associated X/R ratios are as shown in **Table 1**. The SKM low-voltage short-circuit output report shows the calculated fault duty levels calculated at each bus, and when these values differ from the calculated short-circuit current levels, they are used in the device evaluation tables. See IEEE 1015-1997, *IEEE Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems*, for additional details.

Table 1: Summary of Test Power Factor and X/R Values for LV Devices.

Device	pf	X/R Ratio
Power circuit breaker, unfused	0.15	6.591
Power circuit breaker, fused	0.20	4.899
Molded case breaker, interrupting rating greater than 20000 A	0.15-0.20	6.591-4.899
Molded case breaker, interrupting rating 10001 to 20000 A	0.25-0.30	3.9-3.18
Molded case breaker, interrupting rating 10000 A and less	0.45-0.50	2.0-1.732

For power circuit breakers, the power factors are taken from ANSI/IEEE C37.13. For molded case breakers, the power factors are taken from NEMA standard AB1. Since the NEMA standard specifies a range of test circuit power factors, the highest value (lowest X/R ratio) is used to determine the multiplying factor. This produces the most conservative (largest) factor.

The included one-line diagrams are a simplified version of the system drawings, showing only those parts of the electrical system under consideration. The various circuit locations on the diagrams have been labeled with bus identification numbers so input data could be supplied to the computer and the computer output could be readily interpreted.

2.2 Data Used in the Calculations

2.2.1 Power Company Data

CPS Energy has advised that their system is capable of delivering a maximum available three-phase short-circuit current of 1233A at 13800V with an X/R ratio of 2.42. This short-circuit current determined the starting point for the analysis and is provided from existing circuit B421 out of Chavaneaux Rd. Substation. CPS Energy provides an additional maximum available three-phase short-circuit current of 2912A at 13800V with an X/R ratio of 2.339. This new fault current will be fed from future circuit A522 out of Mauermann Rd Substation which will replace the existing Chavaneaux Rd. Substation.

For worst case short circuit condition one set of parallel service transformer is considered in service and the ties are closed in for both the existing and future cases. The panelboards AEL-PDP-11A and AEL-PDP-11B are fed from AEL-XFMR-01A, with ties closed and main breaker on AEL-PDP-11B open.

2.2.2 Cable Data

The "FEEDER INPUT DATA" computer printouts list the conductor (cable and/or busway) data used for each circuit segment. Included are lengths, number per phase, size, conductor material, cable insulation type, conduit material and resistance and reactance values. Also, conductor lengths, number per phase, and size and conductor material are recorded on the one-line diagrams.

Resistance values are based on 25 degrees Celsius (room temperature) rather than the full load temperature usually shown in descriptive literature since short-circuits can occur when the circuit is initially energized or lightly loaded as well as when fully loaded. The resistance and reactance values are typical values obtained from a study of data from various conductor manufactures. Values are tabulated according to whether several single conductors or one multiple conductor is used and whether the conduit is steel, aluminum or plastic.

2.2.3 Transformer Data

Square D nameplate transformer percent impedance and typical X/R ratio values were used for all transformers. The exact R and X component values used are shown on the "TRANSFORMER INPUT DATA" printouts.

2.2.4 Motor Contribution To Short-Circuit Current

Motor contribution to the short-circuit current is taken into account in this short-circuit analysis. During the first few cycles of a fault, running motors act as generators and produce a current which will combine with the source short-circuit current flowing to the fault as illustrated in **Figure 1**. Sources may be, but are not limited to, the Power Company, local generators, or both.

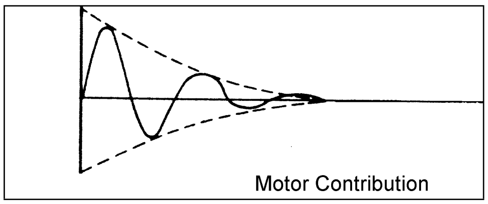

Figure 1: Example motor contribution.

Connected motors shown on the study one-line were assumed to be running at the time of the fault. Motors fed by adjustable speed drives equipped with bypass contactors were considered to contribute to system fault currents as well. However, motors fed by drives without bypass contactors were not considered since they do not contribute to fault current. Redundant motors shown on the study one-line were also assumed to be running at the time of the fault unless operating controls prohibit these conditions.

A motor's contribution to a fault *at its terminals* is equal to the full-load ampere (FLA) rating of the motor divided by its per-unit subtransient reactance, similar to the contribution from a generator. However, at the upstream switchboard, panelboard, or motor-control center, the fault contribution from the individual motors is reduced by the impedance of the motor branch circuit conductors. Since data on motor subtransient reactances and branch-circuit conductor lengths is often difficult to obtain, assumptions regarding the motors' subtransient reactances are typically made when the system model is built.

For calculation of low-voltage fault duty, the contribution from induction motors and synchronous motors in the system are considered. For small induction motors (less than 50 hp) where the impedance of the installation (i.e., motor and conductor) is not known, an equivalent subtransient reactance of 0.25 pu, resulting in a fault contribution of 4 times rated current, is assumed. Larger motors (50 hp and above) have an assumed subtransient reactance of 0.2 pu, resulting in a fault contribution of 5 times rated current. This is consistent with recommendations in IEEE Std. 141, *IEEE Recommended Practice for Electric Power Distribution for Industrial Plants* (the IEEE Red Book).

If applicable, multiplying factors are adjusted per Table 7 of ANSI/IEEE C37.010, *IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis for* medium/high voltage fault duty. The table also shows contributions from induction motors less than 50 hp to be neglected.

The motor short-circuit contribution is determined and included in the computer short-circuit analysis so that the results should represent the highest short-circuit current to which the equipment might be subjected.

Unless otherwise indicated in the "CONTRIBUTION DATA" computer printouts, some motor loads are modeled as lumped induction motors connected directly to the low voltage buses using the recommended subtransient reactance values from C37.010, C37.13, and IEEE Std. 141. These modeled values appear on the "CONTRIBUTION DATA" and the "FAULT REPORT" computer printouts.

2.3 Short-Circuit Analysis Results and Recommendations

After making the calculations, the distribution equipment was checked to determine its adequacy to interrupt or withstand the effects of the calculated maximum short-circuit current at its location. For some solidly-grounded systems, like close-coupled unit substations and generator gear, it is possible the bolted three-phase fault current is not the maximum fault current. The power systems engineer performing the study considered applicable buses and has reported bolted line-to-ground fault current when required. The results are listed in the "SHORT-CIRCUIT EVALUATION TABLE".

For worst case short circuit condition one set of parallel service transformer is considered in service and the ties are closed for both the existing and future cases. The panelboards AEL-PDP-11A and AEL-PDP-11B are fed from AEL-XFMR-01A, with ties closed and main breaker on AEL-PDP-11B open.

Listed in the tables are the calculated short-circuit currents at each piece of equipment and the ratings of the lowest rated device in the equipment enclosure. Comparing the two sets of values shows that all of the equipment examined is either adequate by itself or when used in series with another circuit breaker or protected by a line side current-limiting fuse or circuit breaker.

If applicable, equipment using series ratings that are shown in the short-circuit evaluation table must meet field labeling requirements per NEC Sections 110.22 and 240.86(B). There are two types of markings which must be present; the first requires series combination ratings to be marked on equipment by the manufacture. The second equipment marking must be readily visible and state the following:

CAUTION – SERIES COMBINATION SYSTEM RATED _____ AMPERES.
IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.

This labeling serves as a warning to those who may install new breakers or replace existing breakers at the given location in the future, alerting them to the fact that a specific device type must be used in order to ensure that the series rating is maintained.

The short-circuit evaluation table shows buses with #N/A in the “NOTES” column. This is defined at the bottom of the table as #N/A = Number not available. Some of these buses do not require evaluation and may correspond to equipment such as transformer windings or motor terminals.

Input data and short-circuit output data pages are included in separate appendices.

2.4 Short-Circuit Evaluation Table

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SHORT-CIRCUIT EVALUATION TABLE

SAWS LEON CREEK WRC
SAN ANTONIO, TX
D-ML-10-660-1,2
EXISTING UTILITY SERVICE

BUS NO.	EQUIP. DESCRIPTION PER SYSTEM ONE LINE DIAGRAM(S)	NOMINAL L-L VOLTS	LOWEST RATED DEVICE IN EQUIPMENT ENCLOSURE TYPE	AIC OR WCR	MAXIMUM AVAILABLE SCA OR DUTY	X/R RATIO	LINE SIDE MAXIMUM DEVICE	LINE SIDE SERIES RATING	NOTES EVALUATION	#
001	AMC-MCC-01A	4160.0		42,000	7,290	9.388			#N/A	
002	LC-AASBC01	4160.0		#N/A	7,219	8.922			#N/A	
003	LC-AASBC02	4160.0		#N/A	7,219	8.922			#N/A	
005	AEL-PDP-11A	480.0	SCCR14	14,000	10,434	4.844			Adequate	
006	AIS-LCP-01	480.0	SCCR14	14,000	8,209	2.331			Adequate	
007	AIS-LCP-02	480.0	SCCR14	14,000	8,209	2.331			Adequate	
008L	AEL-ATS-01	480.0	SCCR22	22,000	9,012	3.976			Adequate	
009	AEL-PDP-12	480.0	SCCR14	14,000	8,739	3.364			Adequate	
010	AEL-LP-11	208.0	QOB(1P)/15-30A	10,000	5,178	0.719			Adequate	
011	AEL-CPP-11	208.0	QOB(1P)/15-30A	10,000	1,640	2.398			Adequate	
012	AEL-MPC-01	208.0	QOB(1P)/15-30A	10,000	1,471	2.027			Adequate	
013	AEL-MPC-02	208.0	QOB(1P)/15-30A	10,000	1,301	1.650			Adequate	
014	AMC-MCC-01B	4160.0		42,000	7,278	9.374			#N/A	
015	AEL-PDP-11B	480.0	SCCR14	14,000	10,433	4.844			Adequate	
016	AIS-LCP-03	480.0	SCCR14	14,000	8,208	2.330			Adequate	
017	AIS-LCP-04	480.0	SCCR14	14,000	8,208	2.330			Adequate	
018	LC-AASBC03	4160.0		#N/A	7,208	8.911			#N/A	
019	LC-AASBC04	4160.0		#N/A	7,208	8.911			#N/A	
100	PLANT MAIN SWBD SWB-1	4160.0		100,000	2,659	3.607			#N/A	
101	FUSE CUT-OUTS	4160.0		#N/A	2,659	3.607			#N/A	
102	HV44	4160.0		#N/A	2,579	3.206			#N/A	
103L	HEL-ATS-01	480.0	SCCR22	22,000	6,870	3.849			Adequate	
104	MCC-1	480.0	SCCR42	42,000	6,560	3.590			Adequate	
105	HEL-PDP-01	480.0	SCCR14	14,000	5,412	1.763			Adequate	
106	HEL-LP-01	208.0	QOB(1P)/15-30A	10,000	2,238	1.117			Adequate	
107	HEL-CPP-01	208.0	QOB(1P)/15-30A	10,000	784	2.023			Adequate	
108	PELXFM PRI	4160.0		#N/A	2,617	3.425			#N/A	
109	PMC-MCC-02	480.0	SCCR42	42,000	7,232	3.804			Adequate	
110	AEL-PDP-02	480.0	SCCR14	14,000	4,482	1.121			Adequate	
111	FUSE CUT-OUTS	4160.0		#N/A	2,637	3.539			#N/A	
112	PMC-MCC-01	480.0	SCCR42	42,000	5,227	4.284			Adequate	
113	AEL-PDP-01	480.0	SCCR14	14,000	3,012	1.046			Adequate	
114	PEL-PDP-01	480.0	SCCR14	14,000	4,186	1.638			Adequate	
115	SEL-PDP-11	480.0	SCCR14	14,000	5,488	4.019			Adequate	
116	SEL-LP-12	240.0	QOB(1P)/15-30A	10,000	2,236	2.972			Adequate	

#N/A = Number not available.

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SHORT-CIRCUIT EVALUATION TABLE

SAWS LEON CREEK WRC
SAN ANTONIO, TX
D-ML-10-660-1,2
EXISTING UTILITY SERVICE

BUS NO.	EQUIP. DESCRIPTION PER SYSTEM ONE LINE DIAGRAM(S)	NOMINAL L-L VOLTS	LOWEST RATED DEVICE IN EQUIPMENT ENCLOSURE TYPE	LOWEST RATED DEVICE IN EQUIPMENT ENCLOSURE AIC OR WCR	MAXIMUM AVAILABLE SCA OR DUTY	X/R RATIO	LINE SIDE MAXIMUM DEVICE	LINE SIDE SERIES RATING	NOTES EVALUATION	NOTES #
117	SEL-CPP-11	208.0	QOB(1P)/15-30A	10,000	792	2.104			Adequate	

#N/A = Number not available.

SCET Page 2 of 2
[Form Ver. 3.0]

SQUARE D

by Schneider Electric

SQUARE D ENGINEERING SERVICES

SHORT-CIRCUIT EVALUATION TABLE

SAWS LEON CREEK WRC
SAN ANTONIO, TX
D-ML-10-660-1,2
FUTURE UTILITY SERVICE

BUS NO.	EQUIP. DESCRIPTION PER SYSTEM ONE LINE DIAGRAM(S)	NOMINAL L-L VOLTS	LOWEST RATED DEVICE IN EQUIPMENT ENCLOSURE TYPE	AIC OR WCR	MAXIMUM AVAILABLE SCA OR DUTY	X/R RATIO	LINE SIDE MAXIMUM DEVICE	LINE SIDE SERIES RATING	NOTES EVALUATION	#
001	AMC-MCC-01A	4160.0		42,000	10,089	8.525			#N/A	
002	LC-AASBC01	4160.0		#N/A	9,951	7.954			#N/A	
003	LC-AASBC02	4160.0		#N/A	9,951	7.954			#N/A	
005	AEL-PDP-11A	480.0	SCCR14	14,000	10,767	4.736	MG		Adequate	
006	AIS-LCP-01	480.0	SCCR14	14,000	8,469	2.268			Adequate	
007	AIS-LCP-02	480.0	SCCR14	14,000	8,469	2.268			Adequate	
008L	AEL-ATS-01	480.0	SCCR22	22,000	9,333	3.881			Adequate	
009	AEL-PDP-12	480.0	SCCR14	14,000	8,976	3.282			Adequate	
010	AEL-LP-11	208.0	QOB(1P)/15-30A	10,000	5,213	0.710			Adequate	
011	AEL-CPP-11	208.0	QOB(1P)/15-30A	10,000	1,642	2.393			Adequate	
012	AEL-MPC-01	208.0	QOB(1P)/15-30A	10,000	1,473	2.023			Adequate	
013	AEL-MPC-02	208.0	QOB(1P)/15-30A	10,000	1,304	1.647			Adequate	
014	AMC-MCC-01B	4160.0		42,000	10,064	8.496			#N/A	
015	AEL-PDP-11B	480.0	SCCR14	14,000	10,766	4.736	MG		Adequate	
016	AIS-LCP-03	480.0	SCCR14	14,000	8,468	2.268			Adequate	
017	AIS-LCP-04	480.0	SCCR14	14,000	8,468	2.268			Adequate	
018	LC-AASBC03	4160.0		#N/A	9,927	7.932			#N/A	
019	LC-AASBC04	4160.0		#N/A	9,927	7.932			#N/A	
100	PLANT MAIN SWBD SWB-1	4160.0		100,000	4,057	4.486			#N/A	
101	FUSE CUT-OUTS	4160.0		#N/A	4,057	4.486			#N/A	
102	HV44	4160.0		#N/A	3,882	3.618			#N/A	
103L	HEL-ATS-01	480.0	SCCR22	22,000	7,651	4.061			Adequate	
104	MCC-1	480.0	SCCR42	42,000	7,270	3.737			Adequate	
105	HEL-PDP-01	480.0	SCCR14	14,000	5,882	1.709			Adequate	
106	HEL-LP-01	208.0	QOB(1P)/15-30A	10,000	2,269	1.105			Adequate	
107	HEL-CPP-01	208.0	QOB(1P)/15-30A	10,000	788	2.020			Adequate	
108	PELXFM PRI	4160.0		#N/A	3,964	4.050			#N/A	
109	PMC-MCC-02	480.0	SCCR42	42,000	7,977	3.951			Adequate	
110	AEL-PDP-02	480.0	SCCR14	14,000	4,735	1.068			Adequate	
111	FUSE CUT-OUTS	4160.0		#N/A	4,009	4.318			#N/A	
112	PMC-MCC-01	480.0	SCCR42	42,000	5,650	4.504			Adequate	
113	AEL-PDP-01	480.0	SCCR14	14,000	3,136	1.008			Adequate	
114	PEL-PDP-01	480.0	SCCR14	14,000	4,450	1.593			Adequate	
115	SEL-PDP-11	480.0	SCCR14	14,000	5,960	4.141			Adequate	
116	SEL-LP-12	240.0	QOB(1P)/15-30A	10,000	2,266	2.973			Adequate	

#N/A = Number not available.

SQUARE D

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SHORT-CIRCUIT
EVALUATION TABLE

SAWS LEON CREEK WRC
SAN ANTONIO, TX
D-ML-10-660-1,2
FUTURE UTILITY SERVICE

BUS NO.	EQUIP. DESCRIPTION PER SYSTEM ONE LINE DIAGRAM(S)	NOMINAL L-L VOLTS	LOWEST RATED DEVICE IN EQUIPMENT ENCLOSURE TYPE	AIC OR WCR	MAXIMUM AVAILABLE SCA OR DUTY	X/R RATIO	LINE SIDE MAXIMUM DEVICE	LINE SIDE SERIES RATING	NOTES EVALUATION	#
117	SEL-CPP-11	208.0	QOB(1P)/15-30A	10,000	795	2.101			Adequate	

#N/A = Number not available.

SCET Page 2 of 2
[Form Ver. 3.0]

3 OVERCURRENT DEVICE COORDINATION ANALYSIS

3.1 General Procedure

An overcurrent device time-current coordination analysis is an organized effort to determine the settings and, where appropriate, the ampere ratings and types for the over-current protective devices in an electrical system. The objective of the coordination analysis is to effect a time-current coordination among the devices, thereby achieving the desired system protection and electrical service continuity goals.

Maximum protection requires that the overcurrent protective devices be rated, selected, and adjusted to allow the normal load currents to flow while instantaneously opening the circuit when abnormal currents flow.

However, maximum service continuity requires that the overcurrent protective devices be rated, selected, and adjusted so that only the overcurrent protective device nearest the fault opens and isolates the faulted circuit from the system, permitting the rest of the system to remain in operation. Protective devices farther from the fault location should therefore essentially act as backup protection for the devices nearer to the fault, allowing the fault to be cleared with a minimum of disruption to the system. This is referred to as “selective coordination” between the protective devices. This may allow longer duration faults when the fault point is nearer the service entrance; however, such faults are not as common, and setting the protective devices to operate in this manner is generally more desirable than deenergizing most or all of the system for a fault near one of the loads.

Selecting and setting the overcurrent devices is a procedure where the time-current characteristic curves of the various devices in series are compared with one another on a log-log graph. This procedure should take into account boundaries defined by load currents, short-circuit currents, and ANSI and NEC requirements.

Selective coordination usually will be obtained when the log-log plots of time-current characteristics show sufficient clear space or no overlap between the curves for the protective devices operating in series. Coordination will often stop short of complete selectivity when an acceptable compromise is reached between the various boundaries imposed on the selecting and setting procedure.

The CAPTOR module of the SKM Power*Tools software was used to complete the device coordination analysis. As shown on the one-line diagrams, each overcurrent protective device or motor under consideration by the program has been assigned an identification number so that the computer output could be readily interpreted.

3.2 Specific Procedure

3.2.1 Short-Circuit Current Considerations

All protective device characteristic curves shown on the time-current graphs end at the calculated maximum short-circuit current at that device.

3.2.2 Molded Case Breaker Coordination

A molded case circuit breaker will trip with no intentional time delay for short-circuit currents above its instantaneous trip setting. Because of this, molded case breakers in series can only be selectively coordinated with each other if there is sufficient impedance between them so that the maximum available short-circuit current at the downstream breaker is less than the instantaneous trip setting of the upstream breaker. In **Figure 2**, breaker "C" illustrates this principle.

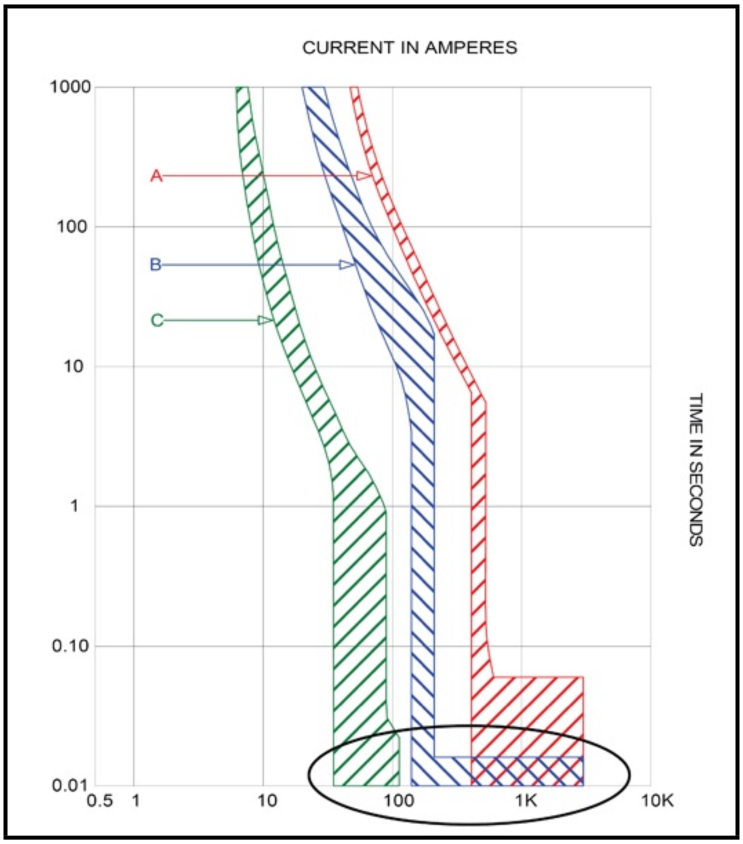


Figure 2: Example molded case breaker coordination.

There is enough cable impedance to limit the maximum available short-circuit current at "C" to less than the instantaneous trip setting of either "A" or "B". When molded case breakers are in series without sufficient impedance between them to permit complete coordination, e.g., a panel main breaker and one of the branch devices in the panel, the time-current curves will overlap in the high-current instantaneous trip region. This is illustrated by the overlap between the curves for devices “A” and “B” in **Figure 2**. Most molded case breakers exhibit some degree of current limitation that will often result in selective operation in the overlap region. Time-current coordination curves included in this report do not match the results from Square D’s data bulletin (0100DB0501R3). The software used to generate the curves is incapable of accounting for the dynamic impedance the system has when two or more devices in series “see” a fault. The data bulletin takes the dynamic impedance introduced by the downstream device into account. Greater separation between the instantaneous settings may increase the likelihood that the two devices will operate selectively. The potential lack of coordination is generally not considered critical and can be avoided only by adopting a different and, in general, less economically practical design especially when the following are considered:

- Most faults occur in equipment such as motors, lighting panels, and process control panels which typically are located at the end of branch circuits, significantly reducing fault level and thereby reducing or eliminating the possibility of non-selective operation.
- Lower magnitude arcing faults in rotating machinery and lighting panels are statistically more common than bolted three-phase faults.
- Ground faults are more common than three-phase faults.
- Maximum fault current is a random event depending on point-on-wave of the fault occurrence and other factors.
- The device cutoff points on time-current coordination graphs are based on bolted fault current levels which correspond to zero impedance. Typical fault current impedance is usually greater than zero so the actual fault current seen by overcurrent devices can be less than what is shown on the time-current coordination graphs.

Recommended breaker trip settings are given in the "OVERCURRENT DEVICE SETTING TABLE – LV CIRCUIT BREAKERS". In addition, an illustration of the actual magnetic trip adjustment dials for Square D circuit breakers is included in the REFERENCES section to aid the setting process.

3.2.3 Motor Control Center Instantaneous Trip Breakers

Specific settings are not suggested for the motor control center instantaneous trip circuit breakers, otherwise referred to as motor circuit protectors (MCPs). Instead, Schneider Electric Engineering Services, LLC assumes that they have been previously field adjusted per the following:

- The setting should be field adjusted just high enough to allow the motor to start without tripping the breaker and not exceed the NEC Article 430 guidelines for best protection.

Square D offers two different types of MCPs with one being a traditional type and another which is an electronic version, refer Figure 3 below. Each one is discussed further, but both may or may not actually exist in this particular project.

Specific settings are not suggested for the motor control center MAG-GARD instantaneous trip circuit breakers. Instead, Schneider Electric Engineering Services, LLC recommends that they be field adjusted. All MAG-GARD breakers are automatically set at LO when shipped from the factory. The setting may need to be adjusted for proper motor startup. For best protection, it is suggested the final setting be field adjusted just high enough to allow the motor to start without tripping the breaker. However, when using this setting procedure, it should not be assumed a breaker tripped because of normal motor starting current - a fault or overload may indeed exist. Furthermore, the number of motor starts attempted within any time period should not exceed the motor manufacturer's recommendations. The final setting should not exceed the NEC guidelines given in Article 430.

Settings for the motor control center PowerPact electronic MCPs are shipped with default settings corresponding to the minimum FLA and **Auto 1**; however, these should be field adjusted based on the characteristics of the motor being protected.

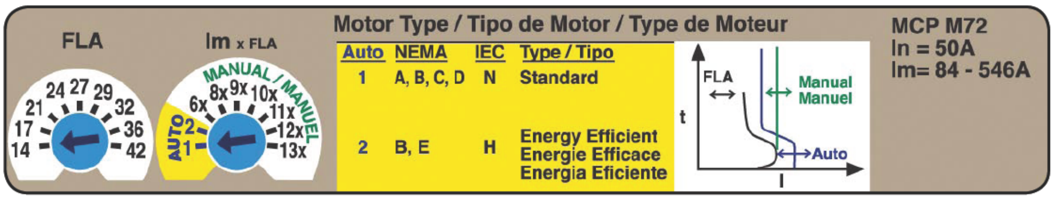


Figure 3: Example of MCP setting dial.

Schneider Electric Engineering Services, LLC recommends that the FLA dial (Figure 3) be set to match the nameplate data of the motor. If it does not match up exactly, then choose the next closest lower value. Additionally, the instantaneous dial (Im x FLA) can be set using either Auto settings or Manual mode.

- Manual mode settings can be chosen for traditional motor protection from 600% to 1300% times the selected FLA and should follow the same approach described for MAG-GARD circuit breakers.

- **Auto 1** can be used for Standard type NEMA and IEC motors whereas **Auto 2** can be used for Energy Efficient motors as indicated in Figure 3. Both of the Auto settings provide a dampening means to accommodate transient motor inrush currents and at the same time not resulting in an overly high adjustment. The maximum percentage of full-load current for Auto 1 will not exceed 1300%, whereas Auto 2 will not exceed 1700%.

3.2.4 Low-Voltage Ground Fault Relay Settings

The main ground fault time setting was chosen to selectively coordinate with the appropriate load side devices. The ground fault current pickup setting was chosen to selectively coordinate with small load side branch breakers rated 20A and smaller with the consideration that most of the exposure to ground faults would likely occur in the electrical system downstream of these numerous small breakers.

Selective coordination with larger downstream breakers does not exist for any ground fault current exceeding the pickup setting but less than the magnetic setting of the load side breaker. This is unavoidable because the larger load side protective devices are not equipped with ground fault protection. **Figure 4** illustrates this.

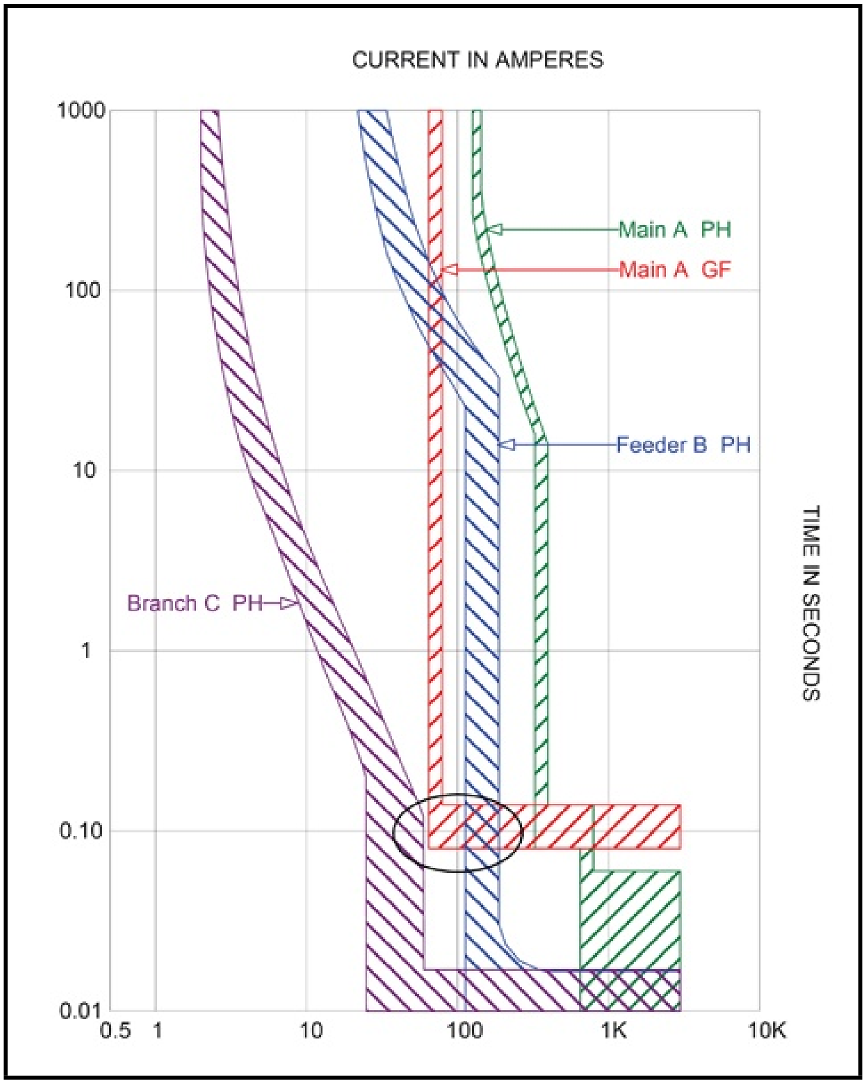


Figure 4: Example ground fault coordination (current scale X 10).

As shown in **Figure 4**, the main ground fault device A selectively coordinates with the small branch breaker C but not with the larger feeder breaker B for ground fault currents in the range of 640A-1,900A as indicated.

All ground fault settings are tabulated in the appropriate overcurrent device setting tables.

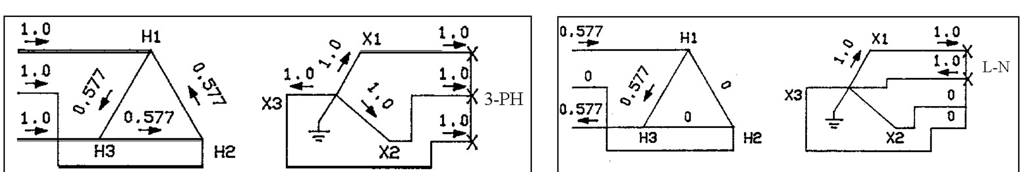
3.2.5 Transformer Protective Devices

If in the project scope, medium- and/or low-voltage transformer primary overcurrent protective devices were checked for compliance with NEC Article 450. Also, medium voltage protective devices, primary, secondary and secondary feeder, were evaluated with respect to the applicable ANSI/IEEE Through Fault Guides (C57.12.59 for dry and cast resin type and C57.109 for liquid immersed type) and the Appendix for ANSI/IEEE C37.91. Transformer standards define low-voltage transformers as having a primary voltage less than or equal to 600V. Transformer full load currents and magnetizing inrush currents were also considered.

If a transformer is subject to a through fault, thermal damage occurs to conductors and insulation due to resistive heating. Mechanical damage occurs to windings and structural components due to large magnetic forces associated with the fault current. In general, smaller transformers are assigned a single damage characteristic that accounts for both thermal and mechanical damage. Larger transformers are assigned a two-part characteristic with a thermal characteristic and a more restrictive mechanical characteristic. For the most conservative protection, the thermal-mechanical limits should be used. In many cases, it may be acceptable to use only the thermal characteristic, especially if the transformer is not subject to frequent through faults. Transformers connected to overhead secondary feeders should be considered to be subject to frequent through faults.

To evaluate through fault protection according to the ANSI Guides, the applicable curve was plotted representing a transformer's projected damage threshold for the cumulative effects of through faults. However, this ANSI through fault curve must be reduced for certain unbalanced secondary faults, because even though full short-circuit current is flowing in one or more secondary windings, the primary overcurrent device experiences less current.

Secondary line-to-neutral faults on delta-wye connected transformers produce only 0.577 of the maximum 3-phase fault current in the primary overcurrent device while one secondary winding experiences the full short-circuit current as illustrated in **Figure 5** below. Therefore, to account for this fault condition, the ANSI through fault curve has been adjusted by a factor of 0.577. Both curves (three phase line-to-line and single phase line-to-neutral) are plotted on the time-current graphs.



3-PH FAULT - Current values are per unit of the 3-ph fault current

L-N FAULT - Current values are per unit of the 3-ph fault current

Figure 5: Delta–Wye 3-PH and L-N fault current per unit values.

Since the through fault curves represent a transformer's projected damage threshold for the cumulative mechanical and thermal effects of through faults, all applicable primary and secondary overcurrent devices were checked to ensure interruption before these through fault curves were reached.

Further, to avoid nuisance interruptions, the primary overcurrent devices were also checked to ensure they will carry the transformers rated full load and equivalent magnetic inrush currents which are plotted on the time-current graphs.

Because of the restrictions mentioned above, complete selective coordination between the transformer primary and secondary main devices may not exist for transformers examined as shown by the overlapping of their characteristics on the time-current graphs. However, this is judged acceptable, because the opening of either device results in the same extent of service interruption.

3.2.6 Cable Protection

Feeder overcurrent protective devices were reviewed to verify the protection of their load side cables as shown on the one-line diagrams in accordance with NEC Article 240. If the adjustable low-voltage protective devices are set as suggested in this report, then the cables reviewed will be properly protected, unless noted otherwise in the *NEC Compliance Issues* section.

The above analysis does not include any aspects of cable ampacity adjustment factors such as derating for conduit fill, elevated ambient temperature, and so on allowed by the NEC.

It should be noted that if a low voltage phase conductor is properly sized per NEC 240, then it is not possible to damage the phase conductor during short-circuits below the AIC rating of the breaker protecting the phase conductor. UL tests to verify the short-circuit rating of a circuit breaker are performed considering 75°C cable. The corresponding phase conductor is sized according to the NEC and must pass the fault tests without compromising its integrity. Therefore, the ICEA cable withstand curves have not been included on the time-current coordination graphs.

3.2.7 Selective Coordination and the 2008 NEC

In some situations, even though individual devices are not coordinated, the system may still be considered to be well-coordinated. For example, where two devices are in series with no loads connected between them, operation of either/both devices interrupts power to the exact same portion of the power system. The system may be considered to be coordinated even though the two devices, strictly speaking, do not coordinate with one another.

Selective coordination, while always desirable, is not required by the NEC except in certain situations:

- In health-care facilities, per NEC 517.17(C): "Ground-fault protection for operation of the service and feeder disconnecting means shall be fully selective such that the feeder device, but not the service device, shall open on ground faults on the load side of the feeder device."

- In elevator circuits when more than one elevator motor is fed by a single feeder. See NEC 620.62.

- In emergency and legally-required standby power systems (including those in hospitals and other health-care facilities where so required), per NEC 700.27 and NEC 701.18.

The requirements for selective coordination in emergency and legally-required standby systems, call for each overcurrent device to be "selectively coordinated with all supply side overcurrent protective devices." This requirement can be problematic for system designers because it recognizes only device coordination and not system coordination. Special consideration of selective coordination (beyond the traditional coordination study) must be given when the system is initially designed, since for both fusible and circuit-breaker based systems, designs that are otherwise NEC compliant may not meet the selective coordination requirements of the NEC.

Compliance with NEC articles 517.17 (Health Care Facilities), 700.27 (Emergency Systems), and 701.18 (Legally Required Standby Systems) may require interpretation and approval by the local authority having jurisdiction.

3.2.8 Assumptions

The following assumptions were made:

1. The plant main distribution switchboard fuse data was assumed, as noted on the one-lines, since the site device data was not available due to lock out and restricted access.
2. Breakers for panelboards AEL-MPC-01 and AEL-MPC-02 do not match with the one line drawing 32E16.

3.3 Analysis of Results and Recommendations

The basic results of an overcurrent device coordination analysis are the time-current coordination graphs which are plotted to illustrate the degree of selective coordination achieved in the system. Fifteen graphs are included in this report. Settings for all devices which have adjustable characteristics are summarized in the appropriate overcurrent device setting tables. Smaller devices with fixed time-current characteristics are not shown on the graphs unless they directly affect the setting of an adjustable upstream device or are protective devices for transformers rated 15 kVA and larger.

For a digital relay, a setpoint file is provided in Appendix D. Before a setpoint file is downloaded to a relay, the setpoint file in the relay needs to be backed up even if the relay is new. The backed up setpoint file needs to be readily available until relay commissioning confirms proper operation.

To generate the time-current graphs, a computer program was used which allows the power system engineer to determine optimum coordination, after first insuring that loading and protection requirements are satisfied. The engineer's objective is to determine the best coordination for the entire system. This approach necessitates tradeoffs in selectivity for some parts of the system to achieve maximum coordination in more critical areas. Regions in which coordination has been sacrificed are as previously discussed involving transformer primary and secondary main devices, high current regions of molded case breakers, etc.

3.3.1 TCC Plot Remarks

The following comments refer to the graphs shown in the Time Current Coordination Graphs section of this report.

Time-current coordination graph 005 HELPDP01.tcc shows device numbers 105-01 and 105-02 as well as other devices. As shown by the graph, these devices do not selectively coordinate well. If achieving selective coordination is absolutely required for this particular circuit, then we recommend upgrading device 105-01 to a solid-state type. These devices have been adjusted to obtain the highest level of selectively possible for the protection level required.

Time-current coordination graph 006 HELLP01.tcc shows device numbers 106-01 and 106-02 as well as other devices. As shown by the graph, these devices do not selectively coordinate well. If achieving selective coordination is absolutely required for this particular circuit, then we recommend upgrading device 106-01 to a thermal magnetic breaker, LA 125ATrip. These devices have been adjusted to obtain the highest level of selectively possible for the protection level required.

Time-current coordination graph 007 HELCPP01.tcc shows device numbers 105-03, 107-01 and 107-02. As shown by the graph, device numbers 105-03 and 107-01 does not selectively coordinate well with device number 107-02. However, these devices are sized at nearly the same trip level so this situation is unavoidable. These devices have been adjusted to obtain the highest level of selectively possible for the protection level required.

Time-current coordination graph 008 AELPDP02.tcc shows device numbers 109-02, 110-01 and 110-02 as well as other devices. As shown by the graph, these devices do not selectively coordinate well. If achieving selective coordination is absolutely required for this particular circuit, then we recommend increasing the device 109-02 plug size from 100A to 200A, and use a

LTPU of 0.5. The devices 110-01 and 110-02 are sized at nearly the same trip level so this situation is unavoidable. These devices have been adjusted to obtain the highest level of selectively possible for the protection level required.

Time-current coordination graph 010 AELPDP01.tcc shows device numbers 112-02, 113-01 and 113-02. As shown by the graph, device numbers 112-02 and 113-01 does not selectively coordinate well with device number 113-02. However, these devices are sized at nearly the same trip level so this situation is unavoidable. These devices have been adjusted to obtain the highest level of selectively possible for the protection level required.

Time-current coordination graph 011 PELPDP01.tcc shows device numbers 112-03, 114-01 and 114-02. As shown by the graph, these devices do not selectively coordinate well. However, these devices are non adjustable, hence no settings are available to obtain the highest level of selectively possible for the protection level required.

Time-current coordination graph 013 SELCPP11.tcc shows device numbers 115-03, 117-01 and 117-02. As shown by the graph, device numbers 115-03 and 117-01 does not selectively coordinate well with device number 117-02. However, these devices are sized at nearly the same trip level so this situation is unavoidable. These devices have been adjusted to obtain the highest level of selectively possible for the protection level required.

3.4 Overcurrent Device Setting Table

BUS NUMBER & NAME	DEVICE NUMBER & NAME DEVICE TYPE	MANUFACTURER DESCRIPTION	BUS VOLTS DEV. VOLTS	FRAME SENSOR PLUG	SETTINGS
005 AEL-PDP-11A	005-01 Thermal Magnetic	SQUARE D MG w/ ET1.0, 2-10x Inst. 300-800A	480.0V 600V	800.0A 600.0A	Thermal Curve INST 8 (4800A) INST OVERRIDE Fixed (12000A)
005 AEL-PDP-11A	005-05 Thermal Magnetic	SQUARE D LA (10/04) 125-400A, 2-3 poles	480.0V 600V	400.0A 400.0A	Thermal Curve INST (LO-HI) LO (2000A)
005 AEL-PDP-11A	005-06 Thermal Magnetic	SQUARE D LC 300-600A	480.0V 600V	600.0A 600.0A	Thermal Curve INST HI (4200A)
009 AEL-PDP-12	009-01 Thermal Magnetic	SQUARE D MG w/ ET1.0, 2-10x Inst. 300-800A	480.0V 600V	800.0A 400.0A	Thermal Curve INST 5 (2000A) INST OVERRIDE Fixed (12000A)
015 AEL-PDP-11B	015-01 Thermal Magnetic	SQUARE D MG w/ ET1.0, 2-10x Inst. 300-800A	480.0V 600V	800.0A 600.0A	Thermal Curve INST 8 (4800A) INST OVERRIDE Fixed (12000A)
015 AEL-PDP-11B	015-02 Thermal Magnetic	SQUARE D LC 300-600A	480.0V 600V	600.0A 600.0A	Thermal Curve INST HI (4200A)
015 AEL-PDP-11B	015-03 Thermal Magnetic	SQUARE D LA (10/04) 125-400A, 2-3 poles	480.0V 600V	400.0A 400.0A	Thermal Curve INST (LO-HI) LO (2000A)
105 HEL-PDP-01	105-01 Thermal Magnetic	SQUARE D LA (10/04) 125-400A, 2-3 poles	480.0V 600V	150.0A 150.0A	Thermal Curve INST (LO-HI) HI (1500A)
109 PMC-MCC-02	109-01 Static Trip	SQUARE D Powerpact P-Frame, 5.0 & 6.0 A/P/H LSI, 250-1200A	480.0V 600V	1200.0A 600.0A	Phase LTPU (A);LTD 1 (600A); 4 STPU 3 (1800A) STD 0.2 (I^2t Out) INST (PJ, PL 400-1200) 6 (3600A) Ground Ig H (540A) tg 0.4 (I^2t Out)
109 PMC-MCC-02	109-02 Static Trip	SQUARE D LX / LXI, Series 2B/3B LSI, 250/400AS	480.0V 600V	250.0A 250.0A 100.0A	LTPU 0.8 (80A) LTD 6 STPU 8 (800A) STD 0.2 (I^2t In) INST 8.0 (800A) INST OVERRIDE Fixed (7000A)

Frame, Sensor and Plug types must be verified to agree with this list prior to installing settings. I2t dial settings follow In = On and Out = Off.

BUS NUMBER & NAME	DEVICE NUMBER & NAME DEVICE TYPE	MANUFACTURER DESCRIPTION	BUS VOLTS DEV. VOLTS	FRAME SENSOR PLUG	SETTINGS
115 SEL-PDP-11	115-01 Thermal Magnetic	SQUARE D LA (10/04) 125-400A, 2-3 poles	480.0V 600V	400.0A 400.0A	Thermal Curve INST (LO-HI) 2 (2564A)

Frame, Sensor and Plug types must be verified to agree with this list prior to installing settings. I2t dial settings follow In = On and Out = Off.

SQUARE D

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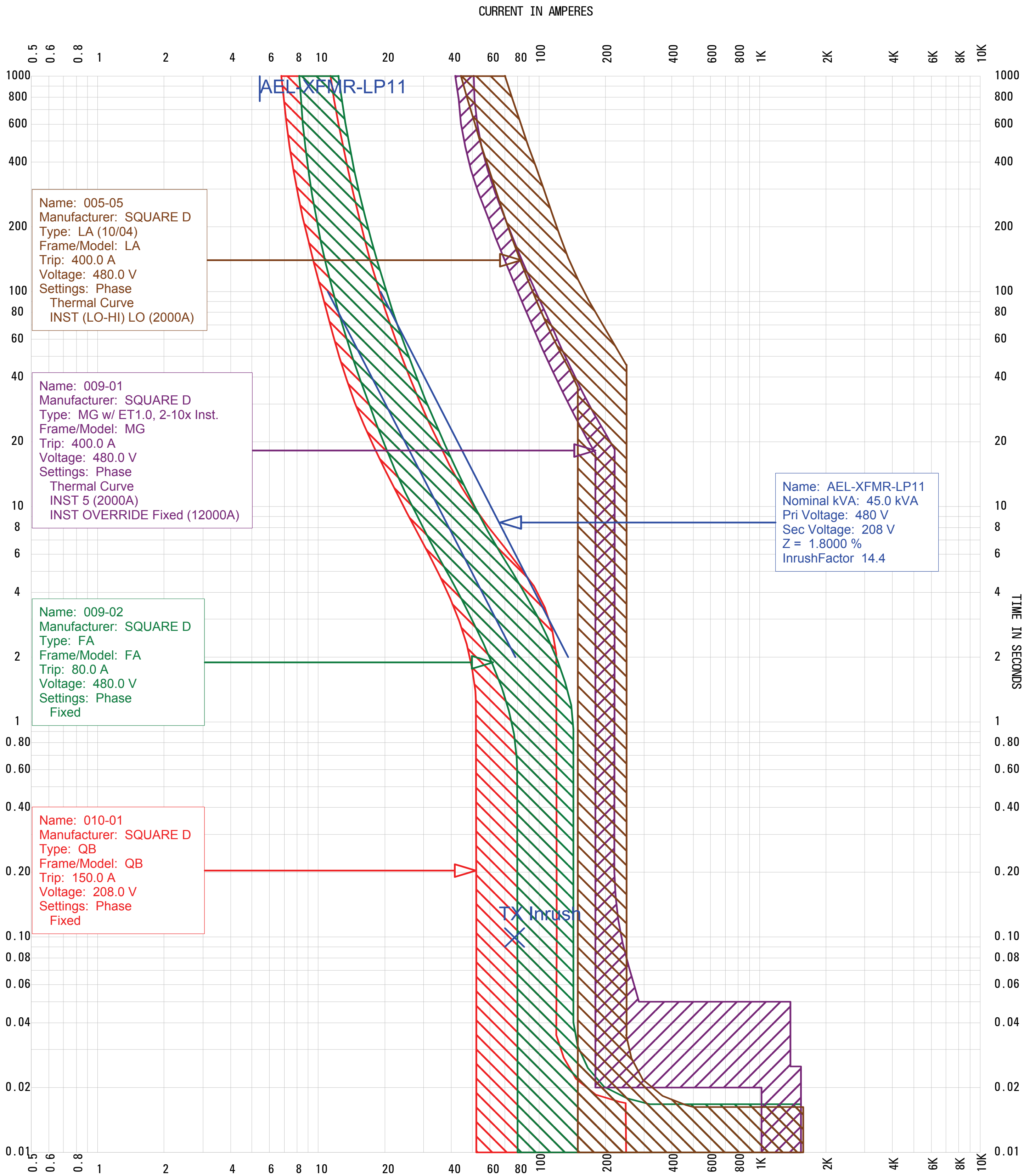
SQUARE D ENGINEERING SERVICES

DEVICE SETTING TABLE
RELAYS

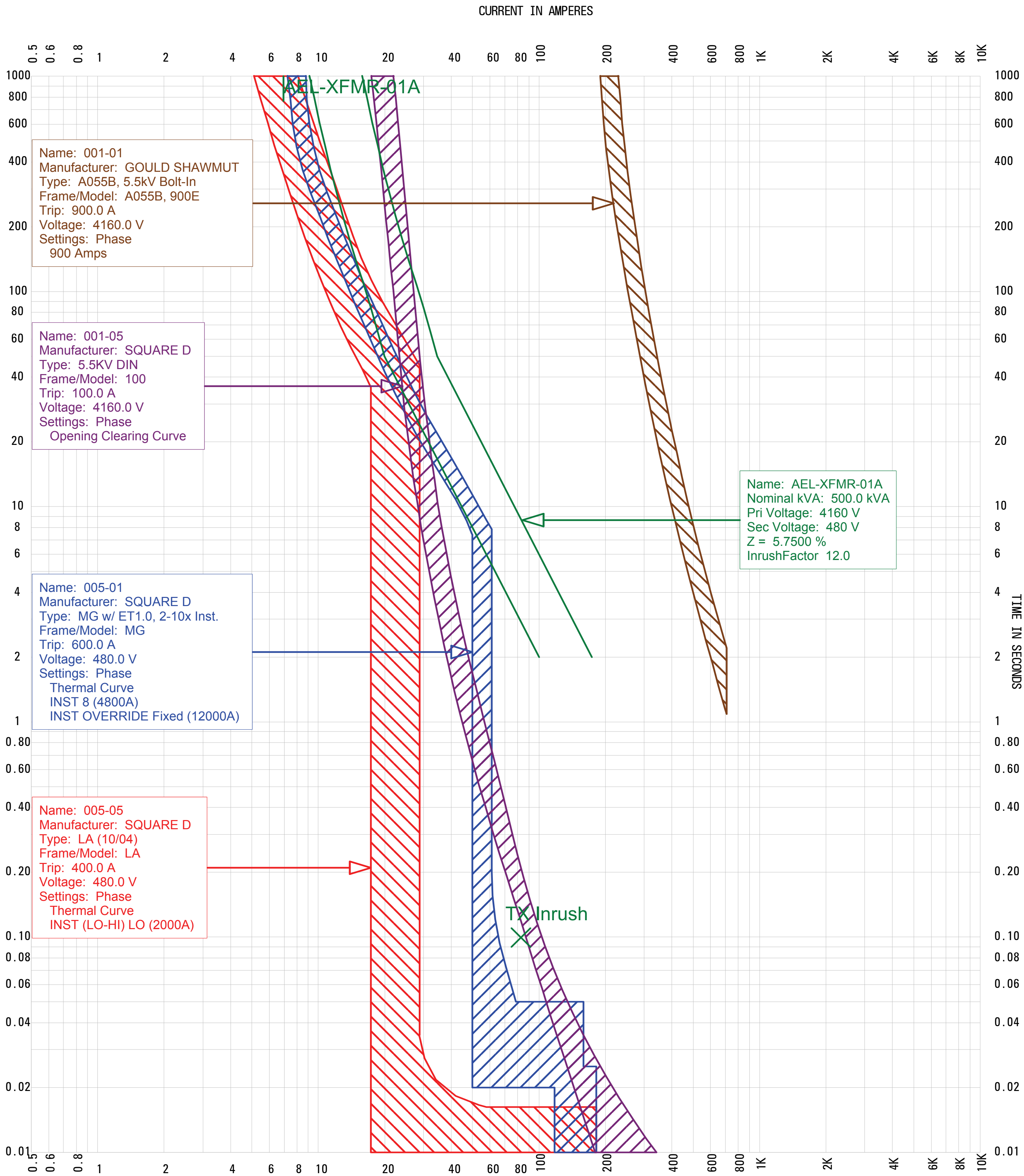
SAWS LEON CREEK WRC
SAN ANTONIO. TX
D-ML-10-660-1,2

BUS NUMBER & NAME	DEVICE NUMBER & NAME DEVICE TYPE	MANUFACTURER DESCRIPTION	BUS VOLTS DEV. VOLTS	CT RATIO	SETTINGS
001 AMC-MCC-01A	001-02 R Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	250/5	O/L PU 1.15 (125.69A) O/L Curves 2
001 AMC-MCC-01A	001-02 RG Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	50/5	GFPU(5A CT Sec) 0.3 (15A) GF Delay 0.01
001 AMC-MCC-01A	001-03 R Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	250/5	O/L PU 1.15 (125.69A) O/L Curves 2
001 AMC-MCC-01A	001-03 RG Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	50/5	GFPU(5A CT Sec) 0.3 (15A) GF Delay 0.01
014 AMC-MCC-01B	014-03 R Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	250/5	O/L PU 1.15 (125.69A) O/L Curves 2
014 AMC-MCC-01B	014-03 RG Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	50/5	GFPU(5A CT Sec) 0.3 (15A) GF Delay 0.01
014 AMC-MCC-01B	014-04 R Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	250/5	O/L PU 1.15 (125.69A) O/L Curves 2
014 AMC-MCC-01B	014-04 RG Static Relay	MULTILIN SR469 Motor Relay 5A CT Sec	4160.0V 230000V	50/5	GFPU(5A CT Sec) 0.3 (15A) GF Delay 0.01

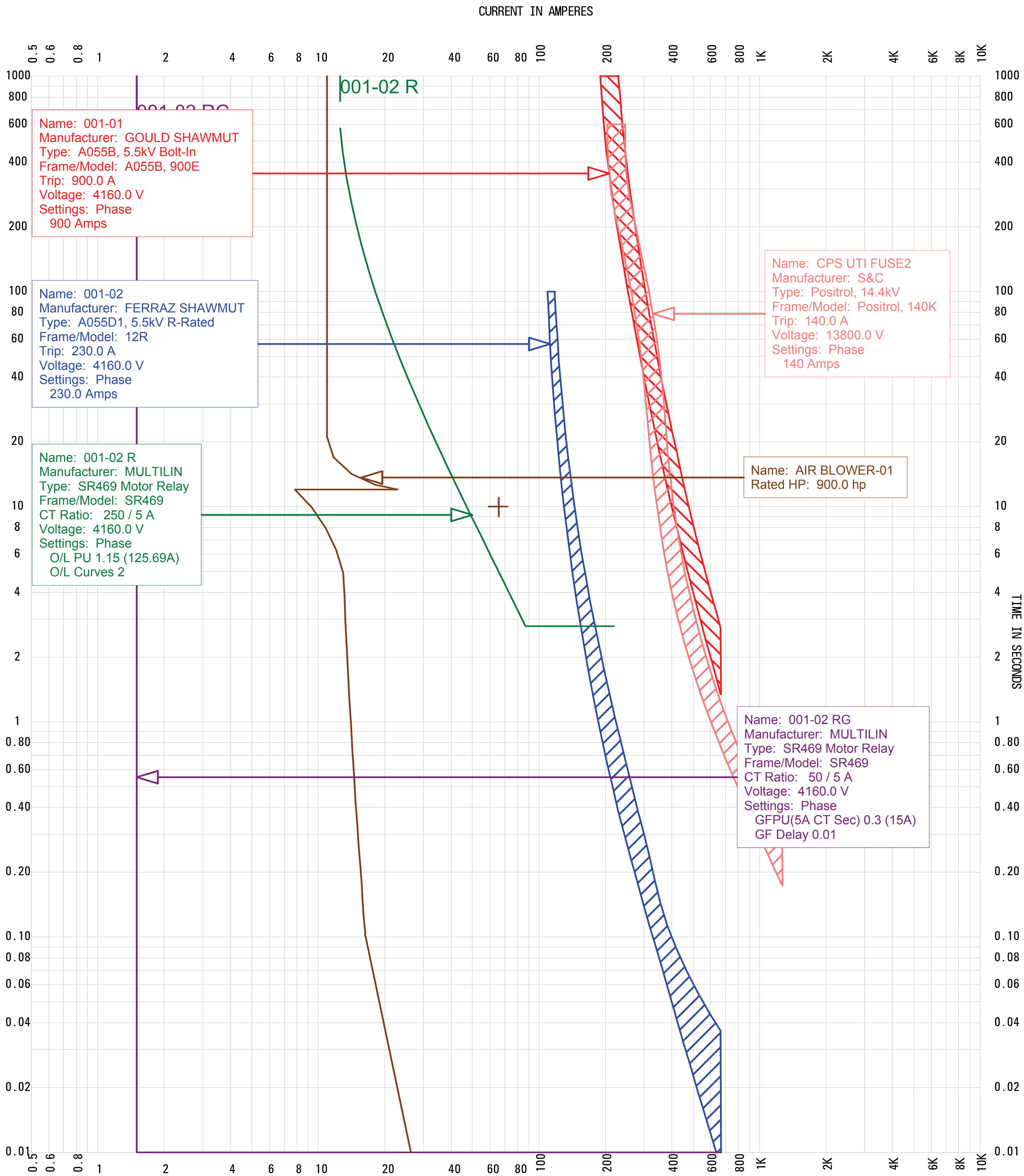
3.5 Time-Current Coordination Graphs - Recommended Settings



Name: 001 AEL-LP11.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D

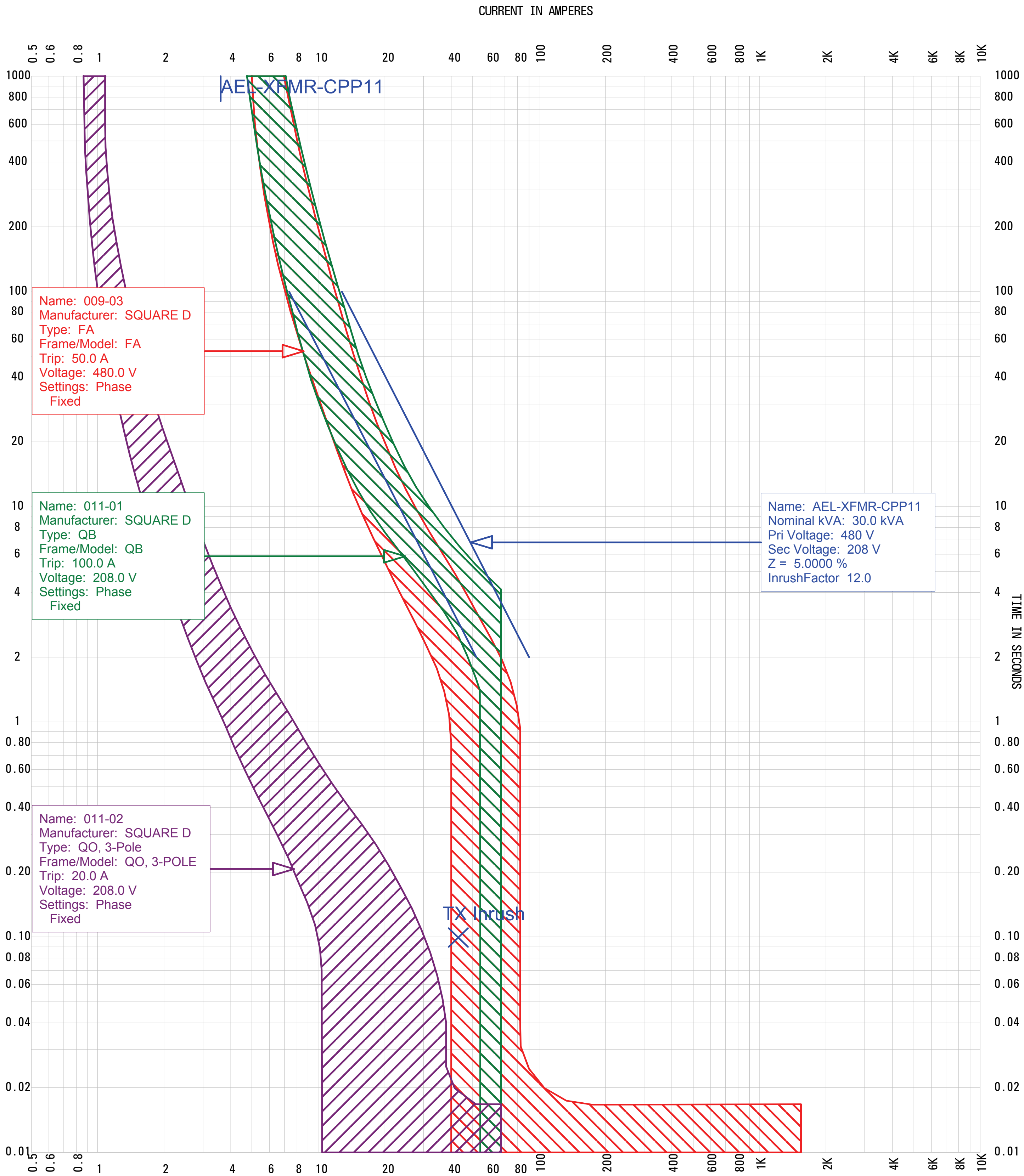


Name: 002 AEL-PDP-11A.tcc	Current Scale x 10	Reference Voltage: 4160
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D

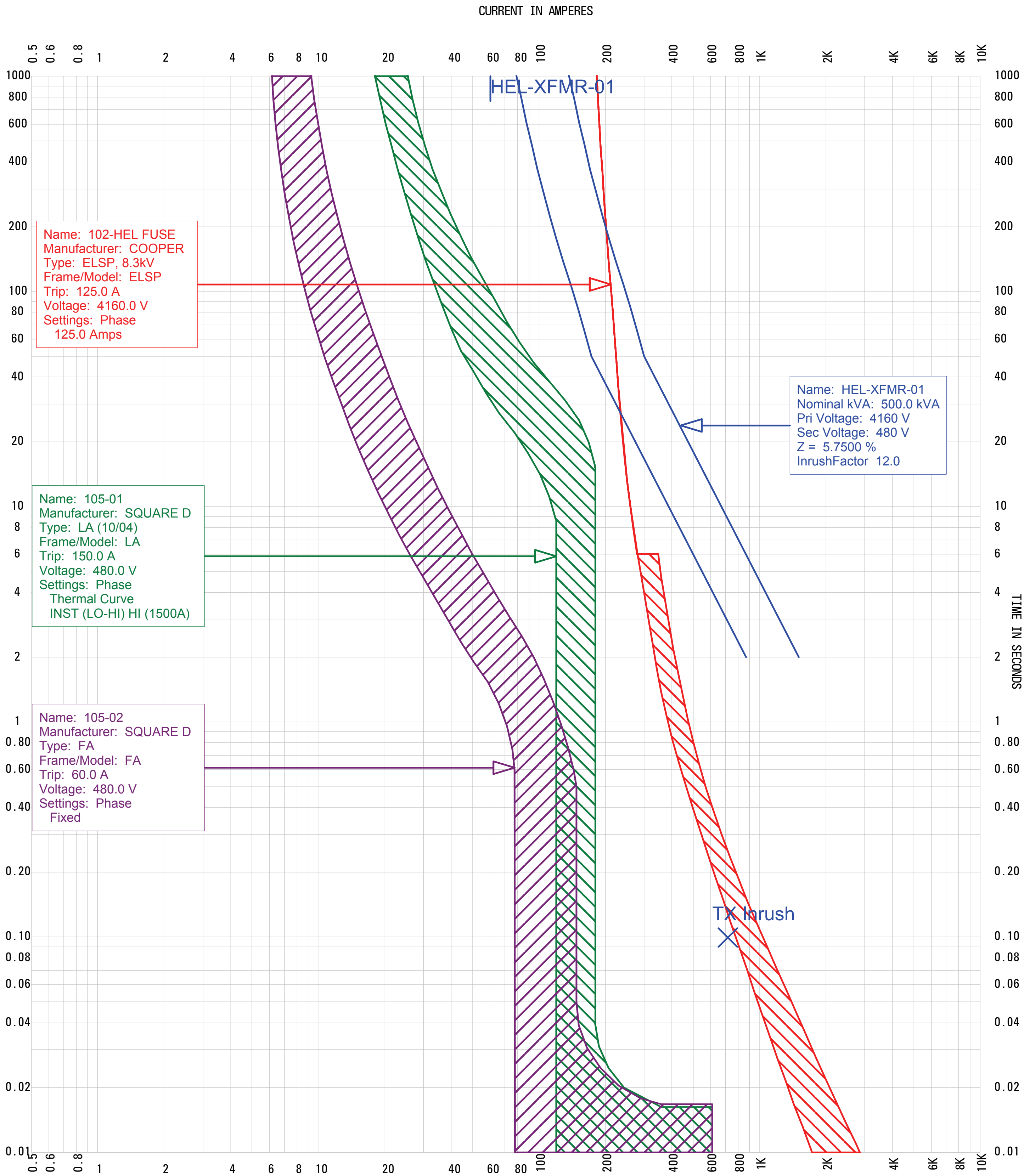


Name: 003 LC-AASBC01.tcc — Current Scale x 10 — Reference Voltage: 4160

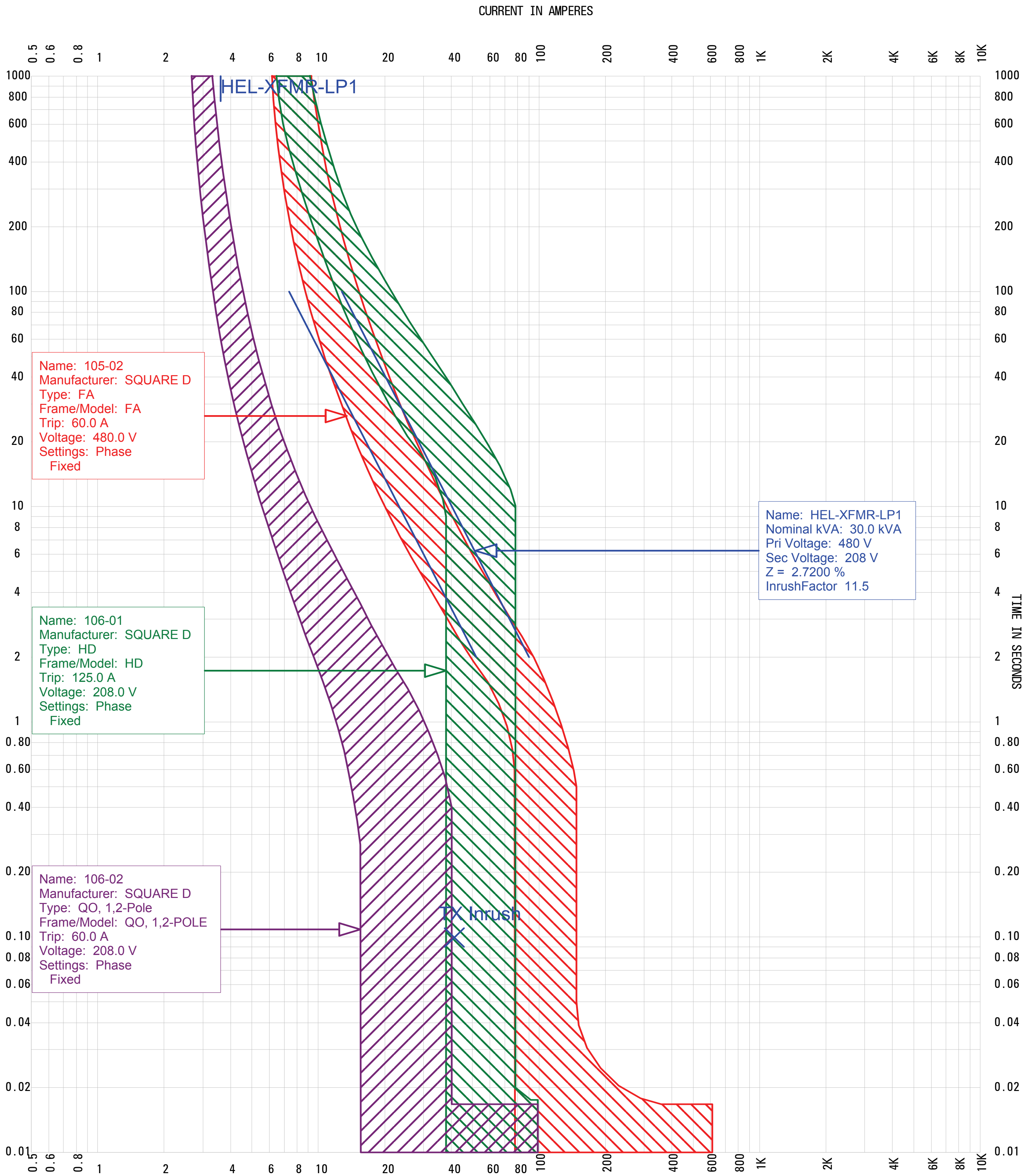
June 17, 2011 — ML10660 SAWS LEON CREEK SAN ANTONIO, TX — Square D



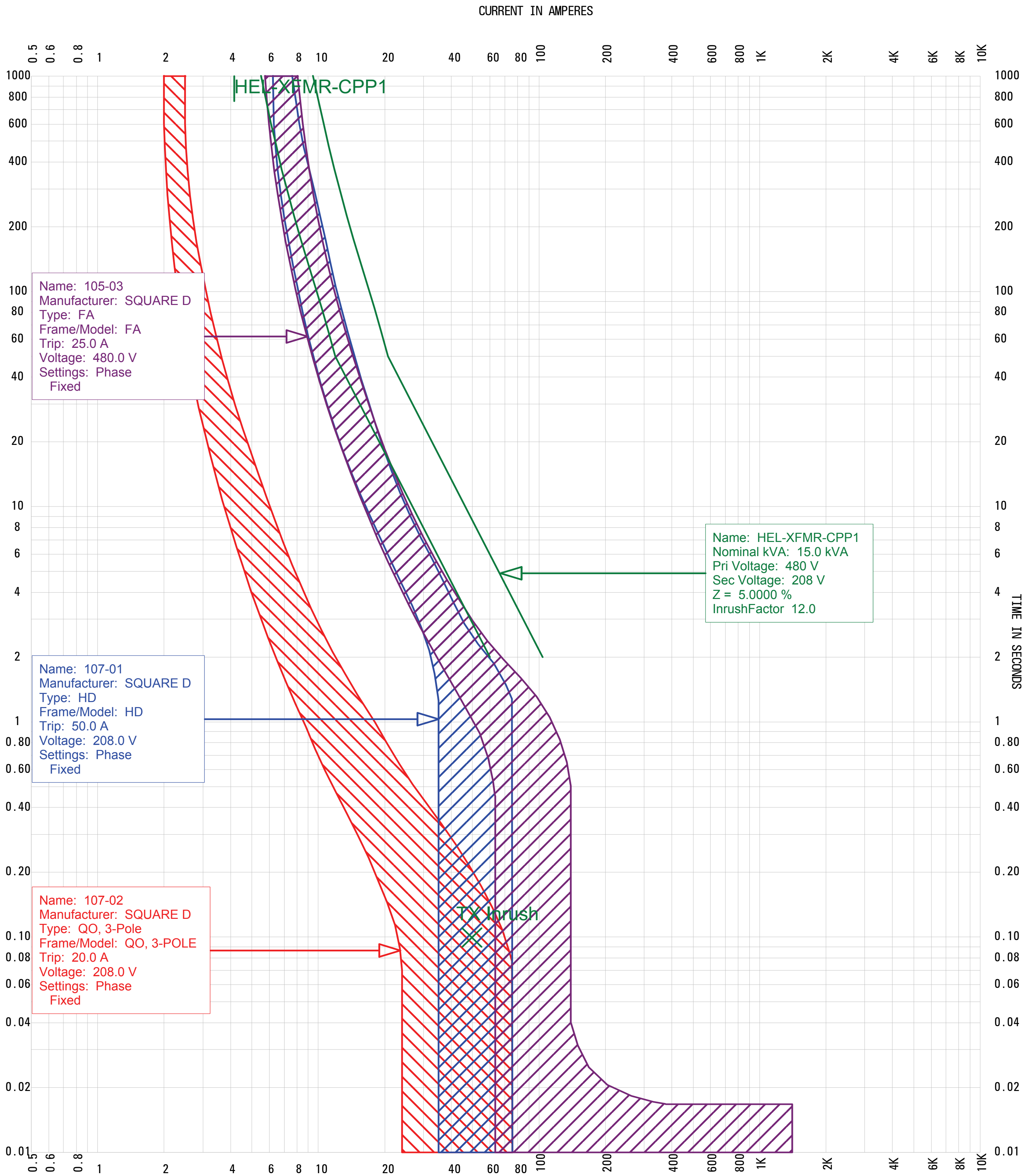
Name: 004 AEL-CPP11.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



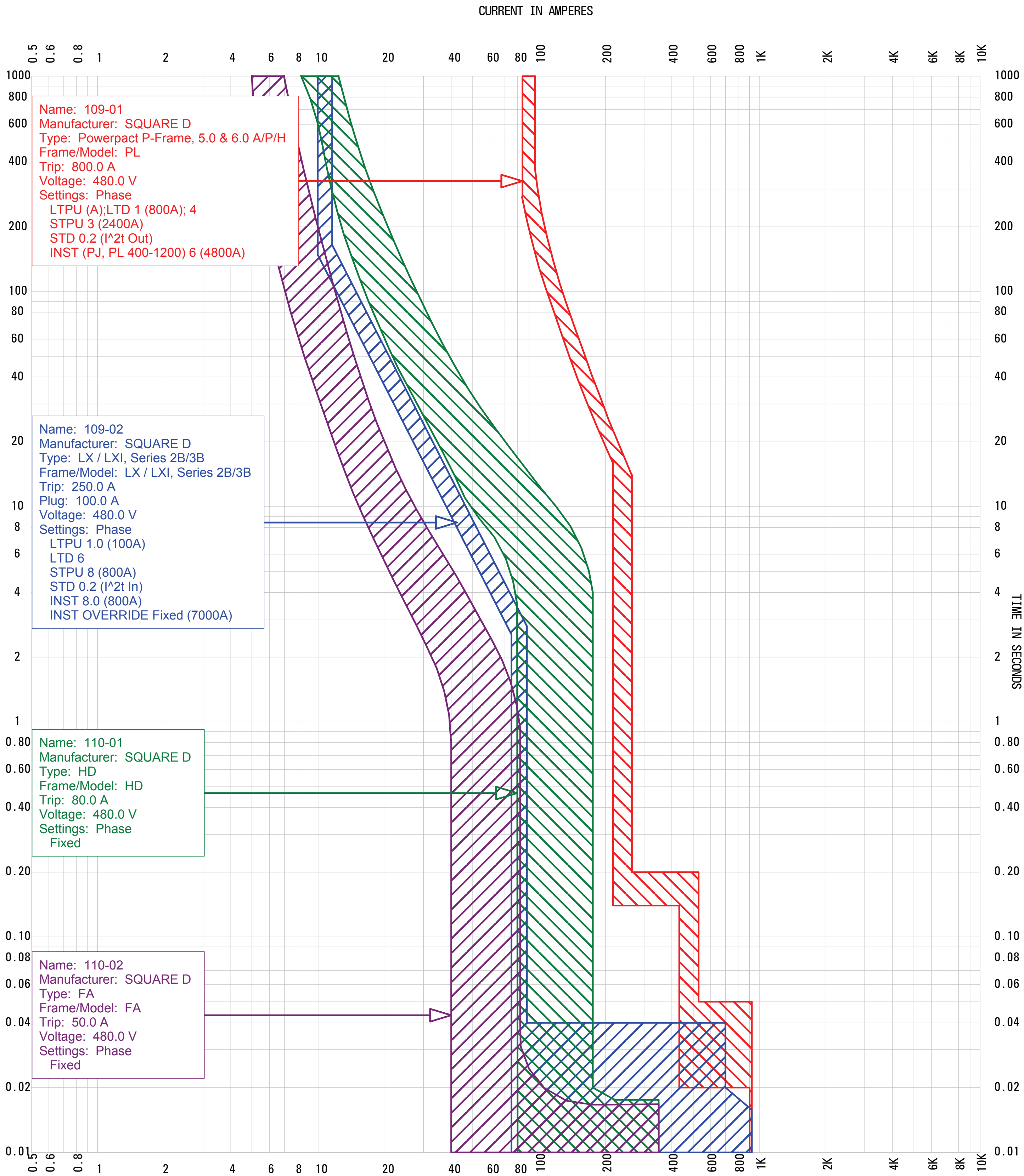
Name: 005 HELPDP01.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



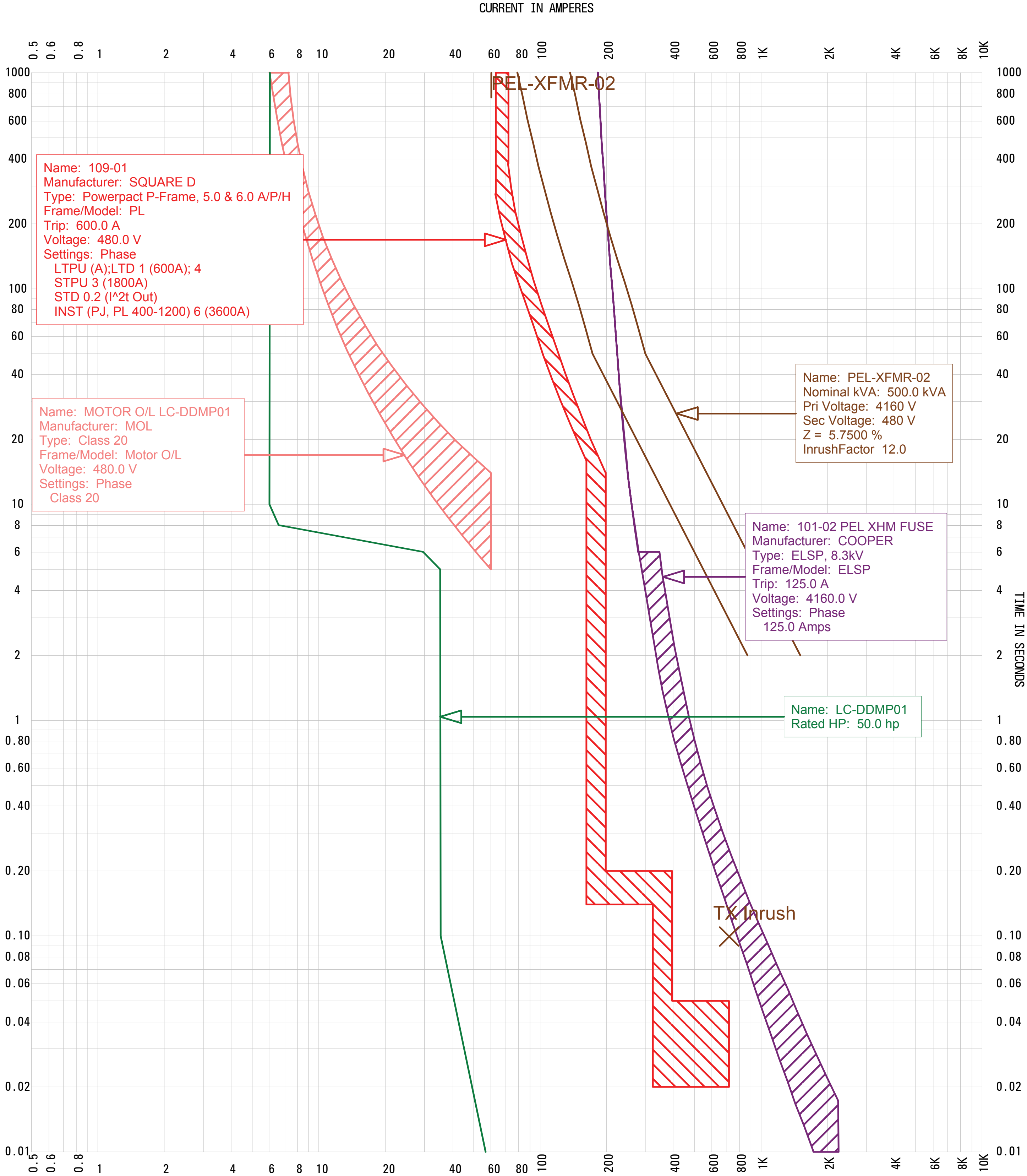
Name: 006 HELLP01.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



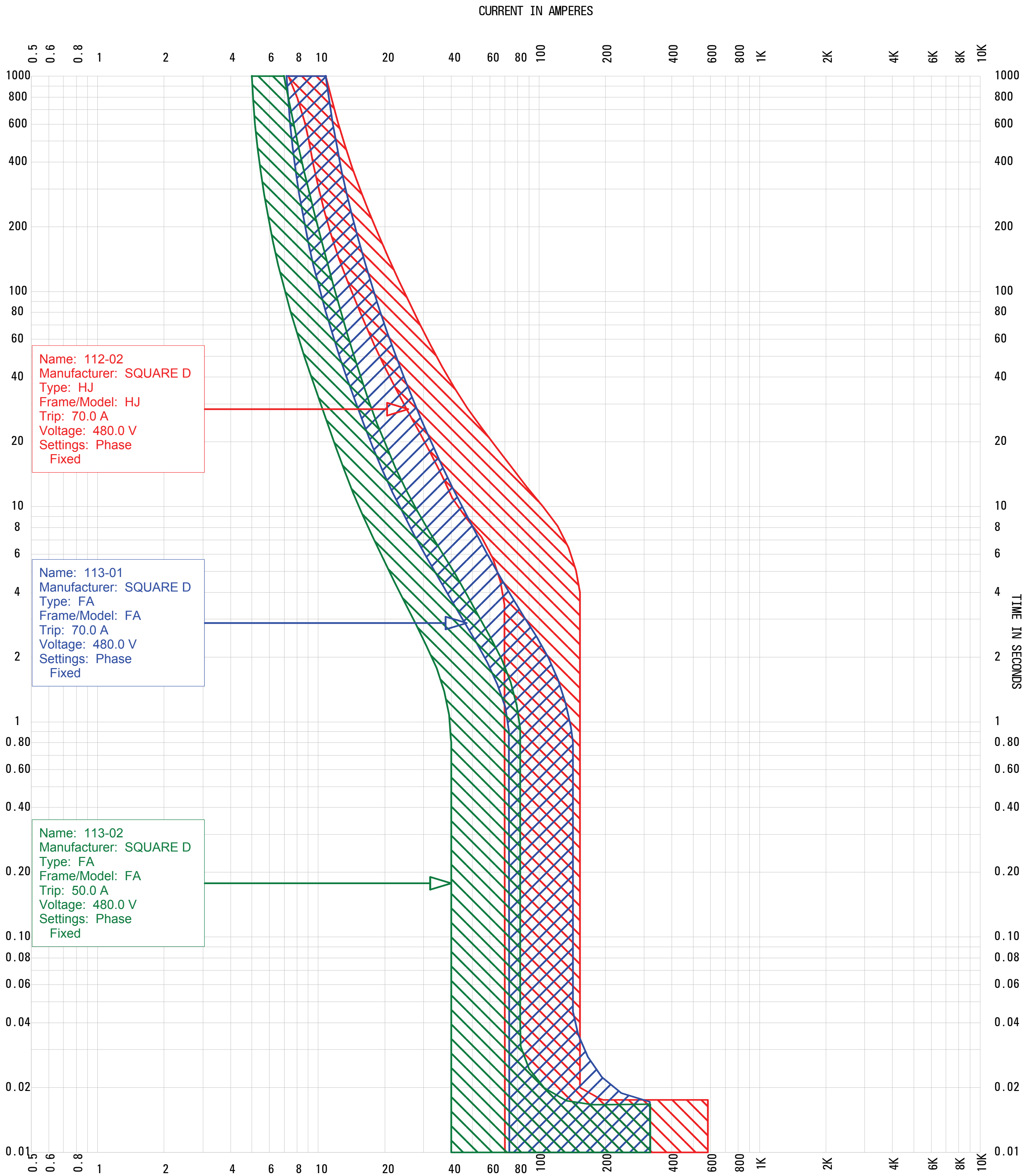
Name: 007 HELCPP01.tcc	Current Scale x 10	Reference Voltage: 208
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



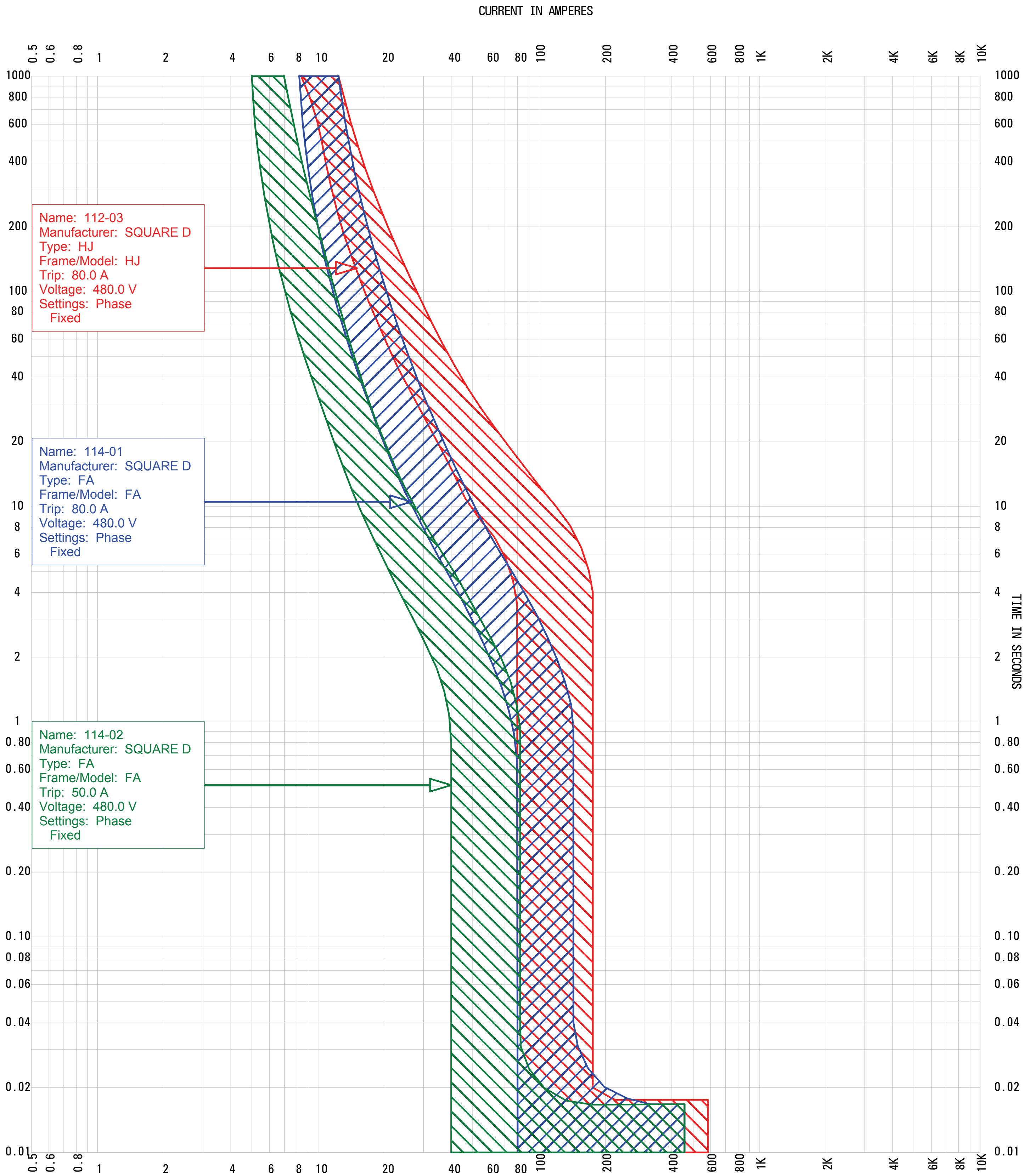
Name: 008 AELPDP02.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



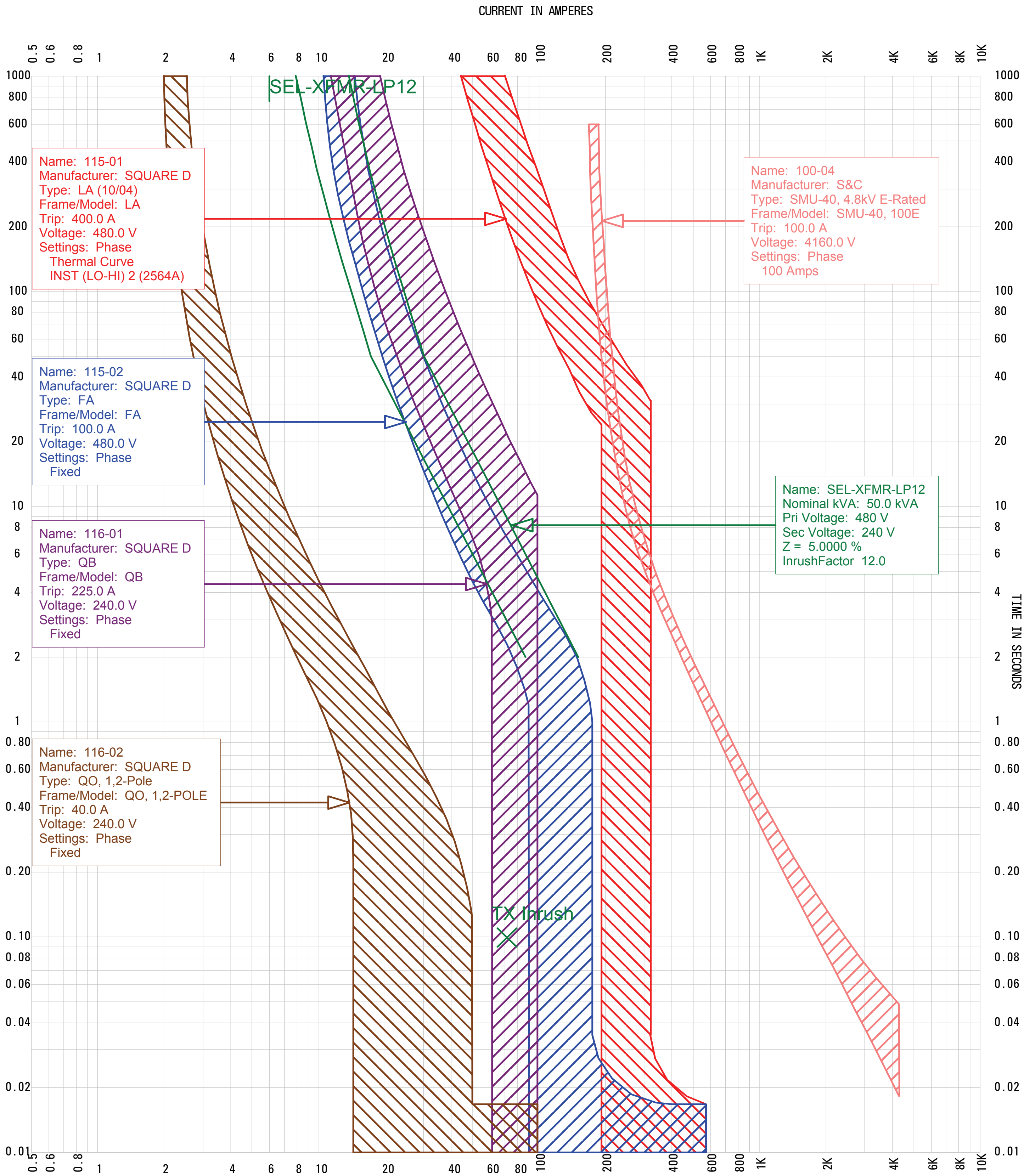
Name: 009 LCDDMP01.tcc	Current Scale x 10	Reference Voltage: 480
July 12, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



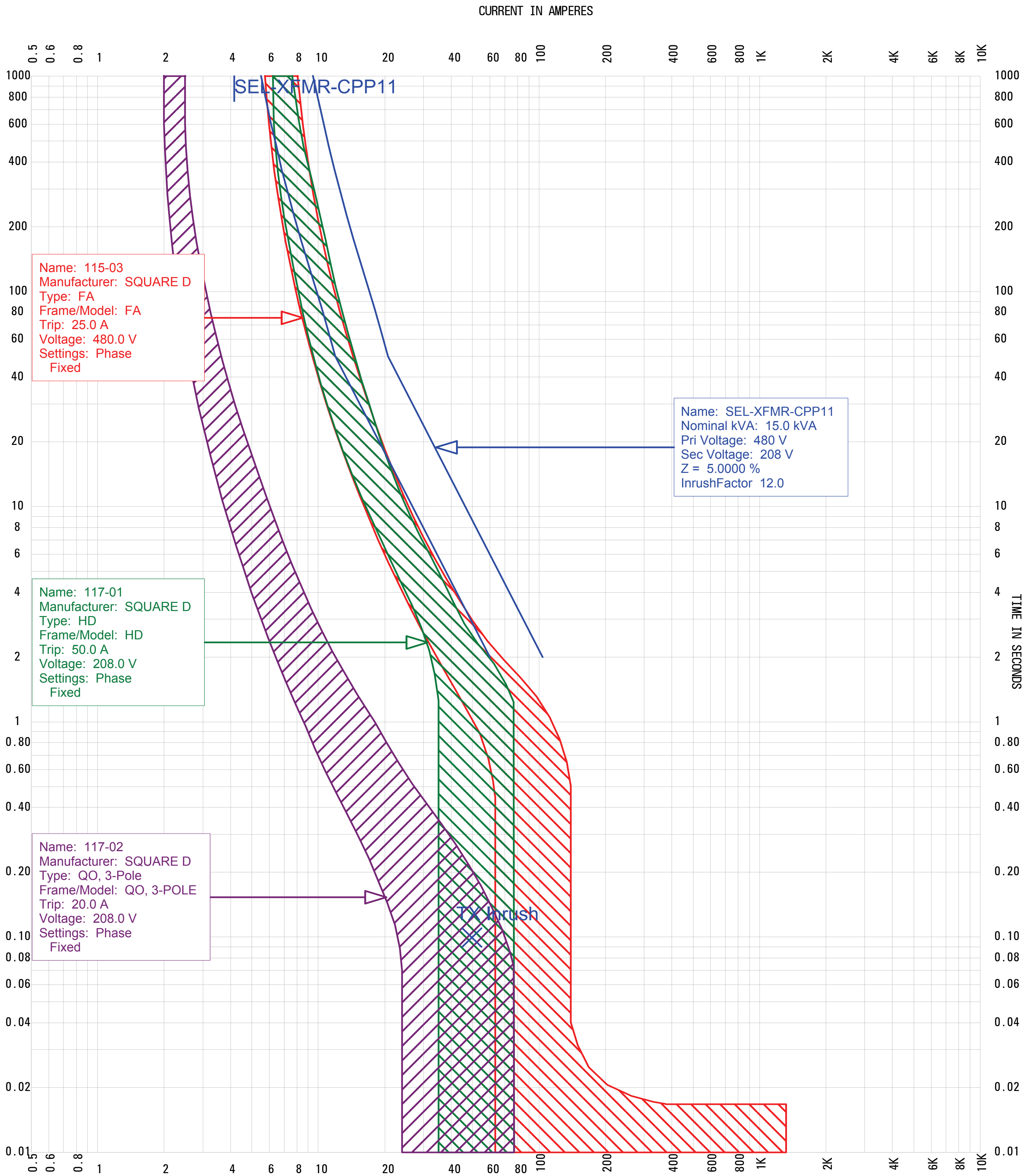
Name: 010 AELPDP01.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



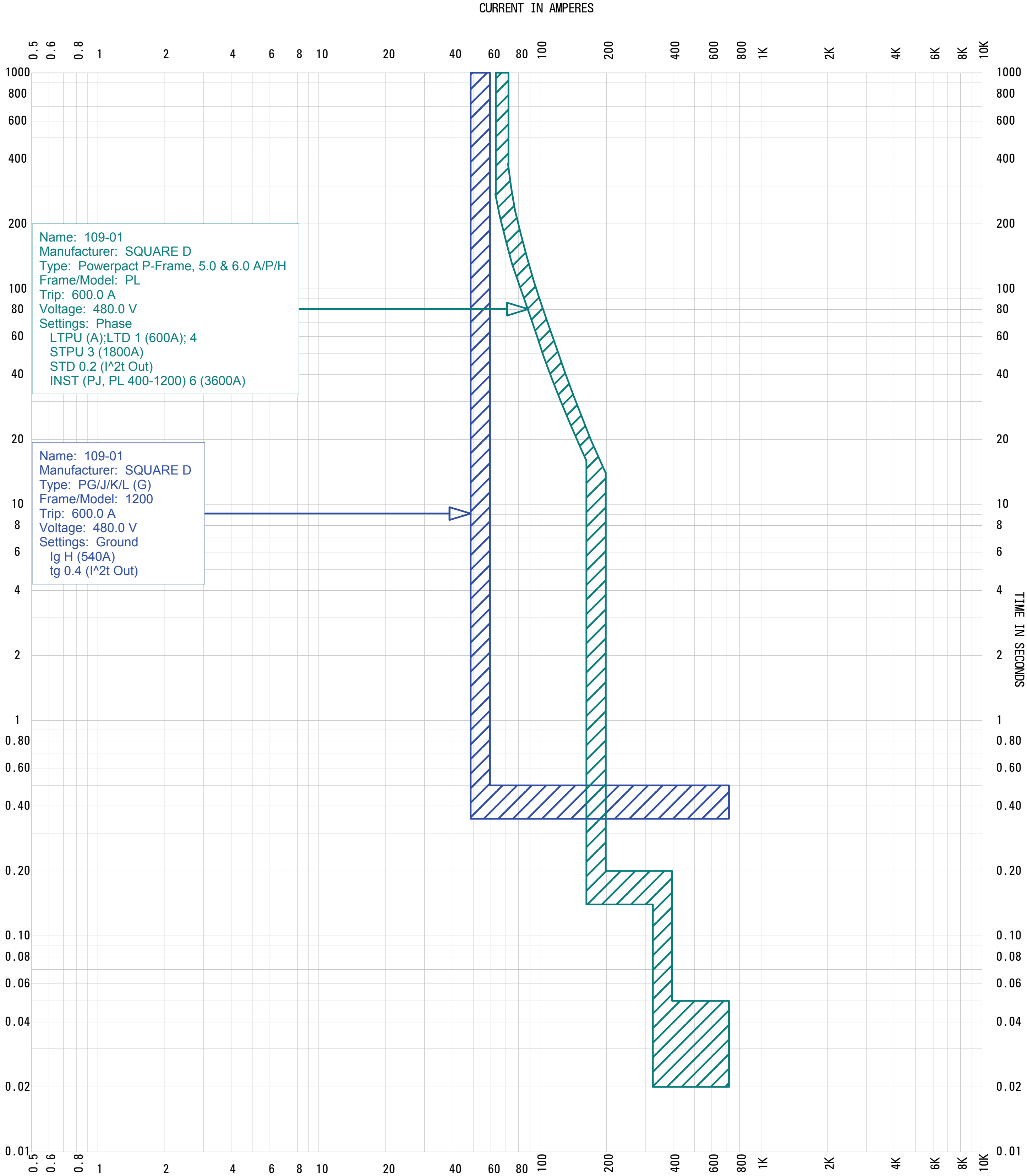
Name: 011 PELPDP01.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



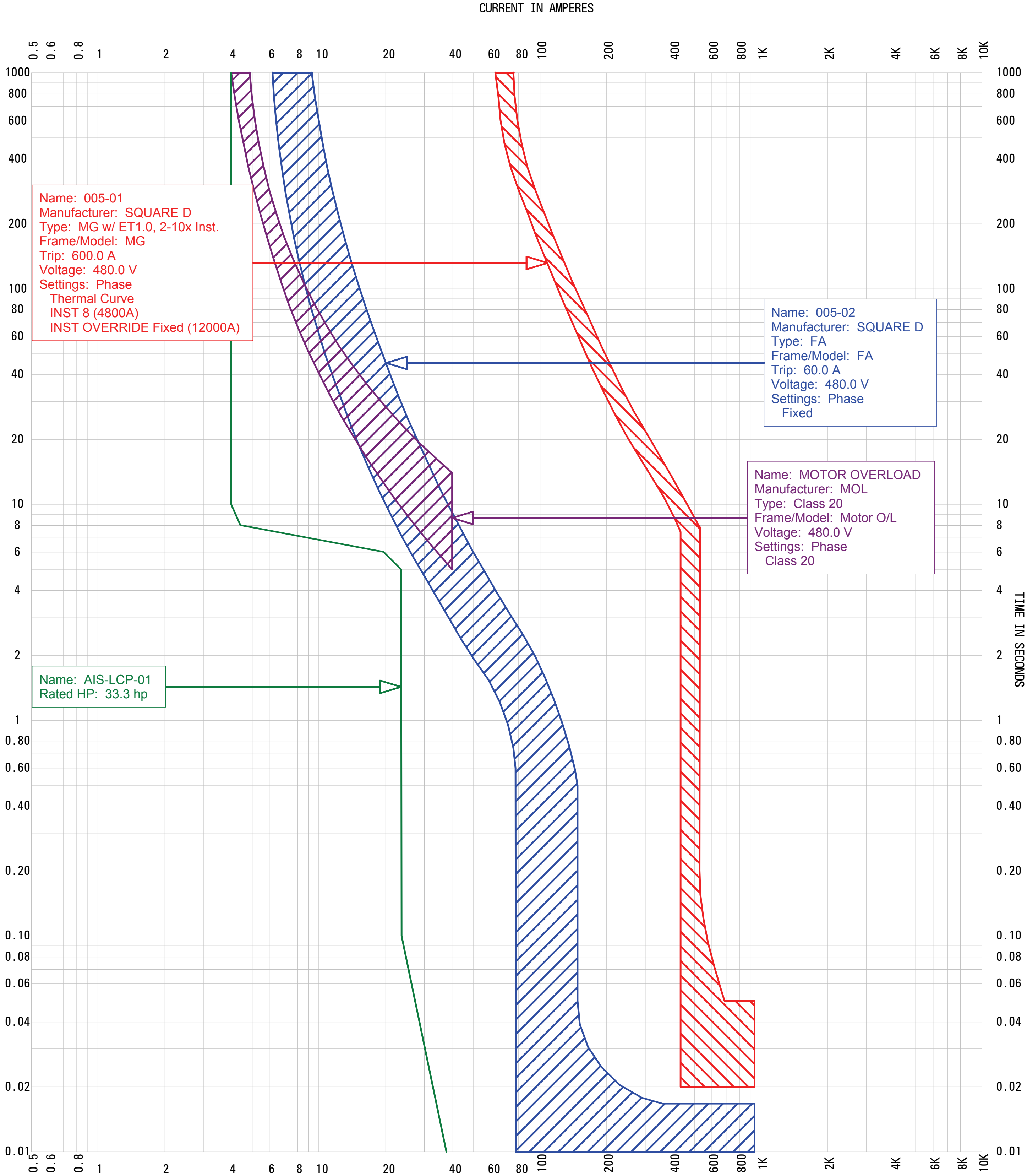
Name: 012 SELLP12.tcc	Current Scale x 10	Reference Voltage: 480
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



Name: 013 SELCPP11.tcc	Current Scale x 10	Reference Voltage: 208
January 24, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



Name: 014G PMCMCC02 MAIN.tcc	Current Scale x 10	Reference Voltage: 480
July 12, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D



Name: 15 AIS-LCP-01.tcc	Current Scale x 10	Reference Voltage: 480
July 12, 2011	ML10660 SAWS LEON CREEK SAN ANTONIO, TX	Square D

APPENDIX A: ABBREVIATIONS AND TRADEMARKS

Organizations and Standards

ANSI	- American National Standards Institute
IEEE	- Institute of Electrical and Electronics Engineers
ICEA	- Insulated Cable Engineers Association
NEC	- National Electrical Code (NFPA No. 70)
NEMA	- National Electrical Manufacturers Association
UL	- Underwriters' Laboratories, Inc.

Other Abbreviations

A	- Amperes (RMS symmetrical)
AFIE	- Arc Flash Incident Energy (cal/cm^2)
AIC	- Amperes Interrupting Capacity (Three-Phase RMS sym.)
ASD	- Adjustable Speed ac Drive
ATPV	- Protective Clothing Arc Rating
ATS	- Automatic Transfer Switch
C/B	- Circuit Breaker
CHP	- Combined Horsepower
CFLA	- Combined Full Load Amperes
CT	- Current Transformer
FLA	- Full Load Amperes
FPB	- Flash Protection Boundary
HP	- Horsepower
I_L	- Max. Demand Load Current at PCC
I_{SC}	- Short-Circuit Current at PCC
kVA	- Kilovolt-Ampere
kVAm	- Kilovolt-Amperes of Motor Short Circuit contribution
kW	- Kilowatt
L-L	- Line-To-Line
LRA	- Locked-Rotor Amperes
L.V.	- Low Voltage
LSIG.	- L = Long Time, S = Short time, I = Instantaneous, G = Ground fault protection
MCC	- Motor Control Center
MCS	- Molded Case Switch
Mohms	- Milliohms
M.V.	- Medium Voltage
OCPD	- Overcurrent Protective Device
O.L.	- Overload
PCC	- Point of Common Coupling
PF	- Power Factor
PPE	- Personal Protective Equipment
PWM	- Pulse Width Modulated
R	- Resistance
RMS	- Root-Mean-Square
SCA	- Short-Circuit Amperes
SCAm	- Short-Circuit Amperes of Motor Contribution
SCCR	- Short-Circuit Current Rating
S.F.	- Service Factor
sym.	- Symmetrical
TCC.	- Time Current Coordination graph
TCR	- Trip Current Rating
TDD	- Total Demand Distortion
THD	- Total Harmonic Distortion
V	- Line-To-Line Volts (RMS sym.)
WCR	- Withstand Current Rating
X	- Reactance
Z	- Impedance
%Z	- Percent Impedance

Trademarks

BOLT-LOC, ECONOPAK, EZ METER-PAK, GROUND CENSOR, I-LIMITER, I-LINE, ISO-FLEX, MAG-GARD, MICROLOGIC, MINI POWER-ZONE, OMEGAPAK, POWER-CAST, POWER STYLE, POWER ZONE, QF, QO, QWIK-GARD, SORGEL, SPEED-D, SQUARE D, VACARC and WATCHDOG are registered trademarks of Square D Company. I-75,000, METER-PAK, and PZ-8 are trademarks of Square D Company.

Company Abbreviations

Allen-Bradley	A-B
Allis-Chalmers	A-C
ASEA Brown Boveri	ABB
Automatic Switch Co	ASCO
Basler	BAS
Bussmann	BUSS
Challenger	CHA
Cooper	COOP
Cutler – Hammer	C-H
Economy Fuse	ECON
Federal Pacific Electric	FPE
G & W Electric	G&W
General Electric	GE
Gould Shawmut	GS
I-T-E Imperial	ITE
Kearney	KEA
Klockner	KLO
Littlefuse	LIT
McGraw Edison	ME
Merlin Gerin	MG
Powell	POW
Reliance	REL
RTE Corp.	RTE
Russelectric	RUSS
S & C Electric	S&C
Schweitzer Engr. Labs	SEL
Siemens	SIE
Square D	SQD
Thomas Betts	T-B
Toshiba	TOS
Westinghouse	WEST
Zenith	Z

APPENDIX B: SHORT CIRCUIT INPUT TABULATIONS

ALL PU VALUES ARE EXPRESSED ON A 100 MVA BASE.

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AASBC01-P	001 AMC-MCC-01A	002 LC-AASBC01	1	4160	65.0 FEET	4/0	Copper

Duct Material: Plastic Insulation Type: EPR Insulation Class:
+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft 0.0193 + J 0.0178 PU
Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft 0.0308 + J 0.0453 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AASBC02-P	001 AMC-MCC-01A	003 LC-AASBC02	1	4160	65.0 FEET	4/0	Copper

Duct Material: Plastic Insulation Type: EPR Insulation Class:
+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft 0.0193 + J 0.0178 PU
Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft 0.0308 + J 0.0453 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AASBC03-P	014 AMC-MCC-01B	018 LC-AASBC03	1	4160	65.0 FEET	4/0	Copper

Duct Material: Plastic Insulation Type: EPR Insulation Class:
+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft 0.0193 + J 0.0178 PU
Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft 0.0308 + J 0.0453 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AASBC04-P	014 AMC-MCC-01B	019 LC-AASBC04	1	4160	65.0 FEET	4/0	Copper

Duct Material: Plastic Insulation Type: EPR Insulation Class:
+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft 0.0193 + J 0.0178 PU
Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft 0.0308 + J 0.0453 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AEL-CPP11-P	009 AEL-PDP-12	BUS-0066	1	480	35.0 FEET	8	Copper

Duct Material: Magnetic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.6404 + J 0.0475 Ohms/1000 ft 9.73 + J 0.7216 PU
Z0 Impedance: 2.02 + J 0.1170 Ohms/1000 ft 30.66 + J 1.78 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AEL-H1-P	005 AEL-PDP-11A	BUS-0059	1	480	30.0 FEET	10	Copper

Duct Material: Magnetic Insulation Type: THHN Insulation Class:
+/- Impedance: 1.02 + J 0.0463 Ohms/1000 ft 13.26 + J 0.6029 PU
Z0 Impedance: 3.21 + J 0.1140 Ohms/1000 ft 41.77 + J 1.48 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AEL-H2-P	015 AEL-PDP-11B	BUS-0077	1	480	30.0 FEET	10	Copper

Duct Material: Magnetic Insulation Type: THHN Insulation Class:
+/- Impedance: 1.02 + J 0.0463 Ohms/1000 ft 13.26 + J 0.6029 PU
Z0 Impedance: 3.21 + J 0.1140 Ohms/1000 ft 41.77 + J 1.48 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AEL-LP11-P	009 AEL-PDP-12	BUS-0063	1	480	30.0 FEET	4	Copper

Duct Material: Magnetic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.2590 + J 0.0441 Ohms/1000 ft 3.37 + J 0.5742 PU
Z0 Impedance: 0.8163 + J 0.1086 Ohms/1000 ft 10.63 + J 1.41 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AEL-MPC1-P	009 AEL-PDP-12	BUS-0069	1	480	360.0 FEET	2	Copper

Duct Material: Magnetic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.1640 + J 0.0420 Ohms/1000 ft 25.63 + J 6.56 PU
Z0 Impedance: 0.5168 + J 0.1034 Ohms/1000 ft 80.76 + J 16.16 PU

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
AEL-MPC2-P	009 AEL-PDP-12	BUS-0071	1	480	690.0 FEET	2	Copper
	Duct Material: Magnetic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1640 + J 0.0420 Ohms/1000 ft	49.11 + J 12.58 PU					
	Z0 Impedance: 0.5168 + J 0.1034 Ohms/1000 ft	154.79 + J 30.98 PU					
AEL-PDP1-F	112 PMC-MCC-01	113 AEL-PDP-01	1	480	410.0 FEET	1	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1293 + J 0.0342 Ohms/1000 ft	23.01 + J 6.09 PU					
	Z0 Impedance: 0.2056 + J 0.0870 Ohms/1000 ft	36.58 + J 15.48 PU					
AEL-PDP11-T	005 AEL-PDP-11A	015 AEL-PDP-11B	2	480	0.100 FEET	500	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0220 + J 0.0303 Ohms/1000 ft	0.00048 + J 0.00066 PU					
	Z0 Impedance: 0.0350 + J 0.0771 Ohms/1000 ft	0.00076 + J 0.0017 PU					
AEL-PDP11A-F	BUS-0089	005 AEL-PDP-11A	2	480	60.0 FEET	500	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0220 + J 0.0303 Ohms/1000 ft	0.2865 + J 0.3945 PU					
	Z0 Impedance: 0.0350 + J 0.0771 Ohms/1000 ft	0.4555 + J 1.00 PU					
AEL-PDP12-F	008L AEL-ATS-01	009 AEL-PDP-12	2	480	65.0 FEET	4/0	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0511 + J 0.0314 Ohms/1000 ft	0.7208 + J 0.4429 PU					
	Z0 Impedance: 0.0812 + J 0.0799 Ohms/1000 ft	1.15 + J 1.13 PU					
AEL-PDP2-F	109 PMC-MCC-02	110 AEL-PDP-02	1	480	250.0 FEET	1	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1293 + J 0.0342 Ohms/1000 ft	14.03 + J 3.71 PU					
	Z0 Impedance: 0.2056 + J 0.0870 Ohms/1000 ft	22.31 + J 9.44 PU					
AEL-TSE-F	015 AEL-PDP-11B	BUS-0061	2	480	30.0 FEET	4/0	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0511 + J 0.0314 Ohms/1000 ft	0.3327 + J 0.2044 PU					
	Z0 Impedance: 0.0812 + J 0.0799 Ohms/1000 ft	0.5286 + J 0.5202 PU					
AEL-TSN-F	005 AEL-PDP-11A	BUS-0062	2	480	60.0 FEET	4/0	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0511 + J 0.0314 Ohms/1000 ft	0.6654 + J 0.4089 PU					
	Z0 Impedance: 0.0812 + J 0.0799 Ohms/1000 ft	1.06 + J 1.04 PU					
AEL-XFMR-01A-F	001 AMC-MCC-01A	BUS-0007	1	4160	45.0 FEET	6	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.4154 + J 0.0674 Ohms/1000 ft	0.1080 + J 0.0175 PU					
	Z0 Impedance: 0.6604 + J 0.1715 Ohms/1000 ft	0.1717 + J 0.0446 PU					

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE
AEL-XFMR-01B-F	014 AMC-MCC-01B	BUS-0015	1	4160	60.0 FEET	6	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.4154 + J 0.0674 Ohms/1000 ft	0.1440 + J 0.0234 PU					
	Z0 Impedance: 0.6604 + J 0.1715 Ohms/1000 ft	0.2290 + J 0.0594 PU					
AIS-LCP1-P	005 AEL-PDP-11A	006 AIS-LCP-01	1	480	60.0 FEET	1	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1293 + J 0.0342 Ohms/1000 ft	3.37 + J 0.8906 PU					
	Z0 Impedance: 0.2056 + J 0.0870 Ohms/1000 ft	5.35 + J 2.27 PU					
AIS-LCP2-P	005 AEL-PDP-11A	007 AIS-LCP-02	1	480	60.0 FEET	1	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1293 + J 0.0342 Ohms/1000 ft	3.37 + J 0.8906 PU					
	Z0 Impedance: 0.2056 + J 0.0870 Ohms/1000 ft	5.35 + J 2.27 PU					
AIS-LCP3-P	015 AEL-PDP-11B	016 AIS-LCP-03	1	480	60.0 FEET	1	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1293 + J 0.0342 Ohms/1000 ft	3.37 + J 0.8906 PU					
	Z0 Impedance: 0.2056 + J 0.0870 Ohms/1000 ft	5.35 + J 2.27 PU					
AIS-LCP4-P	015 AEL-PDP-11B	017 AIS-LCP-04	1	480	60.0 FEET	1	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1293 + J 0.0342 Ohms/1000 ft	3.37 + J 0.8906 PU					
	Z0 Impedance: 0.2056 + J 0.0870 Ohms/1000 ft	5.35 + J 2.27 PU					
AMC-MCC01-TF	001 AMC-MCC-01A	014 AMC-MCC-01B	4	4160	65.0 FEET	500	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.0234 + J 0.0414 Ohms/1000 ft	0.0022 + J 0.0039 PU					
	Z0 Impedance: 0.0372 + J 0.1053 Ohms/1000 ft	0.0035 + J 0.0099 PU					
AMC-MCC01A-F	BUS-0003	001 AMC-MCC-01A	4	4160	0.100 FEET	500	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.0234 + J 0.0414 Ohms/1000 ft	0.00001 + J 0.00001 PU					
	Z0 Impedance: 0.0372 + J 0.1053 Ohms/1000 ft	0.00001 + J 0.00002 PU					
CBL-0061	BUS-0082	100 PLANT MAIN SWBD SWB-1	4	4160	1.000 FEET	500	Copper
	Duct Material: Magnetic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0244 + J 0.0379 Ohms/1000 ft	0.00004 + J 0.00005 PU					
	Z0 Impedance: 0.0769 + J 0.0933 Ohms/1000 ft	0.00011 + J 0.00013 PU					
CPS-XFMR01A-F	BUS-0002	BUS-0003	4	4160	140.0 FEET	500	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.0234 + J 0.0414 Ohms/1000 ft	0.0047 + J 0.0084 PU					
	Z0 Impedance: 0.0372 + J 0.1053 Ohms/1000 ft	0.0075 + J 0.0213 PU					

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE	Duct Material	Insulation Type	Insulation Class	+/- Impedance (Ohms/1000 ft)	+/- Impedance (PU)	Z0 Impedance (Ohms/1000 ft)	Z0 Impedance (PU)
CPS-XFMR02A-F	BUS-0001	BUS-0003	4	4160	140.0 FEET	500	Copper	Plastic	EPR		0.0234 + J 0.0414	0.0047 + J 0.0084	0.0372 + J 0.1053	0.0075 + J 0.0213
HEL-ATSNF	BUS-0081	BUS-0033	2	480	75.0 FEET	500	Copper	Plastic	THHN		0.0220 + J 0.0303	0.3581 + J 0.4932	0.0350 + J 0.0771	0.5697 + J 1.25
HEL-CPP1-F	BUS-0048	107 HEL-CPP-01	1	208	20.0 FEET	6	Copper	Non-Magnetic	THHN		0.4100 + J 0.0349	18.95 + J 1.61	0.6518 + J 0.0888	30.13 + J 4.10
HEL-LP1-F	BUS-0045	106 HEL-LP-01	1	208	15.0 FEET	1	Copper	Non-Magnetic	THHN		0.1303 + J 0.0342	4.52 + J 1.19	0.2071 + J 0.0870	7.18 + J 3.02
HEL-PDP01-F	104 MCC-1	105 HEL-PDP-01	1	480	110.0 FEET	1	Copper	Plastic	THHN		0.1293 + J 0.0342	6.17 + J 1.63	0.2056 + J 0.0870	9.81 + J 4.15
HEL-XFMR-CPP-1	105 HEL-PDP-01	BUS-0047	1	480	30.0 FEET	8	Copper	Non-Magnetic	THHN		0.6404 + J 0.0380	8.34 + J 0.4948	1.02 + J 0.0967	13.26 + J 1.26
HEL-XFMR-LP-1	105 HEL-PDP-01	BUS-0044	1	480	40.0 FEET	8	Copper	Non-Magnetic	THHN		0.6404 + J 0.0380	11.12 + J 0.6597	1.02 + J 0.0967	17.68 + J 1.68
HEL-XFMR01-F	102 HV44	BUS-0032	1	4160	360.0 FEET	1/0	Copper	Plastic	EPR		0.1032 + J 0.0529	0.2147 + J 0.1100	0.1641 + J 0.1345	0.3414 + J 0.2799
HV44	101 FUSE CUT-OUTS	102 HV44	1	4160	350.0 FEET	1/0	Copper	Plastic	EPR		0.1032 + J 0.0529	0.2087 + J 0.1070	0.1641 + J 0.1345	0.3319 + J 0.2720

ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
MCC1-F	103L HEL-ATS-01	104 MCC-1	2	480	110.0 FEET	500	Copper

Duct Material: Plastic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.0220 + J 0.0303 Ohms/1000 ft 0.5252 + J 0.7233 PU
Z0 Impedance: 0.0350 + J 0.0771 Ohms/1000 ft 0.8350 + J 1.84 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
OE-WH	100 PLANT MAIN SWBD SWB-1	111 FUSE CUT-OUTS	1	4160	125.0 FEET	4/0	Copper

Duct Material: Plastic Insulation Type: EPR Insulation Class:
+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft 0.0372 + J 0.0342 PU
Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft 0.0592 + J 0.0870 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
OE-WL	100 PLANT MAIN SWBD SWB-1	101 FUSE CUT-OUTS	1	4160	0.100 FEET	4/0	Copper

Duct Material: Plastic Insulation Type: EPR Insulation Class:
+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft 0.00003 + J 0.00003 PU
Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft 0.00005 + J 0.00007 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
PEL-PDP-F	112 PMC-MCC-01	114 PEL-PDP-01	1	480	140.0 FEET	2	Copper

Duct Material: Non-Magnetic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.1640 + J 0.0336 Ohms/1000 ft 9.97 + J 2.04 PU
Z0 Impedance: 0.2607 + J 0.0855 Ohms/1000 ft 15.84 + J 5.19 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
PEL-XFMR02-F	101 FUSE CUT-OUTS	108 PELXFM PRI	1	4160	210.0 FEET	2/0	Copper

Duct Material: Plastic Insulation Type: EPR Insulation Class:
+/- Impedance: 0.0819 + J 0.0509 Ohms/1000 ft 0.0994 + J 0.0618 PU
Z0 Impedance: 0.1302 + J 0.1296 Ohms/1000 ft 0.1580 + J 0.1573 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
PMC-MCC-02	BUS-0088	109 PMC-MCC-02	2	480	150.0 FEET	350	Copper

Duct Material: Magnetic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.0333 + J 0.0388 Ohms/1000 ft 1.08 + J 1.26 PU
Z0 Impedance: 0.1050 + J 0.0956 Ohms/1000 ft 3.42 + J 3.11 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
SEL-CPP11-F	BUS-0055	117 SEL-CPP-11	1	208	20.0 FEET	6	Copper

Duct Material: Plastic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.4100 + J 0.0349 Ohms/1000 ft 18.95 + J 1.61 PU
Z0 Impedance: 0.6518 + J 0.0888 Ohms/1000 ft 30.13 + J 4.11 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
SEL-LP12-F	BUS-0052	116 SEL-LP-12	1	240	12.0 FEET	3/0	Copper

Duct Material: Plastic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.0643 + J 0.0320 Ohms/1000 ft 1.34 + J 0.6667 PU
Z0 Impedance: 0.1022 + J 0.0814 Ohms/1000 ft 2.13 + J 1.70 PU

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
SEL-PDP-F	BUS-0079	115 SEL-PDP-11	2	480	75.0 FEET	4/0	Copper

Duct Material: Plastic Insulation Type: THHN Insulation Class:
+/- Impedance: 0.0511 + J 0.0314 Ohms/1000 ft 0.8317 + J 0.5111 PU
Z0 Impedance: 0.0812 + J 0.0799 Ohms/1000 ft 1.32 + J 1.30 PU

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	TYPE
SEL-XFMR01-F	BUS-0082	BUS-0078	2	4160	125.0 FEET	4/0	Copper
	Duct Material: Plastic Insulation Type: EPR Insulation Class:						
	+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft	0.0186 + J 0.0171 PU					
	Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft	0.0296 + J 0.0435 PU					
SEL-XFMRCPP11-F	115 SEL-PDP-11	BUS-0054	1	480	20.0 FEET	10	Copper
	Duct Material: Plastic Insulation Type: THHN Insulation Class:						
	+/- Impedance: 1.02 + J 0.0371 Ohms/1000 ft	8.84 + J 0.3220 PU					
	Z0 Impedance: 1.62 + J 0.0944 Ohms/1000 ft	14.05 + J 0.8194 PU					
SEL-XFMRLP12-F	115 SEL-PDP-11	BUS-0051	1	480	12.0 FEET	1	Copper
	Duct Material: Plastic Insulation Type: THHN Insulation Class:						
	+/- Impedance: 0.1293 + J 0.0342 Ohms/1000 ft	0.6734 + J 0.1781 PU					
	Z0 Impedance: 0.2056 + J 0.0870 Ohms/1000 ft	1.07 + J 0.4531 PU					
T-PS1-F	111 FUSE CUT-OUTS	BUS-0080	1	4160	0.100 FEET	2/0	Copper
	Duct Material: Plastic Insulation Type: EPR Insulation Class:						
	+/- Impedance: 0.0819 + J 0.0509 Ohms/1000 ft	0.00005 + J 0.00003 PU					
	Z0 Impedance: 0.1302 + J 0.1296 Ohms/1000 ft	0.00008 + J 0.00007 PU					

ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

TRANSFORMER INPUT DATA

TRANSFORMER NAME	PRIMARY RECORD NO NAME		VOLTS L-L	* SECONDARY RECORD NO NAME		VOLTS L-L	FULL-LOAD KVA	NOMINAL KVA
AEL-XFMR-01A	BUS-0007	D	4160.00	BUS-0089	YG	480.00	500.00	500.00
	Pos. Seq. Z%: 1.13 + J 5.64 (Zpu 2.26 + j 11.28) Shell Type							
	Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)							
	Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.							
AEL-XFMR-CPP11	BUS-0066	D	480.00	011 AEL-CPP-11	YG	208.00	30.00	30.00
	Pos. Seq. Z%: 1.72 + J 4.69 (Zpu 57.42 + j 156.4) Shell Type							
	Zero Seq. Z%: 1.72 + J 4.69 (Sec 57.42 + j 156.4 Pri Open)							
	Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.							
AEL-XFMR-LP11	BUS-0063	D	480.00	010 AEL-LP-11	YG	208.00	45.00	45.00
	Pos. Seq. Z%: 1.62 + J 0.778 (Zpu 36.06 + j 17.31) Shell Type							
	Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)							
	Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.							
CPS-XFMR-01	CPS ENERGY	D	13800.0	100 PLANT MAIN SWBD SWB-1	YG	4160.00	2500.00	2500.00
	Pos. Seq. Z%: 0.526 + J 5.29 (Zpu 0.210 + j 2.12) Shell Type							
	Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)							
	Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.							
CPS-XFMR-01A	BUS-0085	D	13800.0	BUS-0002	YG	4160.00	2500.00	2500.00
	Pos. Seq. Z%: 0.529 + J 5.29 (Zpu 0.211 + j 2.12) Shell Type							
	Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)							
	Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.							
CPS-XFMR-02A	BUS-0084	D	13800.0	BUS-0001	YG	4160.00	2500.00	2500.00
	Pos. Seq. Z%: 0.529 + J 5.29 (Zpu 0.211 + j 2.12) Shell Type							
	Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)							
	Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.							

TRANSFORMER INPUT DATA

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=========================================================================================================================
=
 TRANSFORMER               PRIMARY RECORD                 VOLTS  * SECONDARY RECORD                 VOLTS  FULL-LOAD
NOMINAL
 NAME                      NO NAME                        L-L      NO NAME                          L-L    KVA        KVA
=========================================================================================================================
=
 HEL-XFMR-01              BUS-0032                    D  4160.00  BUS-0081                     YG   480.00  500.00     500.00
            Pos. Seq. Z%:    1.13 + J  5.64   (Zpu   2.26 + j  11.28 )   Shell Type
            Zero Seq. Z%:   0.000 + J  0.000  (Sec  0.000 + j  0.000 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 HEL-XFMR-CPP1            BUS-0047                    D   480.00  BUS-0048                     YG   208.00   15.00      15.00
            Pos. Seq. Z%:    1.88 + J  4.63   (Zpu  125.1 + j  308.9 )   Shell Type
            Zero Seq. Z%:    1.88 + J  4.63   (Sec  125.1 + j  308.9 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 HEL-XFMR-LP1             BUS-0044                    D   480.00  BUS-0045                     YG   208.00   30.00      30.00
            Pos. Seq. Z%:    1.68 + J  2.14   (Zpu  56.09 + j  71.23 )   Shell Type
            Zero Seq. Z%:   0.000 + J  0.000  (Sec  0.000 + j  0.000 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 MPZ XFM-01               BUS-0069                    D   480.00  012 AEL-MPC-01               YG   208.00   30.00      30.00
            Pos. Seq. Z%:    1.72 + J  4.69   (Zpu  57.42 + j  156.4 )   Shell Type
            Zero Seq. Z%:    1.72 + J  4.69   (Sec  57.42 + j  156.4 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 MPZ XFM-02               BUS-0071                    D   480.00  013 AEL-MPC-02               YG   208.00   30.00      30.00
            Pos. Seq. Z%:    1.72 + J  4.69   (Zpu  57.42 + j  156.4 )   Shell Type
            Zero Seq. Z%:    1.72 + J  4.69   (Sec  57.42 + j  156.4 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 PEL-XFMR-02              108 PELXFM PRI              D  4160.00  BUS-0088                     YG   480.00  500.00     500.00
            Pos. Seq. Z%:    1.13 + J  5.64   (Zpu   2.26 + j  11.28 )   Shell Type
            Zero Seq. Z%:   0.000 + J  0.000  (Sec  0.000 + j  0.000 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.
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TRANSFORMER INPUT DATA

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==================================================================================================================================
=
 TRANSFORMER                 PRIMARY RECORD                  VOLTS   * SECONDARY RECORD                   VOLTS   FULL-LOAD
NOMINAL
 NAME                        NO NAME                         L-L       NO NAME                            L-L     KVA         KVA
==================================================================================================================================
=
 SEL-XFMR-01                 BUS-0078                     D  4160.00  BUS-0079                   YG    480.00  300.00      300.00
              Pos. Seq. Z%:     1.19 + J   5.37    (Zpu   3.98 + j  17.90 )    Shell Type
              Zero Seq. Z%:    0.000 + J  0.000    (Sec  0.000 + j  0.000 Pri  Open)
              Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 SEL-XFMR-CPP11              BUS-0054                     D   480.00  BUS-0055                   YG    208.00   15.00       15.00
              Pos. Seq. Z%:     1.88 + J   4.63    (Zpu  125.1 + j  308.9 )    Shell Type
              Zero Seq. Z%:     1.88 + J   4.63    (Sec  125.1 + j  308.9 Pri  Open)
              Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 SEL-XFMR-LP12               BUS-0051                     D   480.00  BUS-0052                   YG    240.00   50.00       50.00
              Pos. Seq. Z%:     1.61 + J   4.74    (Zpu  32.11 + j  94.71 )    Shell Type
              Zero Seq. Z%:     1.61 + J   4.74    (Sec  32.11 + j  94.71 Pri  Open)
              Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 T-PS1                       BUS-0080                     D  4160.00  112 PMC-MCC-01             YG    480.00  300.00      300.00
              Pos. Seq. Z%:     1.19 + J   5.37    (Zpu   3.98 + j  17.90 )    Shell Type
              Zero Seq. Z%:    0.000 + J  0.000    (Sec  0.000 + j  0.000 Pri  Open)
              Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.
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GENERATION CONTRIBUTION DATA

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==================================================================================
BUS                         CONTRIBUTION                   VOLTAGE
NAME                        NAME                              L-L     MVA     X"d    X/R
==================================================================================
BUS-0084                    UTILITY 2                      13800.0   29.47
                  Three Phase          Contribution:    1233.00 AMPS       2.42
                  Pos  Sequence Impedance (100 MVA Base)    1.30 + J     3.14 PU
                  Zero Sequence Impedance (100 MVA Base)10000000 + J 10000000 PU

BUS-0085                    UTILITY 1                      13800.0   29.47
                  Three Phase          Contribution:    1233.00 AMPS       2.42
                  Pos  Sequence Impedance (100 MVA Base)    1.30 + J     3.14 PU
                  Zero Sequence Impedance (100 MVA Base)10000000 + J 10000000 PU

CPS ENERGY                  CPS UTI1                       13800.0   29.47
                  Three Phase          Contribution:    1233.00 AMPS       2.42
                  Pos  Sequence Impedance (100 MVA Base)    1.30 + J     3.14 PU
                  Zero Sequence Impedance (100 MVA Base)10000000 + J 10000000 PU
```

MOTOR CONTRIBUTION DATA

BUS NAME	CONTRIBUTION NAME	VOLTAGE L-L	BASE kVA	X"d	X/R		Motor Number
002 LC-AASBC01	AIR BLOWER-01	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
003 LC-AASBC02	AIR BLOWER-02	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
006 AIS-LCP-01	AIS-LCP-01	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
007 AIS-LCP-02	AIS-LCP-02	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
016 AIS-LCP-03	AIS-LCP-03	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
017 AIS-LCP-04	AIS-LCP-04	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
018 LC-AASBC03	AIR BLOWER-03	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
019 LC-AASBC04	AIR BLOWER-04	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
105 HEL-PDP-01	T.LOAD HEL-PDP01	480	7.00	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 595.24 + j 3571.43 PU						
109 PMC-MCC-02	LC-DDMP02	480	50.00	0.2	5.30	1.00	
	Pos Sequence Impedance (100 MVA Base) 75.47 + j 400.00 PU						

MOTOR CONTRIBUTION DATA

BUS NAME	CONTRIBUTION NAME	VOLTAGE L-L	BASE kVA	X"d	X/R		Motor Number
109 PMC-MCC-02	T.LOAD PMC-MCC-02	480	16.00	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 260.42 + j 1562.50 PU						
109 PMC-MCC-02	LC-DDMP01	480	50.00	0.2	5.30	1.00	
	Pos Sequence Impedance (100 MVA Base) 75.47 + j 400.00 PU						
110 AEL-PDP-02	T.LOAD AEL-PDP02	480	9.00	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 462.96 + j 2777.78 PU						
112 PMC-MCC-01	T.LOAD PMC-MCC-01	480	16.50	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 252.53 + j 1515.15 PU						
113 AEL-PDP-01	T.LOAD AEL-PDP01	480	6.00	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 694.44 + j 4166.67 PU						
114 PEL-PDP-01	T.LOAD PEL-PDP01	480	6.00	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 694.44 + j 4166.67 PU						
115 SEL-PDP-11	T.LOAD SEL-PDP-11	480	31.58	0.1692	10.0	1.00	
	Pos Sequence Impedance (100 MVA Base) 53.57 + j 535.70 PU						
BUS-0059	AEL-H-01	480	13.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 313.28 + j 1879.70 PU						
BUS-0077	AEL-H-02	480	13.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 313.28 + j 1879.70 PU						

ALL PU VALUES ARE EXPRESSED ON A 100 MVA BASE.

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE	Duct Material	Insulation Type	Insulation Class	+/- Impedance (Ohms/1000 ft)	+/- Impedance (PU)	Z0 Impedance (Ohms/1000 ft)	Z0 Impedance (PU)
AASBC01-P	001 AMC-MCC-01A	002 LC-AASBC01	1	4160	65.0 FEET	4/0	Copper	Plastic	EPR		0.0515 + J 0.0474	0.0193 + J 0.0178	0.0819 + J 0.1205	0.0308 + J 0.0453
AASBC02-P	001 AMC-MCC-01A	003 LC-AASBC02	1	4160	65.0 FEET	4/0	Copper	Plastic	EPR		0.0515 + J 0.0474	0.0193 + J 0.0178	0.0819 + J 0.1205	0.0308 + J 0.0453
AASBC03-P	014 AMC-MCC-01B	018 LC-AASBC03	1	4160	65.0 FEET	4/0	Copper	Plastic	EPR		0.0515 + J 0.0474	0.0193 + J 0.0178	0.0819 + J 0.1205	0.0308 + J 0.0453
AASBC04-P	014 AMC-MCC-01B	019 LC-AASBC04	1	4160	65.0 FEET	4/0	Copper	Plastic	EPR		0.0515 + J 0.0474	0.0193 + J 0.0178	0.0819 + J 0.1205	0.0308 + J 0.0453
AEL-CPP11-P	009 AEL-PDP-12	BUS-0066	1	480	35.0 FEET	8	Copper	Magnetic	THHN		0.6404 + J 0.0475	9.73 + J 0.7216	2.02 + J 0.1170	30.66 + J 1.78
AEL-H1-P	005 AEL-PDP-11A	BUS-0059	1	480	30.0 FEET	10	Copper	Magnetic	THHN		1.02 + J 0.0463	13.26 + J 0.6029	3.21 + J 0.1140	41.77 + J 1.48
AEL-H2-P	015 AEL-PDP-11B	BUS-0077	1	480	30.0 FEET	10	Copper	Magnetic	THHN		1.02 + J 0.0463	13.26 + J 0.6029	3.21 + J 0.1140	41.77 + J 1.48
AEL-LP11-P	009 AEL-PDP-12	BUS-0063	1	480	30.0 FEET	4	Copper	Magnetic	THHN		0.2590 + J 0.0441	3.37 + J 0.5742	0.8163 + J 0.1086	10.63 + J 1.41
AEL-MPC1-P	009 AEL-PDP-12	BUS-0069	1	480	360.0 FEET	2	Copper	Magnetic	THHN		0.1640 + J 0.0420	25.63 + J 6.56	0.5168 + J 0.1034	80.76 + J 16.16

FEEDER INPUT DATA

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====================================================================================================================
CABLE              FEEDER FROM                   FEEDER TO                        QTY  VOLTS   LENGTH           FEEDER
NAME               NAME                          NAME                             /PH  L-L                  SIZE      TYPE
====================================================================================================================
AEL-MPC2-P         009 AEL-PDP-12                BUS-0071                          1    480  690.0  FEET      2     Copper
           Duct Material:   Magnetic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.1640 + J  0.0420  Ohms/1000 ft     49.11 + J   12.58  PU
           Z0   Impedance: 0.5168 + J  0.1034  Ohms/1000 ft    154.79 + J   30.98  PU

AEL-PDP1-F         112 PMC-MCC-01                113 AEL-PDP-01                    1    480  410.0  FEET      1     Copper
           Duct Material:    Plastic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.1293 + J  0.0342  Ohms/1000 ft     23.01 + J    6.09  PU
           Z0   Impedance: 0.2056 + J  0.0870  Ohms/1000 ft     36.58 + J   15.48  PU

AEL-PDP11-T        005 AEL-PDP-11A               015 AEL-PDP-11B                   2    480  0.100  FEET    500     Copper
           Duct Material:    Plastic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.0220 + J  0.0303  Ohms/1000 ft   0.00048 + J 0.00066  PU
           Z0   Impedance: 0.0350 + J  0.0771  Ohms/1000 ft   0.00076 + J  0.0017  PU

AEL-PDP11A-F       BUS-0089                      005 AEL-PDP-11A                   2    480   60.0  FEET    500     Copper
           Duct Material:    Plastic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.0220 + J  0.0303  Ohms/1000 ft    0.2865 + J  0.3945  PU
           Z0   Impedance: 0.0350 + J  0.0771  Ohms/1000 ft    0.4555 + J    1.00  PU

AEL-PDP12-F        008L AEL-ATS-01               009 AEL-PDP-12                    2    480   65.0  FEET    4/0     Copper
           Duct Material:    Plastic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.0511 + J  0.0314  Ohms/1000 ft    0.7208 + J  0.4429  PU
           Z0   Impedance: 0.0812 + J  0.0799  Ohms/1000 ft      1.15 + J    1.13  PU

AEL-PDP2-F         109 PMC-MCC-02                110 AEL-PDP-02                    1    480  250.0  FEET      1     Copper
           Duct Material:    Plastic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.1293 + J  0.0342  Ohms/1000 ft     14.03 + J    3.71  PU
           Z0   Impedance: 0.2056 + J  0.0870  Ohms/1000 ft     22.31 + J    9.44  PU

AEL-TSE-F          015 AEL-PDP-11B               BUS-0061                          2    480   30.0  FEET    4/0     Copper
           Duct Material:    Plastic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.0511 + J  0.0314  Ohms/1000 ft    0.3327 + J  0.2044  PU
           Z0   Impedance: 0.0812 + J  0.0799  Ohms/1000 ft    0.5286 + J  0.5202  PU

AEL-TSN-F          005 AEL-PDP-11A               BUS-0062                          2    480   60.0  FEET    4/0     Copper
           Duct Material:    Plastic   Insulation Type:     THHN   Insulation Class:
           +/-  Impedance: 0.0511 + J  0.0314  Ohms/1000 ft    0.6654 + J  0.4089  PU
           Z0   Impedance: 0.0812 + J  0.0799  Ohms/1000 ft      1.06 + J    1.04  PU

AEL-XFMR-01A-F     001 AMC-MCC-01A               BUS-0007                          1   4160   45.0  FEET      6     Copper
           Duct Material:    Plastic   Insulation Type:      EPR   Insulation Class:
           +/-  Impedance: 0.4154 + J  0.0674  Ohms/1000 ft    0.1080 + J  0.0175  PU
           Z0   Impedance: 0.6604 + J  0.1715  Ohms/1000 ft    0.1717 + J  0.0446  PU
```

ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

FEEDER INPUT DATA

```
=====================================================================================================================
CABLE                    FEEDER FROM                  FEEDER TO                    QTY  VOLTS   LENGTH         FEEDER
NAME                     NAME                         NAME                         /PH  L-L                 SIZE    TYPE
=====================================================================================================================
AEL-XFMR-01B-F           014 AMC-MCC-01B              BUS-0015                      1   4160   60.0  FEET     6     Copper
             Duct Material:     Plastic     Insulation Type:      EPR     Insulation Class:
             +/-  Impedance: 0.4154 + J  0.0674  Ohms/1000 ft      0.1440 + J  0.0234  PU
             Z0   Impedance: 0.6604 + J  0.1715  Ohms/1000 ft      0.2290 + J  0.0594  PU

AIS-LCP1-P               005 AEL-PDP-11A              006 AIS-LCP-01                1    480   60.0  FEET     1     Copper
             Duct Material:     Plastic     Insulation Type:      THHN    Insulation Class:
             +/-  Impedance: 0.1293 + J  0.0342  Ohms/1000 ft        3.37 + J  0.8906  PU
             Z0   Impedance: 0.2056 + J  0.0870  Ohms/1000 ft        5.35 + J    2.27  PU

AIS-LCP2-P               005 AEL-PDP-11A              007 AIS-LCP-02                1    480   60.0  FEET     1     Copper
             Duct Material:     Plastic     Insulation Type:      THHN    Insulation Class:
             +/-  Impedance: 0.1293 + J  0.0342  Ohms/1000 ft        3.37 + J  0.8906  PU
             Z0   Impedance: 0.2056 + J  0.0870  Ohms/1000 ft        5.35 + J    2.27  PU

AIS-LCP3-P               015 AEL-PDP-11B              016 AIS-LCP-03                1    480   60.0  FEET     1     Copper
             Duct Material:     Plastic     Insulation Type:      THHN    Insulation Class:
             +/-  Impedance: 0.1293 + J  0.0342  Ohms/1000 ft        3.37 + J  0.8906  PU
             Z0   Impedance: 0.2056 + J  0.0870  Ohms/1000 ft        5.35 + J    2.27  PU

AIS-LCP4-P               015 AEL-PDP-11B              017 AIS-LCP-04                1    480   60.0  FEET     1     Copper
             Duct Material:     Plastic     Insulation Type:      THHN    Insulation Class:
             +/-  Impedance: 0.1293 + J  0.0342  Ohms/1000 ft        3.37 + J  0.8906  PU
             Z0   Impedance: 0.2056 + J  0.0870  Ohms/1000 ft        5.35 + J    2.27  PU

AMC-MCC01-TF             001 AMC-MCC-01A              014 AMC-MCC-01B               4   4160   65.0  FEET   500     Copper
             Duct Material:     Plastic     Insulation Type:      EPR     Insulation Class:
             +/-  Impedance: 0.0234 + J  0.0414  Ohms/1000 ft      0.0022 + J  0.0039  PU
             Z0   Impedance: 0.0372 + J  0.1053  Ohms/1000 ft      0.0035 + J  0.0099  PU

AMC-MCC01A-F             BUS-0003                     001 AMC-MCC-01A               4   4160  0.100  FEET   500     Copper
             Duct Material:     Plastic     Insulation Type:      EPR     Insulation Class:
             +/-  Impedance: 0.0234 + J  0.0414  Ohms/1000 ft     0.00001 + J 0.00001  PU
             Z0   Impedance: 0.0372 + J  0.1053  Ohms/1000 ft     0.00001 + J 0.00002  PU

CBL-0061                 BUS-0082                     100 PLANT MAIN SWBD SWB-1     4   4160  1.000  FEET   500     Copper
             Duct Material:     Magnetic    Insulation Type:      THHN    Insulation Class:
             +/-  Impedance: 0.0244 + J  0.0379  Ohms/1000 ft     0.00004 + J 0.00005  PU
             Z0   Impedance: 0.0769 + J  0.0933  Ohms/1000 ft     0.00011 + J 0.00013  PU

CPS-XFMR01A-F            BUS-0002                     BUS-0003                      4   4160  140.0  FEET   500     Copper
             Duct Material:     Plastic     Insulation Type:      EPR     Insulation Class:
             +/-  Impedance: 0.0234 + J  0.0414  Ohms/1000 ft      0.0047 + J  0.0084  PU
             Z0   Impedance: 0.0372 + J  0.1053  Ohms/1000 ft      0.0075 + J  0.0213  PU
```

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE	Duct Material	Insulation Type	Insulation Class	+/- Impedance (Ohms/1000 ft)	+/- Impedance (PU)	Z0 Impedance (Ohms/1000 ft)	Z0 Impedance (PU)
CPS-XFMR02A-F	BUS-0001	BUS-0003	4	4160	140.0 FEET	500	Copper	Plastic	EPR		0.0234 + J 0.0414	0.0047 + J 0.0084	0.0372 + J 0.1053	0.0075 + J 0.0213
HEL-ATSNF	BUS-0081	BUS-0033	2	480	75.0 FEET	500	Copper	Plastic	THHN		0.0220 + J 0.0303	0.3581 + J 0.4932	0.0350 + J 0.0771	0.5697 + J 1.25
HEL-CPP1-F	BUS-0048	107 HEL-CPP-01	1	208	20.0 FEET	6	Copper	Non-Magnetic	THHN		0.4100 + J 0.0349	18.95 + J 1.61	0.6518 + J 0.0888	30.13 + J 4.10
HEL-LP1-F	BUS-0045	106 HEL-LP-01	1	208	15.0 FEET	1	Copper	Non-Magnetic	THHN		0.1303 + J 0.0342	4.52 + J 1.19	0.2071 + J 0.0870	7.18 + J 3.02
HEL-PDP01-F	104 MCC-1	105 HEL-PDP-01	1	480	110.0 FEET	1	Copper	Plastic	THHN		0.1293 + J 0.0342	6.17 + J 1.63	0.2056 + J 0.0870	9.81 + J 4.15
HEL-XFMR-CPP-1	105 HEL-PDP-01	BUS-0047	1	480	30.0 FEET	8	Copper	Non-Magnetic	THHN		0.6404 + J 0.0380	8.34 + J 0.4948	1.02 + J 0.0967	13.26 + J 1.26
HEL-XFMR-LP-1	105 HEL-PDP-01	BUS-0044	1	480	40.0 FEET	8	Copper	Non-Magnetic	THHN		0.6404 + J 0.0380	11.12 + J 0.6597	1.02 + J 0.0967	17.68 + J 1.68
HEL-XFMR01-F	102 HV44	BUS-0032	1	4160	360.0 FEET	1/0	Copper	Plastic	EPR		0.1032 + J 0.0529	0.2147 + J 0.1100	0.1641 + J 0.1345	0.3414 + J 0.2799
HV44	101 FUSE CUT-OUTS	102 HV44	1	4160	350.0 FEET	1/0	Copper	Plastic	EPR		0.1032 + J 0.0529	0.2087 + J 0.1070	0.1641 + J 0.1345	0.3319 + J 0.2720

FEEDER INPUT DATA

CABLE NAME	FEEDER FROM NAME	FEEDER TO NAME	QTY /PH	VOLTS L-L	LENGTH	FEEDER SIZE	FEEDER TYPE
MCC1-F	103L HEL-ATS-01	104 MCC-1	2	480	110.0 FEET	500	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0220 + J 0.0303 Ohms/1000 ft	0.5252 + J 0.7233 PU					
	Z0 Impedance: 0.0350 + J 0.0771 Ohms/1000 ft	0.8350 + J 1.84 PU					
OE-WH	100 PLANT MAIN SWBD SWB-1	111 FUSE CUT-OUTS	1	4160	125.0 FEET	4/0	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft	0.0372 + J 0.0342 PU					
	Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft	0.0592 + J 0.0870 PU					
OE-WL	100 PLANT MAIN SWBD SWB-1	101 FUSE CUT-OUTS	1	4160	0.100 FEET	4/0	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.0515 + J 0.0474 Ohms/1000 ft	0.00003 + J 0.00003 PU					
	Z0 Impedance: 0.0819 + J 0.1205 Ohms/1000 ft	0.00005 + J 0.00007 PU					
PEL-PDP-F	112 PMC-MCC-01	114 PEL-PDP-01	1	480	140.0 FEET	2	Copper
	Duct Material: Non-Magnetic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.1640 + J 0.0336 Ohms/1000 ft	9.97 + J 2.04 PU					
	Z0 Impedance: 0.2607 + J 0.0855 Ohms/1000 ft	15.84 + J 5.19 PU					
PEL-XFMR02-F	101 FUSE CUT-OUTS	108 PELXFM PRI	1	4160	210.0 FEET	2/0	Copper
	Duct Material: Plastic	Insulation Type: EPR	Insulation Class:				
	+/- Impedance: 0.0819 + J 0.0509 Ohms/1000 ft	0.0994 + J 0.0618 PU					
	Z0 Impedance: 0.1302 + J 0.1296 Ohms/1000 ft	0.1580 + J 0.1573 PU					
PMC-MCC-02	BUS-0088	109 PMC-MCC-02	2	480	150.0 FEET	350	Copper
	Duct Material: Magnetic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0333 + J 0.0388 Ohms/1000 ft	1.08 + J 1.26 PU					
	Z0 Impedance: 0.1050 + J 0.0956 Ohms/1000 ft	3.42 + J 3.11 PU					
SEL-CPP11-F	BUS-0055	117 SEL-CPP-11	1	208	20.0 FEET	6	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.4100 + J 0.0349 Ohms/1000 ft	18.95 + J 1.61 PU					
	Z0 Impedance: 0.6518 + J 0.0888 Ohms/1000 ft	30.13 + J 4.11 PU					
SEL-LP12-F	BUS-0052	116 SEL-LP-12	1	240	12.0 FEET	3/0	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0643 + J 0.0320 Ohms/1000 ft	1.34 + J 0.6667 PU					
	Z0 Impedance: 0.1022 + J 0.0814 Ohms/1000 ft	2.13 + J 1.70 PU					
SEL-PDP-F	BUS-0079	115 SEL-PDP-11	2	480	75.0 FEET	4/0	Copper
	Duct Material: Plastic	Insulation Type: THHN	Insulation Class:				
	+/- Impedance: 0.0511 + J 0.0314 Ohms/1000 ft	0.8317 + J 0.5111 PU					
	Z0 Impedance: 0.0812 + J 0.0799 Ohms/1000 ft	1.32 + J 1.30 PU					

FEEDER INPUT DATA

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=================================================================================================================================
CABLE                 FEEDER FROM                  FEEDER TO                              QTY  VOLTS    LENGTH          FEEDER
NAME                  NAME                         NAME                                   /PH  L-L                  SIZE        TYPE
=================================================================================================================================
SEL-XFMR01-F          BUS-0082                     BUS-0078                                2   4160  125.0  FEET    4/0       Copper
           Duct Material:     Plastic     Insulation Type:       EPR    Insulation Class:
           +/-  Impedance: 0.0515 + J  0.0474  Ohms/1000 ft     0.0186 + J  0.0171  PU
           Z0   Impedance: 0.0819 + J  0.1205  Ohms/1000 ft     0.0296 + J  0.0435  PU

SEL-XFMRCPP11-F       115 SEL-PDP-11               BUS-0054                                1    480   20.0  FEET     10       Copper
           Duct Material:     Plastic     Insulation Type:      THHN    Insulation Class:
           +/-  Impedance:   1.02 + J  0.0371  Ohms/1000 ft       8.84 + J  0.3220  PU
           Z0   Impedance:   1.62 + J  0.0944  Ohms/1000 ft      14.05 + J  0.8194  PU

SEL-XFMRLP12-F        115 SEL-PDP-11               BUS-0051                                1    480   12.0  FEET      1       Copper
           Duct Material:     Plastic     Insulation Type:      THHN    Insulation Class:
           +/-  Impedance: 0.1293 + J  0.0342  Ohms/1000 ft     0.6734 + J  0.1781  PU
           Z0   Impedance: 0.2056 + J  0.0870  Ohms/1000 ft       1.07 + J  0.4531  PU

T-PS1-F               111 FUSE CUT-OUTS            BUS-0080                                1   4160  0.100  FEET    2/0       Copper
           Duct Material:     Plastic     Insulation Type:       EPR    Insulation Class:
           +/-  Impedance: 0.0819 + J  0.0509  Ohms/1000 ft    0.00005 + J 0.00003  PU
           Z0   Impedance: 0.1302 + J  0.1296  Ohms/1000 ft    0.00008 + J 0.00007  PU
```

TRANSFORMER INPUT DATA

TRANSFORMER NAME	PRIMARY RECORD NO NAME		VOLTS L-L	* SECONDARY RECORD NO NAME		VOLTS L-L	FULL-LOAD KVA	NOMINAL KVA
AEL-XFMR-01A	BUS-0007	D	4160.00	BUS-0089	YG	480.00	500.00	500.00
AEL-XFMR-CPP11	BUS-0066	D	480.00	011 AEL-CPP-11	YG	208.00	30.00	30.00
AEL-XFMR-LP11	BUS-0063	D	480.00	010 AEL-LP-11	YG	208.00	45.00	45.00
CPS-XFMR-01	CPS ENERGY	D	13800.0	100 PLANT MAIN SWBD SWB-1	YG	4160.00	2500.00	2500.00
CPS-XFMR-01A	BUS-0085	D	13800.0	BUS-0002	YG	4160.00	2500.00	2500.00
CPS-XFMR-02A	BUS-0084	D	13800.0	BUS-0001	YG	4160.00	2500.00	2500.00

AEL-XFMR-01A
Pos. Seq. Z%: 1.13 + J 5.64 (Zpu 2.26 + j 11.28) Shell Type
Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)
Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.

AEL-XFMR-CPP11
Pos. Seq. Z%: 1.72 + J 4.69 (Zpu 57.42 + j 156.4) Shell Type
Zero Seq. Z%: 1.72 + J 4.69 (Sec 57.42 + j 156.4 Pri Open)
Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.

AEL-XFMR-LP11
Pos. Seq. Z%: 1.62 + J 0.778 (Zpu 36.06 + j 17.31) Shell Type
Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)
Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.

CPS-XFMR-01
Pos. Seq. Z%: 0.526 + J 5.29 (Zpu 0.210 + j 2.12) Shell Type
Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)
Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.

CPS-XFMR-01A
Pos. Seq. Z%: 0.529 + J 5.29 (Zpu 0.211 + j 2.12) Shell Type
Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)
Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.

CPS-XFMR-02A
Pos. Seq. Z%: 0.529 + J 5.29 (Zpu 0.211 + j 2.12) Shell Type
Zero Seq. Z%: 0.000 + J 0.000 (Sec 0.000 + j 0.000 Pri Open)
Taps Pri. 0.000 % Sec. 0.000 % Phase Shift (Pri. Leading Sec.): 30.00 Deg.

TRANSFORMER INPUT DATA

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==========================================================================================================================
=
TRANSFORMER               PRIMARY RECORD               VOLTS   * SECONDARY RECORD               VOLTS  FULL-LOAD
NOMINAL
NAME                      NO NAME                      L-L      NO NAME                         L-L    KVA         KVA
==========================================================================================================================
=
HEL-XFMR-01               BUS-0032                   D 4160.00  BUS-0081                   YG   480.00 500.00     500.00
            Pos. Seq. Z%:    1.13 + J  5.64   (Zpu   2.26 + j  11.28 )   Shell Type
            Zero Seq. Z%:   0.000 + J 0.000   (Sec  0.000 + j  0.000 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

HEL-XFMR-CPP1             BUS-0047                   D  480.00  BUS-0048                   YG   208.00  15.00      15.00
            Pos. Seq. Z%:    1.88 + J  4.63   (Zpu  125.1 + j  308.9 )   Shell Type
            Zero Seq. Z%:    1.88 + J  4.63   (Sec  125.1 + j  308.9 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

HEL-XFMR-LP1              BUS-0044                   D  480.00  BUS-0045                   YG   208.00  30.00      30.00
            Pos. Seq. Z%:    1.68 + J  2.14   (Zpu  56.09 + j  71.23 )   Shell Type
            Zero Seq. Z%:   0.000 + J 0.000   (Sec  0.000 + j  0.000 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

MPZ XFM-01                BUS-0069                   D  480.00  012 AEL-MPC-01             YG   208.00  30.00      30.00
            Pos. Seq. Z%:    1.72 + J  4.69   (Zpu  57.42 + j  156.4 )   Shell Type
            Zero Seq. Z%:    1.72 + J  4.69   (Sec  57.42 + j  156.4 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

MPZ XFM-02                BUS-0071                   D  480.00  013 AEL-MPC-02             YG   208.00  30.00      30.00
            Pos. Seq. Z%:    1.72 + J  4.69   (Zpu  57.42 + j  156.4 )   Shell Type
            Zero Seq. Z%:    1.72 + J  4.69   (Sec  57.42 + j  156.4 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

PEL-XFMR-02               108 PELXFM PRI             D 4160.00  BUS-0088                   YG   480.00 500.00     500.00
            Pos. Seq. Z%:    1.13 + J  5.64   (Zpu   2.26 + j  11.28 )   Shell Type
            Zero Seq. Z%:   0.000 + J 0.000   (Sec  0.000 + j  0.000 Pri  Open)
            Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.
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TRANSFORMER INPUT DATA

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==========================================================================================================================
=
 TRANSFORMER               PRIMARY RECORD                  VOLTS   * SECONDARY RECORD              VOLTS  FULL-LOAD
NOMINAL
 NAME                      NO NAME                         L-L      NO NAME                        L-L    KVA        KVA
==========================================================================================================================
=
 SEL-XFMR-01               BUS-0078                      D  4160.00  BUS-0079                YG    480.00 300.00     300.00
             Pos. Seq. Z%:     1.19 + J   5.37    (Zpu   3.98 + j  17.90 )    Shell Type
             Zero Seq. Z%:   0.000 + J  0.000    (Sec  0.000 + j  0.000 Pri  Open)
             Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 SEL-XFMR-CPP11            BUS-0054                      D   480.00  BUS-0055                YG    208.00  15.00      15.00
             Pos. Seq. Z%:     1.88 + J   4.63    (Zpu  125.1 + j  308.9 )    Shell Type
             Zero Seq. Z%:     1.88 + J   4.63    (Sec  125.1 + j  308.9 Pri  Open)
             Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 SEL-XFMR-LP12             BUS-0051                      D   480.00  BUS-0052                YG    240.00  50.00      50.00
             Pos. Seq. Z%:     1.61 + J   4.74    (Zpu  32.11 + j  94.71 )    Shell Type
             Zero Seq. Z%:     1.61 + J   4.74    (Sec  32.11 + j  94.71 Pri  Open)
             Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.

 T-PS1                     BUS-0080                      D  4160.00  112 PMC-MCC-01          YG    480.00 300.00     300.00
             Pos. Seq. Z%:     1.19 + J   5.37    (Zpu   3.98 + j  17.90 )    Shell Type
             Zero Seq. Z%:   0.000 + J  0.000    (Sec  0.000 + j  0.000 Pri  Open)
             Taps  Pri. 0.000 %  Sec. 0.000 %  Phase Shift (Pri. Leading Sec.):  30.00 Deg.
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ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

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                    GENERATION  CONTRIBUTION  DATA
=====================================================================================
BUS                            CONTRIBUTION                   VOLTAGE
NAME                           NAME                             L-L     MVA      X"d    X/R
=====================================================================================
BUS-0084                       UTIL-0007                      13800.0   69.60
                  Three Phase           Contribution:    2912.00 AMPS       2.34
                  Pos  Sequence Impedance (100 MVA Base)  0.5648 + J     1.32 PU
                  Zero Sequence Impedance (100 MVA Base)10000000 + J 10000000 PU

BUS-0085                       UTIL-0008                      13800.0   69.60
                  Three Phase           Contribution:    2912.00 AMPS       2.34
                  Pos  Sequence Impedance (100 MVA Base)  0.5648 + J     1.32 PU
                  Zero Sequence Impedance (100 MVA Base)10000000 + J 10000000 PU

CPS ENERGY                     CPS UTI2                       13800.0   69.60
                  Three Phase           Contribution:    2912.00 AMPS       2.34
                  Pos  Sequence Impedance (100 MVA Base)  0.5648 + J     1.32 PU
                  Zero Sequence Impedance (100 MVA Base)10000000 + J 10000000 PU
```

MOTOR CONTRIBUTION DATA

BUS NAME	CONTRIBUTION NAME	VOLTAGE L-L	BASE kVA	X"d	X/R		Motor Number
002 LC-AASBC01	AIR BLOWER-01	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
003 LC-AASBC02	AIR BLOWER-02	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
006 AIS-LCP-01	AIS-LCP-01	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
007 AIS-LCP-02	AIS-LCP-02	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
016 AIS-LCP-03	AIS-LCP-03	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
017 AIS-LCP-04	AIS-LCP-04	480	33.30	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 125.13 + j 750.75 PU						
018 LC-AASBC03	AIR BLOWER-03	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
019 LC-AASBC04	AIR BLOWER-04	4160	787.37	0.2	24.2	1.00	
	Pos Sequence Impedance (100 MVA Base) 1.05 + j 25.40 PU						
105 HEL-PDP-01	T.LOAD HEL-PDP01	480	7.00	0.25	6.00	1.00	
	Pos Sequence Impedance (100 MVA Base) 595.24 + j 3571.43 PU						
109 PMC-MCC-02	LC-DDMP02	480	50.00	0.2	5.30	1.00	
	Pos Sequence Impedance (100 MVA Base) 75.47 + j 400.00 PU						

MOTOR CONTRIBUTION DATA

BUS NAME		CONTRIBUTION NAME	VOLTAGE L-L	BASE kVA	X"d	X/R		Motor Number
109 PMC-MCC-02		T.LOAD PMC-MCC-02	480	16.00	0.25	6.00	1.00	
	Pos	Sequence Impedance (100 MVA Base) 260.42 + j 1562.50 PU						
109 PMC-MCC-02		LC-DDMP01	480	50.00	0.2	5.30	1.00	
	Pos	Sequence Impedance (100 MVA Base) 75.47 + j 400.00 PU						
110 AEL-PDP-02		T.LOAD AEL-PDP02	480	9.00	0.25	6.00	1.00	
	Pos	Sequence Impedance (100 MVA Base) 462.96 + j 2777.78 PU						
112 PMC-MCC-01		T.LOAD PMC-MCC-01	480	16.50	0.25	6.00	1.00	
	Pos	Sequence Impedance (100 MVA Base) 252.53 + j 1515.15 PU						
113 AEL-PDP-01		T.LOAD AEL-PDP01	480	6.00	0.25	6.00	1.00	
	Pos	Sequence Impedance (100 MVA Base) 694.44 + j 4166.67 PU						
114 PEL-PDP-01		T.LOAD PEL-PDP01	480	6.00	0.25	6.00	1.00	
	Pos	Sequence Impedance (100 MVA Base) 694.44 + j 4166.67 PU						
115 SEL-PDP-11		T.LOAD SEL-PDP-11	480	31.58	0.1692	10.0	1.00	
	Pos	Sequence Impedance (100 MVA Base) 53.57 + j 535.70 PU						
BUS-0059		AEL-H-01	480	13.30	0.25	6.00	1.00	
	Pos	Sequence Impedance (100 MVA Base) 313.28 + j 1879.70 PU						
BUS-0077		AEL-H-02	480	13.30	0.25	6.00	1.00	
	Pos	Sequence Impedance (100 MVA Base) 313.28 + j 1879.70 PU						

APPENDIX C: SHORT CIRCUIT OUTPUT TABULATIONS

ML10660
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EXISTING UTILITY
Jul 12, 2011   14:51:27

ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

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             T H R E E   P H A S E   F A U L T   R E P O R T
                (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                     PRE FAULT VOLTAGE: 1.0000
                     MODEL TRANSFORMER TAPS: NO
===============================================================================================================

 001 AMC-MCC-01A              3P Duty:  7.290 KA AT  -78.08 DEG (  52.53 MVA)  X/R:     9.39
             VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0681 + J  0.3224  OHMS
             AASBC02-P                    003 LC-AASBC02                  0.546 KA      ANG:    92.40
             AASBC01-P                    002 LC-AASBC01                  0.546 KA      ANG:    92.40
             AEL-XFMR-01A-F               BUS-0007                        0.081 KA      ANG:    99.94
             AMC-MCC01A-F                 BUS-0003                        5.070 KA      ANG:   -73.96
             AMC-MCC01-TF                 014 AMC-MCC-01B                 1.091 KA      ANG:    92.41

 002 LC-AASBC01               3P Duty:  7.219 KA AT  -77.71 DEG (  52.02 MVA)  X/R:     8.92
             VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0708 + J  0.3251  OHMS
             CONTRIBUTIONS:  AIR BLOWER-01                                0.546 KA      ANG:   -87.64
             AASBC01-P                    001 AMC-MCC-01A                 6.682 KA      ANG:   -76.90

 003 LC-AASBC02               3P Duty:  7.219 KA AT  -77.71 DEG (  52.02 MVA)  X/R:     8.92
             VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0708 + J  0.3251  OHMS
             CONTRIBUTIONS:  AIR BLOWER-02                                0.546 KA      ANG:   -87.64
             AASBC02-P                    001 AMC-MCC-01A                 6.682 KA      ANG:   -76.90

 005 AEL-PDP-11A              3P Duty:  9.403 KA AT  -77.58 DEG (   7.82 MVA)  X/R:     4.84
             VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0063 + J  0.0288  OHMS
             LOW VOLTAGE POWER CIRCUIT BREAKER    9.403 KA
             MOLDED CASE CIRCUIT BREAKER < 20KA  10.434 KA
             MOLDED CASE CIRCUIT BREAKER > 20KA   9.403 KA
             AIS-LCP2-P                   007 AIS-LCP-02                  0.158 KA      ANG:    99.70
             AIS-LCP1-P                   006 AIS-LCP-01                  0.158 KA      ANG:    99.70
             AEL-H1-P                     BUS-0059                        0.063 KA      ANG:    99.85
             AEL-PDP11A-F                 BUS-0089                        8.647 KA      ANG:  -257.34
             AEL-PDP11-T                  015 AEL-PDP-11B                 0.378 KA      ANG:    99.73

 006 AIS-LCP-01               3P Duty:  8.209 KA AT  -65.85 DEG (   6.82 MVA)  X/R:     2.33
             VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0138 + J  0.0308  OHMS
             LOW VOLTAGE POWER CIRCUIT BREAKER    8.209 KA
             MOLDED CASE CIRCUIT BREAKER < 10KA   8.891 KA
             MOLDED CASE CIRCUIT BREAKER < 20KA   8.209 KA
             MOLDED CASE CIRCUIT BREAKER > 20KA   8.209 KA
             CONTRIBUTIONS:  AIS-LCP-01                                   0.158 KA      ANG:   -80.54
             AIS-LCP1-P                   005 AEL-PDP-11A                 8.056 KA      ANG:   -65.57

 007 AIS-LCP-02               3P Duty:  8.209 KA AT  -65.85 DEG (   6.82 MVA)  X/R:     2.33
             VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0138 + J  0.0308  OHMS
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ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

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              T H R E E   P H A S E   F A U L T   R E P O R T
                 (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                      PRE FAULT VOLTAGE: 1.0000
                      MODEL TRANSFORMER TAPS: NO
=============================================================================================================
              LOW VOLTAGE POWER CIRCUIT BREAKER    8.209 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   8.891 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.209 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.209 KA
              CONTRIBUTIONS:  AIS-LCP-02                                     0.158 KA      ANG:   -80.54
              AIS-LCP2-P                   005 AEL-PDP-11A                   8.056 KA      ANG:   -65.57

 008L AEL-ATS-01              3P Duty:  9.012 KA AT  -75.16 DEG (   7.49 MVA)  X/R:     3.98
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0079 + J  0.0297  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    9.012 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   9.547 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   9.012 KA
              AUTO-0001                    BUS-0062                          9.012 KA      ANG:   104.84

 009 AEL-PDP-12               3P Duty:  8.609 KA AT  -72.77 DEG (   7.16 MVA)  X/R:     3.36
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0095 + J  0.0307  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    8.609 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.739 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.609 KA
              AEL-PDP12-F                  008L AEL-ATS-01                   8.609 KA      ANG:   -72.77

 010 AEL-LP-11                3P Duty:  5.178 KA AT  -35.63 DEG (   1.87 MVA)  X/R:     0.72
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0189 + J  0.0135  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    5.178 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   5.178 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   5.178 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   5.178 KA
              AEL-XFMR-LP11                BUS-0063                          5.178 KA      ANG:  -215.63

 011 AEL-CPP-11               3P Duty:  1.502 KA AT  -67.31 DEG (   0.54 MVA)  X/R:     2.40
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0308 + J  0.0738  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    1.502 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   1.640 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   1.502 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   1.502 KA
              AEL-XFMR-CPP11               BUS-0066                          1.502 KA      ANG:   112.69

 012 AEL-MPC-01               3P Duty:  1.411 KA AT  -63.70 DEG (   0.51 MVA)  X/R:     2.03
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0377 + J  0.0763  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    1.411 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   1.471 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   1.411 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   1.411 KA
              MPZ XFM-01                   BUS-0069                          1.411 KA      ANG:   116.30
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 ML10660
 SAWS LEON CREEK WRC
 SAN ANTONIO, TX

              T H R E E   P H A S E   F A U L T   R E P O R T
                 (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                      PRE FAULT VOLTAGE: 1.0000
                      MODEL TRANSFORMER TAPS: NO
===========================================================================================================

 013 AEL-MPC-02               3P Duty:  1.301 KA AT  -58.75 DEG (   0.47 MVA)  X/R:     1.65
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0479 + J  0.0789  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    1.301 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   1.301 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   1.301 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   1.301 KA
              MPZ XFM-02                  BUS-0071                            1.301 KA      ANG: -238.75

 014 AMC-MCC-01B              3P Duty:  7.278 KA AT  -78.05 DEG (  52.44 MVA)  X/R:     9.37
              VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0683 + J  0.3229  OHMS
              AASBC04-P                   019 LC-AASBC04                      0.546 KA      ANG:   92.40
              AASBC03-P                   018 LC-AASBC03                      0.546 KA      ANG:   92.40
              AMC-MCC01-TF                001 AMC-MCC-01A                     6.205 KA      ANG:  -76.38

 015 AEL-PDP-11B              3P Duty:  9.402 KA AT  -77.58 DEG (   7.82 MVA)  X/R:     4.84
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0063 + J  0.0288  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    9.402 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA  10.433 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   9.402 KA
              AIS-LCP4-P                  017 AIS-LCP-04                      0.158 KA      ANG:   99.70
              AIS-LCP3-P                  016 AIS-LCP-03                      0.158 KA      ANG:   99.70
              AEL-H2-P                    BUS-0077                            0.063 KA      ANG:   99.85
              AEL-PDP11-T                 005 AEL-PDP-11A                     9.024 KA      ANG:  -77.46

 016 AIS-LCP-03               3P Duty:  8.208 KA AT  -65.85 DEG (   6.82 MVA)  X/R:     2.33
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0138 + J  0.0308  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    8.208 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   8.891 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.208 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.208 KA
              CONTRIBUTIONS:  AIS-LCP-03                                      0.158 KA      ANG:  -80.54
              AIS-LCP3-P                  015 AEL-PDP-11B                     8.055 KA      ANG:  -65.56

 017 AIS-LCP-04               3P Duty:  8.208 KA AT  -65.85 DEG (   6.82 MVA)  X/R:     2.33
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0138 + J  0.0308  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    8.208 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   8.891 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.208 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.208 KA
              CONTRIBUTIONS:  AIS-LCP-04                                      0.158 KA      ANG:  -80.54
              AIS-LCP4-P                  015 AEL-PDP-11B                     8.055 KA      ANG:  -65.56

 018 LC-AASBC03               3P Duty:  7.208 KA AT  -77.68 DEG (  51.93 MVA)  X/R:     8.91
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             T H R E E   P H A S E   F A U L T   R E P O R T
                (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                      PRE FAULT VOLTAGE: 1.0000
                      MODEL TRANSFORMER TAPS: NO
===========================================================================================
             VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.0711 + J  0.3256  OHMS
             CONTRIBUTIONS: AIR BLOWER-03                         0.546 KA     ANG:  -87.64
             AASBC03-P                014 AMC-MCC-01B             6.671 KA     ANG:  -76.87

 019 LC-AASBC04         3P Duty: 7.208 KA AT  -77.68 DEG (  51.93 MVA)  X/R:    8.91
             VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.0711 + J  0.3256  OHMS
             CONTRIBUTIONS: AIR BLOWER-04                         0.546 KA     ANG:  -87.64
             AASBC04-P                014 AMC-MCC-01B             6.671 KA     ANG:  -76.87

 100 PLANT MAIN SWBD SWB-1   3P Duty:  2.659 KA AT  -74.29 DEG (  19.16 MVA)  X/R:    3.61
             VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.2447 + J  0.8696  OHMS
             CPS-XFMR-01              CPS ENERGY                  2.539 KA     ANG: -254.00
             OE-WH                    111 FUSE CUT-OUTS           0.015 KA     ANG:   99.61
             CBL-0061                 BUS-0082                    0.025 KA     ANG:   96.02
             OE-WL                    101 FUSE CUT-OUTS           0.080 KA     ANG:  100.78

 101 FUSE CUT-OUTS      3P Duty:  2.659 KA AT  -74.29 DEG (  19.16 MVA)  X/R:    3.61
             VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.2447 + J  0.8696  OHMS
             PEL-XFMR02-F             108 PELXFM PRI              0.076 KA     ANG:  100.84
             HV44                     102 HV44                    0.004 KA     ANG:   99.58
             OE-WL                    100 PLANT MAIN SWBD SWB-1   2.579 KA     ANG:  -74.13

 102 HV44               3P Duty:  2.579 KA AT  -72.46 DEG (  18.58 MVA)  X/R:    3.21
             VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.2807 + J  0.8881  OHMS
             HEL-XFMR01-F             BUS-0032                    0.004 KA     ANG:   99.57
             HV44                     101 FUSE CUT-OUTS           2.575 KA     ANG:  -72.45

 103L HEL-ATS-01        3P Duty:  6.870 KA AT  -75.36 DEG (   5.71 MVA)  X/R:    3.85
             VOLTAGE:   480.  EQUIV. IMPEDANCE=  0.0102 + J  0.0390  OHMS
             LOW VOLTAGE POWER CIRCUIT BREAKER    6.870 KA
             MOLDED CASE CIRCUIT BREAKER < 10KA   8.519 KA
             MOLDED CASE CIRCUIT BREAKER < 20KA   7.220 KA
             MOLDED CASE CIRCUIT BREAKER > 20KA   6.870 KA
             AUTO-0002                BUS-0033                    6.837 KA     ANG:  -75.34
             MCC1-F                   104 MCC-1                   0.033 KA     ANG:   99.56

 104 MCC-1              3P Duty:  6.560 KA AT  -74.36 DEG (   5.45 MVA)  X/R:    3.59
             VOLTAGE:   480.  EQUIV. IMPEDANCE=  0.0114 + J  0.0407  OHMS
             LOW VOLTAGE POWER CIRCUIT BREAKER    6.560 KA
             MOLDED CASE CIRCUIT BREAKER < 10KA   7.992 KA
             MOLDED CASE CIRCUIT BREAKER < 20KA   6.773 KA
             MOLDED CASE CIRCUIT BREAKER > 20KA   6.560 KA
             MCC1-F                   103L HEL-ATS-01             6.527 KA     ANG:  -74.32
             HEL-PDP01-F              105 HEL-PDP-01              0.033 KA     ANG:   99.55
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SAWS LEON CREEK WRC
SAN ANTONIO, TX

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              T H R E E   P H A S E   F A U L T   R E P O R T
                 (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                       PRE FAULT VOLTAGE: 1.0000
                       MODEL TRANSFORMER TAPS: NO
=============================================================================================================

 105 HEL-PDP-01              3P Duty:  5.412 KA AT  -60.20 DEG (   4.50 MVA)  X/R:     1.76
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0255 + J  0.0444  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    5.412 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   5.436 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   5.412 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   5.412 KA
              CONTRIBUTIONS:  T.LOAD HEL-PDP01                                  0.033 KA      ANG:   -80.54
              HEL-PDP01-F                 104 MCC-1                             5.380 KA      ANG:   -60.08

 106 HEL-LP-01               3P Duty:  2.238 KA AT  -48.14 DEG (   0.81 MVA)  X/R:     1.12
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0358 + J  0.0400  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    2.238 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   2.238 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   2.238 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   2.238 KA
              HEL-LP1-F                   BUS-0045                              2.238 KA      ANG:   -48.14

 107 HEL-CPP-01              3P Duty:  0.753 KA AT  -63.68 DEG (   0.27 MVA)  X/R:     2.02
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0707 + J  0.1429  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    0.753 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   0.785 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   0.753 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   0.753 KA
              HEL-CPP1-F                  BUS-0048                              0.753 KA      ANG:   -63.68

 108 PELXFM PRI              3P Duty:  2.617 KA AT  -73.49 DEG (  18.86 MVA)  X/R:     3.43
              VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.2608 + J  0.8798  OHMS
              PEL-XFMR-02                 BUS-0088                              0.076 KA      ANG:   100.81
              PEL-XFMR02-F                101 FUSE CUT-OUTS                     2.542 KA      ANG:   -73.32

 109 PMC-MCC-02              3P Duty:  7.232 KA AT  -75.05 DEG (   6.01 MVA)  X/R:     3.80
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0099 + J  0.0370  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    7.232 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   8.941 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   7.577 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   7.232 KA
              CONTRIBUTIONS:  T.LOAD PMC-MCC-02                                 0.076 KA      ANG:   -80.54
                              LC-DDMP02                        0.295 KA     ANG:   -79.32
                              LC-DDMP01                        0.295 KA     ANG:   -79.32
              AEL-PDP2-F                  110 AEL-PDP-02                        0.043 KA      ANG:    99.73
              PMC-MCC-02                  BUS-0088                              6.525 KA      ANG:  -254.56

 110 AEL-PDP-02              3P Duty:  4.482 KA AT  -47.57 DEG (   3.73 MVA)  X/R:     1.12
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ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

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              T H R E E   P H A S E   F A U L T   R E P O R T
                 (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                       PRE FAULT VOLTAGE: 1.0000
                       MODEL TRANSFORMER TAPS: NO
==============================================================================================================
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0417 + J  0.0456  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    4.482 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   4.482 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   4.482 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   4.482 KA
              CONTRIBUTIONS:  T.LOAD AEL-PDP02                              0.043 KA     ANG:  -80.54
              AEL-PDP2-F                  109 PMC-MCC-02                    4.446 KA     ANG:  -47.27

 111 FUSE CUT-OUTS             3P Duty:  2.637 KA AT  -74.00 DEG (  19.00 MVA)  X/R:     3.54
              VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.2510 + J  0.8755  OHMS
              T-PS1-F                     BUS-0080                          0.015 KA     ANG:   99.61
              OE-WH                       100 PLANT MAIN SWBD SWB-1         2.622 KA     ANG:  -73.96

 112 PMC-MCC-01                3P Duty:  5.227 KA AT  -76.78 DEG (   4.35 MVA)  X/R:     4.28
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0121 + J  0.0516  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    5.227 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   6.653 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   5.639 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   5.227 KA
              CONTRIBUTIONS:  T.LOAD PMC-MCC-01                             0.078 KA     ANG:  -80.54
              PEL-PDP-F                   114 PEL-PDP-01                    0.028 KA     ANG:   99.59
              AEL-PDP1-F                  113 AEL-PDP-01                    0.028 KA     ANG:   99.76
              T-PS1                       BUS-0080                          5.093 KA     ANG: -256.68

 113 AEL-PDP-01                3P Duty:  3.012 KA AT  -45.61 DEG (   2.50 MVA)  X/R:     1.05
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0644 + J  0.0658  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    3.012 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   3.012 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   3.012 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   3.012 KA
              CONTRIBUTIONS:  T.LOAD AEL-PDP01                              0.028 KA     ANG:  -80.54
              AEL-PDP1-F                  112 PMC-MCC-01                    2.989 KA     ANG:  -45.30

 114 PEL-PDP-01                3P Duty:  4.186 KA AT  -58.29 DEG (   3.48 MVA)  X/R:     1.64
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0348 + J  0.0563  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    4.186 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   4.186 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   4.186 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   4.186 KA
              CONTRIBUTIONS:  T.LOAD PEL-PDP01                              0.028 KA     ANG:  -80.54
              PEL-PDP-F                   112 PMC-MCC-01                    4.159 KA     ANG:  -58.14

 115 SEL-PDP-11                3P Duty:  5.167 KA AT  -75.47 DEG (   4.30 MVA)  X/R:     4.02
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0135 + J  0.0519  OHMS
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SAWS LEON CREEK WRC
SAN ANTONIO, TX

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             T H R E E   P H A S E   F A U L T   R E P O R T
                (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                      PRE FAULT VOLTAGE: 1.0000
                      MODEL TRANSFORMER TAPS: NO
=========================================================================================================
                LOW VOLTAGE POWER CIRCUIT BREAKER    5.167 KA
                MOLDED CASE CIRCUIT BREAKER < 10KA   6.476 KA
                MOLDED CASE CIRCUIT BREAKER < 20KA   5.489 KA
                MOLDED CASE CIRCUIT BREAKER > 20KA   5.167 KA
                CONTRIBUTIONS:  T.LOAD SEL-PDP-11                              0.223 KA     ANG:  -84.29
                SEL-PDP-F                    BUS-0079                          4.947 KA     ANG: -255.07

 116 SEL-LP-12              3P Duty:  1.930 KA AT  -71.30 DEG (   0.80 MVA)  X/R:     2.97
                VOLTAGE:    240.   EQUIV. IMPEDANCE=  0.0230 + J  0.0680  OHMS
                LOW VOLTAGE POWER CIRCUIT BREAKER    1.930 KA
                MOLDED CASE CIRCUIT BREAKER < 10KA   2.236 KA
                MOLDED CASE CIRCUIT BREAKER < 20KA   1.930 KA
                MOLDED CASE CIRCUIT BREAKER > 20KA   1.930 KA
                SEL-LP12-F                   BUS-0052                          1.930 KA     ANG:  -71.30

 117 SEL-CPP-11             3P Duty:  0.752 KA AT  -64.54 DEG (   0.27 MVA)  X/R:     2.10
                VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0687 + J  0.1443  OHMS
                LOW VOLTAGE POWER CIRCUIT BREAKER    0.752 KA
                MOLDED CASE CIRCUIT BREAKER < 10KA   0.791 KA
                MOLDED CASE CIRCUIT BREAKER < 20KA   0.752 KA
                MOLDED CASE CIRCUIT BREAKER > 20KA   0.752 KA
                SEL-CPP11-F                  BUS-0055                          0.752 KA     ANG:  -64.54

 BUS-0082                   3P Duty:  2.659 KA AT  -74.29 DEG (  19.16 MVA)  X/R:     3.61
                VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.2447 + J  0.8696  OHMS
                SEL-XFMR01-F                 BUS-0078                          0.025 KA     ANG:  -83.98
                CBL-0061                     100 PLANT MAIN SWBD SWB-1         2.634 KA     ANG:  -74.19

 CPS ENERGY                 3P Duty:  1.268 KA AT  -67.91 DEG (  30.30 MVA)  X/R:     2.52
                VOLTAGE:  13800.   EQUIV. IMPEDANCE=  2.3640 + J  5.8237  OHMS
                CONTRIBUTIONS:  CPS UTI1                                       1.233 KA     ANG:  -67.55
                CPS-XFMR-01                  100 PLANT MAIN SWBD SWB-1         0.036 KA     ANG:  -80.43
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ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

F A U L T S T U D Y S U M M A R Y
(FOR APPLICATION OF LOW VOLTAGE BREAKERS)
PRE FAULT VOLTAGE: 1.0000
MODEL TRANSFORMER TAPS: NO

BUS RECORD NO NAME	VOLTAGE L-L	AVAILABLE FAULT DUTIES (KA) 3 PHASE	X/R	LINE/GRND	X/R
001 AMC-MCC-01A	4160.	7.290	9.39		
002 LC-AASBC01	4160.	7.219	8.92		
003 LC-AASBC02	4160.	7.219	8.92		
005 AEL-PDP-11A	480.	9.403	4.84		
006 AIS-LCP-01	480.	8.209	2.33		
007 AIS-LCP-02	480.	8.209	2.33		
008L AEL-ATS-01	480.	9.012	3.98		
009 AEL-PDP-12	480.	8.609	3.36		
010 AEL-LP-11	208.	5.178	0.72		
011 AEL-CPP-11	208.	1.502	2.40		
012 AEL-MPC-01	208.	1.411	2.03		
013 AEL-MPC-02	208.	1.301	1.65		
014 AMC-MCC-01B	4160.	7.278	9.37		
015 AEL-PDP-11B	480.	9.402	4.84		
016 AIS-LCP-03	480.	8.208	2.33		
017 AIS-LCP-04	480.	8.208	2.33		
018 LC-AASBC03	4160.	7.208	8.91		
019 LC-AASBC04	4160.	7.208	8.91		
100 PLANT MAIN SWBD SWB-1	4160.	2.659	3.61		
101 FUSE CUT-OUTS	4160.	2.659	3.61		
102 HV44	4160.	2.579	3.21		
103L HEL-ATS-01	480.	6.870	3.85		
104 MCC-1	480.	6.560	3.59		
105 HEL-PDP-01	480.	5.412	1.76		
106 HEL-LP-01	208.	2.238	1.12		
107 HEL-CPP-01	208.	0.753	2.02		
108 PELXFM PRI	4160.	2.617	3.43		
109 PMC-MCC-02	480.	7.232	3.80		
110 AEL-PDP-02	480.	4.482	1.12		
111 FUSE CUT-OUTS	4160.	2.637	3.54		
112 PMC-MCC-01	480.	5.227	4.28		
113 AEL-PDP-01	480.	3.012	1.05		
114 PEL-PDP-01	480.	4.186	1.64		
115 SEL-PDP-11	480.	5.167	4.02		
116 SEL-LP-12	240.	1.930	2.97		
117 SEL-CPP-11	208.	0.752	2.10		
BUS-0082	4160.	2.659	3.61		
CPS ENERGY	13800.	1.268	2.52		

69 FAULTED BUSES, 89 BRANCHES, 22 CONTRIBUTIONS

*** SHORT CIRCUIT STUDY COMPLETE ***

ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX
FUTURE UTILITY
Jul 12, 2011   14:47:37

ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

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             T H R E E   P H A S E   F A U L T   R E P O R T
                (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                     PRE FAULT VOLTAGE: 1.0000
                     MODEL TRANSFORMER TAPS: NO
==============================================================================================================

 001 AMC-MCC-01A            3P Duty: 10.089 KA AT  -79.48 DEG (  72.69 MVA)  X/R:    8.53
             VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0435 + J  0.2341  OHMS
             AASBC02-P                    003 LC-AASBC02                  0.546 KA     ANG:    92.40
             AASBC01-P                    002 LC-AASBC01                  0.546 KA     ANG:    92.40
             AEL-XFMR-01A-F               BUS-0007                        0.081 KA     ANG:    99.94
             AMC-MCC01A-F                 BUS-0003                        7.854 KA     ANG:   -77.23
             AMC-MCC01-TF                 014 AMC-MCC-01B                 1.091 KA     ANG:    92.41

 002 LC-AASBC01             3P Duty:  9.951 KA AT  -78.92 DEG (  71.70 MVA)  X/R:    7.95
             VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0464 + J  0.2369  OHMS
             CONTRIBUTIONS:  AIR BLOWER-01                                0.546 KA     ANG:   -87.64
             AASBC01-P                    001 AMC-MCC-01A                 9.411 KA     ANG:   -78.41

 003 LC-AASBC02             3P Duty:  9.951 KA AT  -78.92 DEG (  71.70 MVA)  X/R:    7.95
             VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0464 + J  0.2369  OHMS
             CONTRIBUTIONS:  AIR BLOWER-02                                0.546 KA     ANG:   -87.64
             AASBC02-P                    001 AMC-MCC-01A                 9.411 KA     ANG:   -78.41

 005 AEL-PDP-11A            3P Duty:  9.752 KA AT  -77.68 DEG (   8.11 MVA)  X/R:    4.74
             VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0061 + J  0.0278  OHMS
             LOW VOLTAGE POWER CIRCUIT BREAKER    9.752 KA
             MOLDED CASE CIRCUIT BREAKER < 20KA  10.767 KA
             MOLDED CASE CIRCUIT BREAKER > 20KA   9.752 KA
             AIS-LCP2-P                   007 AIS-LCP-02                  0.158 KA     ANG:    99.70
             AIS-LCP1-P                   006 AIS-LCP-01                  0.158 KA     ANG:    99.70
             AEL-H1-P                     BUS-0059                        0.063 KA     ANG:    99.85
             AEL-PDP11A-F                 BUS-0089                        8.996 KA     ANG:  -257.46
             AEL-PDP11-T                  015 AEL-PDP-11B                 0.378 KA     ANG:    99.73

 006 AIS-LCP-01             3P Duty:  8.469 KA AT  -65.55 DEG (   7.04 MVA)  X/R:    2.27
             VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0135 + J  0.0298  OHMS
             LOW VOLTAGE POWER CIRCUIT BREAKER    8.469 KA
             MOLDED CASE CIRCUIT BREAKER < 10KA   9.104 KA
             MOLDED CASE CIRCUIT BREAKER < 20KA   8.469 KA
             MOLDED CASE CIRCUIT BREAKER > 20KA   8.469 KA
             CONTRIBUTIONS:  AIS-LCP-01                                   0.158 KA     ANG:   -80.54
             AIS-LCP1-P                   005 AEL-PDP-11A                 8.316 KA     ANG:   -65.27

 007 AIS-LCP-02             3P Duty:  8.469 KA AT  -65.55 DEG (   7.04 MVA)  X/R:    2.27
             VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0135 + J  0.0298  OHMS
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 ML10660
 SAWS LEON CREEK WRC
 SAN ANTONIO, TX

              T H R E E   P H A S E   F A U L T   R E P O R T
                 (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                       PRE FAULT VOLTAGE: 1.0000
                       MODEL TRANSFORMER TAPS: NO
================================================================================================================
              LOW VOLTAGE POWER CIRCUIT BREAKER    8.469 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   9.104 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.469 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.469 KA
              CONTRIBUTIONS:  AIS-LCP-02                                         0.158 KA     ANG:  -80.54
              AIS-LCP2-P                  005 AEL-PDP-11A                        8.316 KA     ANG:  -65.27

 008L AEL-ATS-01              3P Duty:  9.333 KA AT  -75.18 DEG (   7.76 MVA)  X/R:     3.88
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0076 + J  0.0287  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    9.333 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   9.828 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   9.333 KA
              AUTO-0001                   BUS-0062                               9.333 KA     ANG:  104.82

 009 AEL-PDP-12               3P Duty:  8.901 KA AT  -72.70 DEG (   7.40 MVA)  X/R:     3.28
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0093 + J  0.0297  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    8.901 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.976 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.901 KA
              AEL-PDP12-F                 008L AEL-ATS-01                        8.901 KA     ANG:  -72.70

 010 AEL-LP-11                3P Duty:  5.213 KA AT  -35.32 DEG (   1.88 MVA)  X/R:     0.71
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0188 + J  0.0133  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    5.213 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   5.213 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   5.213 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   5.213 KA
              AEL-XFMR-LP11               BUS-0063                               5.213 KA     ANG:  144.68

 011 AEL-CPP-11               3P Duty:  1.505 KA AT  -67.30 DEG (   0.54 MVA)  X/R:     2.39
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0308 + J  0.0736  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    1.505 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   1.643 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   1.505 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   1.505 KA
              AEL-XFMR-CPP11              BUS-0066                               1.505 KA     ANG:  112.70

 012 AEL-MPC-01               3P Duty:  1.414 KA AT  -63.67 DEG (   0.51 MVA)  X/R:     2.02
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0377 + J  0.0761  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    1.414 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   1.473 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   1.414 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   1.414 KA
              MPZ XFM-01                  BUS-0069                               1.414 KA     ANG:  116.33
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ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

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              T H R E E   P H A S E   F A U L T   R E P O R T
                 (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                      PRE FAULT VOLTAGE: 1.0000
                      MODEL TRANSFORMER TAPS: NO
=========================================================================================================

 013 AEL-MPC-02              3P Duty:  1.304 KA AT  -58.72 DEG (   0.47 MVA)  X/R:     1.65
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0478 + J  0.0787  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER     1.304 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   1.304 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   1.304 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   1.304 KA
              MPZ XFM-02                    BUS-0071                             1.304 KA      ANG:  121.28

 014 AMC-MCC-01B             3P Duty: 10.064 KA AT  -79.44 DEG (  72.52 MVA)  X/R:     8.50
              VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.0437 + J  0.2346  OHMS
              AASBC04-P                     019 LC-AASBC04                       0.546 KA      ANG:   92.40
              AASBC03-P                     018 LC-AASBC03                       0.546 KA      ANG:   92.40
              AMC-MCC01-TF                  001 AMC-MCC-01A                      8.985 KA      ANG:  -78.45

 015 AEL-PDP-11B             3P Duty:  9.751 KA AT  -77.68 DEG (   8.11 MVA)  X/R:     4.74
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0061 + J  0.0278  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER     9.751 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA  10.766 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   9.751 KA
              AIS-LCP4-P                    017 AIS-LCP-04                       0.158 KA      ANG:   99.70
              AIS-LCP3-P                    016 AIS-LCP-03                       0.158 KA      ANG:   99.70
              AEL-H2-P                      BUS-0077                             0.063 KA      ANG:   99.85
              AEL-PDP11-T                   005 AEL-PDP-11A                      9.373 KA      ANG:  -77.57

 016 AIS-LCP-03              3P Duty:  8.468 KA AT  -65.55 DEG (   7.04 MVA)  X/R:     2.27
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0135 + J  0.0298  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER     8.468 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   9.103 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.468 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.468 KA
              CONTRIBUTIONS:  AIS-LCP-03                                         0.158 KA      ANG:  -80.54
              AIS-LCP3-P                    015 AEL-PDP-11B                      8.316 KA      ANG:  -65.27

 017 AIS-LCP-04              3P Duty:  8.468 KA AT  -65.55 DEG (   7.04 MVA)  X/R:     2.27
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0135 + J  0.0298  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER     8.468 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   9.103 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.468 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   8.468 KA
              CONTRIBUTIONS:  AIS-LCP-04                                         0.158 KA      ANG:  -80.54
              AIS-LCP4-P                    015 AEL-PDP-11B                      8.316 KA      ANG:  -65.27

 018 LC-AASBC03              3P Duty:  9.927 KA AT  -78.88 DEG (  71.53 MVA)  X/R:     7.93
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              T H R E E   P H A S E   F A U L T   R E P O R T
                 (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                       PRE FAULT VOLTAGE: 1.0000
                       MODEL TRANSFORMER TAPS: NO
===============================================================================================================
              VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.0467 + J  0.2374  OHMS
              CONTRIBUTIONS:  AIR BLOWER-03                               0.546 KA      ANG:  -87.64
              AASBC03-P                     014 AMC-MCC-01B               9.388 KA      ANG:  -78.37

 019 LC-AASBC04             3P Duty:  9.927 KA AT  -78.88 DEG (  71.53 MVA)  X/R:    7.93
              VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.0467 + J  0.2374  OHMS
              CONTRIBUTIONS:  AIR BLOWER-04                               0.546 KA      ANG:  -87.64
              AASBC04-P                     014 AMC-MCC-01B               9.388 KA      ANG:  -78.37

 100 PLANT MAIN SWBD SWB-1  3P Duty:  4.057 KA AT  -77.38 DEG (  29.23 MVA)  X/R:    4.49
              VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.1293 + J  0.5777  OHMS
              CPS-XFMR-01                   CPS ENERGY                    3.937 KA      ANG: -257.29
              OE-WH                         111 FUSE CUT-OUTS             0.015 KA      ANG:   99.61
              CBL-0061                      BUS-0082                      0.025 KA      ANG:   96.02
              OE-WL                         101 FUSE CUT-OUTS             0.080 KA      ANG:  100.78

 101 FUSE CUT-OUTS          3P Duty:  4.057 KA AT  -77.38 DEG (  29.23 MVA)  X/R:    4.49
              VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.1293 + J  0.5777  OHMS
              PEL-XFMR02-F                  108 PELXFM PRI                0.076 KA      ANG:  100.84
              HV44                          102 HV44                      0.004 KA      ANG:   99.58
              OE-WL                         100 PLANT MAIN SWBD SWB-1     3.977 KA      ANG:  -77.34

 102 HV44                   3P Duty:  3.882 KA AT  -74.50 DEG (  27.97 MVA)  X/R:    3.62
              VOLTAGE:  4160.  EQUIV. IMPEDANCE=  0.1654 + J  0.5962  OHMS
              HEL-XFMR01-F                  BUS-0032                      0.004 KA      ANG:   99.57
              HV44                          101 FUSE CUT-OUTS             3.878 KA      ANG:  -74.49

 103L HEL-ATS-01            3P Duty:  7.651 KA AT  -76.15 DEG (   6.36 MVA)  X/R:    4.06
              VOLTAGE:   480.  EQUIV. IMPEDANCE=  0.0087 + J  0.0352  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER   7.651 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA  9.614 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA  8.148 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA  7.651 KA
              AUTO-0002                     BUS-0033                      7.618 KA      ANG:  -76.13
              MCC1-F                        104 MCC-1                     0.033 KA      ANG:   99.56

 104 MCC-1                  3P Duty:  7.270 KA AT  -74.99 DEG (   6.04 MVA)  X/R:    3.74
              VOLTAGE:   480.  EQUIV. IMPEDANCE=  0.0099 + J  0.0368  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER   7.270 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA  8.948 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA  7.583 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA  7.270 KA
              MCC1-F                        103L HEL-ATS-01               7.237 KA      ANG:  -74.97
              HEL-PDP01-F                   105 HEL-PDP-01                0.033 KA      ANG:   99.55
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             T H R E E   P H A S E   F A U L T   R E P O R T
                (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                      PRE FAULT VOLTAGE: 1.0000
                      MODEL TRANSFORMER TAPS: NO
=================================================================================================================

 105 HEL-PDP-01              3P Duty:  5.882 KA AT  -59.46 DEG (   4.89 MVA)  X/R:     1.71
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0239 + J  0.0406  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    5.882 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   5.882 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   5.882 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   5.882 KA
              CONTRIBUTIONS:  T.LOAD HEL-PDP01                               0.033 KA     ANG:   -80.54
              HEL-PDP01-F                 104 MCC-1                          5.851 KA     ANG:   -59.34

 106 HEL-LP-01               3P Duty:  2.269 KA AT  -47.84 DEG (   0.82 MVA)  X/R:     1.11
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0355 + J  0.0392  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    2.269 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   2.269 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   2.269 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   2.269 KA
              HEL-LP1-F                   BUS-0045                           2.269 KA     ANG:   -47.84

 107 HEL-CPP-01              3P Duty:  0.757 KA AT  -63.65 DEG (   0.27 MVA)  X/R:     2.02
              VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0704 + J  0.1422  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    0.757 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   0.788 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   0.757 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   0.757 KA
              HEL-CPP1-F                  BUS-0048                           0.757 KA     ANG:   -63.65

 108 PELXFM PRI              3P Duty:  3.964 KA AT  -76.07 DEG (  28.56 MVA)  X/R:     4.05
              VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.1459 + J  0.5880  OHMS
              PEL-XFMR-02                 BUS-0088                           0.076 KA     ANG:   100.81
              PEL-XFMR02-F                101 FUSE CUT-OUTS                  3.888 KA     ANG:   -76.01

 109 PMC-MCC-02              3P Duty:  7.977 KA AT  -75.66 DEG (   6.63 MVA)  X/R:     3.95
              VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0086 + J  0.0337  OHMS
              LOW VOLTAGE POWER CIRCUIT BREAKER    7.977 KA
              MOLDED CASE CIRCUIT BREAKER < 10KA   9.956 KA
              MOLDED CASE CIRCUIT BREAKER < 20KA   8.438 KA
              MOLDED CASE CIRCUIT BREAKER > 20KA   7.977 KA
              CONTRIBUTIONS:  T.LOAD PMC-MCC-02                              0.076 KA     ANG:   -80.54
                              LC-DDMP02                      0.295 KA     ANG:   -79.32
                              LC-DDMP01                      0.295 KA     ANG:   -79.32
              AEL-PDP2-F                  110 AEL-PDP-02                     0.043 KA     ANG:    99.73
              PMC-MCC-02                  BUS-0088                           7.270 KA     ANG:  -255.29

 110 AEL-PDP-02              3P Duty:  4.735 KA AT  -46.25 DEG (   3.94 MVA)  X/R:     1.07
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            T H R E E   P H A S E   F A U L T   R E P O R T
               (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                     PRE FAULT VOLTAGE: 1.0000
                     MODEL TRANSFORMER TAPS: NO
=====================================================================================================
            VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0405 + J  0.0423  OHMS
            LOW VOLTAGE POWER CIRCUIT BREAKER    4.735 KA
            MOLDED CASE CIRCUIT BREAKER < 10KA   4.735 KA
            MOLDED CASE CIRCUIT BREAKER < 20KA   4.735 KA
            MOLDED CASE CIRCUIT BREAKER > 20KA   4.735 KA
            CONTRIBUTIONS:  T.LOAD AEL-PDP02                            0.043 KA     ANG:  -80.54
            AEL-PDP2-F                  109 PMC-MCC-02                  4.700 KA     ANG:  -45.96

 111 FUSE CUT-OUTS           3P Duty:  4.009 KA AT  -76.91 DEG (  28.88 MVA)  X/R:     4.32
            VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.1357 + J  0.5836  OHMS
            T-PS1-F                     BUS-0080                        0.015 KA     ANG:   99.61
            OE-WH                       100 PLANT MAIN SWBD SWB-1       3.993 KA     ANG:  -76.90

 112 PMC-MCC-01              3P Duty:  5.650 KA AT  -77.45 DEG (   4.70 MVA)  X/R:     4.50
            VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0107 + J  0.0479  OHMS
            LOW VOLTAGE POWER CIRCUIT BREAKER    5.650 KA
            MOLDED CASE CIRCUIT BREAKER < 10KA   7.277 KA
            MOLDED CASE CIRCUIT BREAKER < 20KA   6.167 KA
            MOLDED CASE CIRCUIT BREAKER > 20KA   5.650 KA
            CONTRIBUTIONS:  T.LOAD PMC-MCC-01                           0.078 KA     ANG:  -80.54
            PEL-PDP-F                   114 PEL-PDP-01                  0.028 KA     ANG:   99.59
            AEL-PDP1-F                  113 AEL-PDP-01                  0.028 KA     ANG:   99.76
            T-PS1                       BUS-0080                        5.515 KA     ANG: -257.38

 113 AEL-PDP-01              3P Duty:  3.136 KA AT  -44.58 DEG (   2.61 MVA)  X/R:     1.01
            VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0629 + J  0.0620  OHMS
            LOW VOLTAGE POWER CIRCUIT BREAKER    3.136 KA
            MOLDED CASE CIRCUIT BREAKER < 10KA   3.136 KA
            MOLDED CASE CIRCUIT BREAKER < 20KA   3.136 KA
            MOLDED CASE CIRCUIT BREAKER > 20KA   3.136 KA
            CONTRIBUTIONS:  T.LOAD AEL-PDP01                            0.028 KA     ANG:  -80.54
            AEL-PDP1-F                  112 PMC-MCC-01                  3.113 KA     ANG:  -44.27

 114 PEL-PDP-01              3P Duty:  4.450 KA AT  -57.62 DEG (   3.70 MVA)  X/R:     1.59
            VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0334 + J  0.0526  OHMS
            LOW VOLTAGE POWER CIRCUIT BREAKER    4.450 KA
            MOLDED CASE CIRCUIT BREAKER < 10KA   4.450 KA
            MOLDED CASE CIRCUIT BREAKER < 20KA   4.450 KA
            MOLDED CASE CIRCUIT BREAKER > 20KA   4.450 KA
            CONTRIBUTIONS:  T.LOAD PEL-PDP01                            0.028 KA     ANG:  -80.54
            PEL-PDP-F                   112 PMC-MCC-01                  4.424 KA     ANG:  -57.47

 115 SEL-PDP-11              3P Duty:  5.570 KA AT  -75.97 DEG (   4.63 MVA)  X/R:     4.14
            VOLTAGE:    480.   EQUIV. IMPEDANCE=  0.0121 + J  0.0483  OHMS
```

```
 ML10660
 SAWS LEON CREEK WRC
 SAN ANTONIO, TX

               T H R E E   P H A S E   F A U L T   R E P O R T
                  (FOR APPLICATION OF LOW VOLTAGE BREAKERS)
                        PRE FAULT VOLTAGE: 1.0000
                        MODEL TRANSFORMER TAPS: NO
==============================================================================================================
               LOW VOLTAGE POWER CIRCUIT BREAKER    5.570 KA
               MOLDED CASE CIRCUIT BREAKER < 10KA   7.032 KA
               MOLDED CASE CIRCUIT BREAKER < 20KA   5.959 KA
               MOLDED CASE CIRCUIT BREAKER > 20KA   5.570 KA
               CONTRIBUTIONS:  T.LOAD SEL-PDP-11                                0.223 KA     ANG:  -84.29
               SEL-PDP-F                     BUS-0079                           5.349 KA     ANG: -255.63

 116 SEL-LP-12                3P Duty:  1.956 KA AT  -71.34 DEG (   0.81 MVA)  X/R:     2.97
               VOLTAGE:    240.   EQUIV. IMPEDANCE=  0.0227 + J  0.0671  OHMS
               LOW VOLTAGE POWER CIRCUIT BREAKER    1.956 KA
               MOLDED CASE CIRCUIT BREAKER < 10KA   2.267 KA
               MOLDED CASE CIRCUIT BREAKER < 20KA   1.956 KA
               MOLDED CASE CIRCUIT BREAKER > 20KA   1.956 KA
               SEL-LP12-F                    BUS-0052                           1.956 KA     ANG:  -71.34

 117 SEL-CPP-11               3P Duty:  0.755 KA AT  -64.52 DEG (   0.27 MVA)  X/R:     2.10
               VOLTAGE:    208.   EQUIV. IMPEDANCE=  0.0684 + J  0.1436  OHMS
               LOW VOLTAGE POWER CIRCUIT BREAKER    0.755 KA
               MOLDED CASE CIRCUIT BREAKER < 10KA   0.795 KA
               MOLDED CASE CIRCUIT BREAKER < 20KA   0.755 KA
               MOLDED CASE CIRCUIT BREAKER > 20KA   0.755 KA
               SEL-CPP11-F                   BUS-0055                           0.755 KA     ANG:  -64.52

 BUS-0082                     3P Duty:  4.057 KA AT  -77.38 DEG (  29.23 MVA)  X/R:     4.49
               VOLTAGE:   4160.   EQUIV. IMPEDANCE=  0.1293 + J  0.5777  OHMS
               SEL-XFMR01-F                  BUS-0078                           0.025 KA     ANG:  -83.98
               CBL-0061                      100 PLANT MAIN SWBD SWB-1          4.032 KA     ANG:  -77.34

 CPS ENERGY                   3P Duty:  2.947 KA AT  -67.01 DEG (  70.43 MVA)  X/R:     2.38
               VOLTAGE:  13800.   EQUIV. IMPEDANCE=  1.0559 + J  2.4893  OHMS
               CONTRIBUTIONS:  CPS UTI2                                         2.912 KA     ANG:  -66.85
               CPS-XFMR-01                   100 PLANT MAIN SWBD SWB-1          0.036 KA     ANG:  -80.43
```

ML10660
SAWS LEON CREEK WRC
SAN ANTONIO, TX

F A U L T S T U D Y S U M M A R Y
(FOR APPLICATION OF LOW VOLTAGE BREAKERS)
PRE FAULT VOLTAGE: 1.0000
MODEL TRANSFORMER TAPS: NO

BUS RECORD NO NAME	VOLTAGE L-L	AVAILABLE FAULT DUTIES (KA) 3 PHASE	X/R	LINE/GRND	X/R
001 AMC-MCC-01A	4160.	10.089	8.53		
002 LC-AASBC01	4160.	9.951	7.95		
003 LC-AASBC02	4160.	9.951	7.95		
005 AEL-PDP-11A	480.	9.752	4.74		
006 AIS-LCP-01	480.	8.469	2.27		
007 AIS-LCP-02	480.	8.469	2.27		
008L AEL-ATS-01	480.	9.333	3.88		
009 AEL-PDP-12	480.	8.901	3.28		
010 AEL-LP-11	208.	5.213	0.71		
011 AEL-CPP-11	208.	1.505	2.39		
012 AEL-MPC-01	208.	1.414	2.02		
013 AEL-MPC-02	208.	1.304	1.65		
014 AMC-MCC-01B	4160.	10.064	8.50		
015 AEL-PDP-11B	480.	9.751	4.74		
016 AIS-LCP-03	480.	8.468	2.27		
017 AIS-LCP-04	480.	8.468	2.27		
018 LC-AASBC03	4160.	9.927	7.93		
019 LC-AASBC04	4160.	9.927	7.93		
100 PLANT MAIN SWBD SWB-1	4160.	4.057	4.49		
101 FUSE CUT-OUTS	4160.	4.057	4.49		
102 HV44	4160.	3.882	3.62		
103L HEL-ATS-01	480.	7.651	4.06		
104 MCC-1	480.	7.270	3.74		
105 HEL-PDP-01	480.	5.882	1.71		
106 HEL-LP-01	208.	2.269	1.11		
107 HEL-CPP-01	208.	0.757	2.02		
108 PELXFM PRI	4160.	3.964	4.05		
109 PMC-MCC-02	480.	7.977	3.95		
110 AEL-PDP-02	480.	4.735	1.07		
111 FUSE CUT-OUTS	4160.	4.009	4.32		
112 PMC-MCC-01	480.	5.650	4.50		
113 AEL-PDP-01	480.	3.136	1.01		
114 PEL-PDP-01	480.	4.450	1.59		
115 SEL-PDP-11	480.	5.570	4.14		
116 SEL-LP-12	240.	1.956	2.97		
117 SEL-CPP-11	208.	0.755	2.10		
BUS-0082	4160.	4.057	4.49		
CPS ENERGY	13800.	2.947	2.38		

69 FAULTED BUSES, 89 BRANCHES, 22 CONTRIBUTIONS

*** SHORT CIRCUIT STUDY COMPLETE ***

APPENDIX D: REFERENCES

I. SCHNEIDER ELECTRIC ENGINEERING SERVICES, LLC

1 Response to Consultant Engineer review comments

2 Time Margins for Solid State Relays

3 Time Margins for Induction Disk Relays

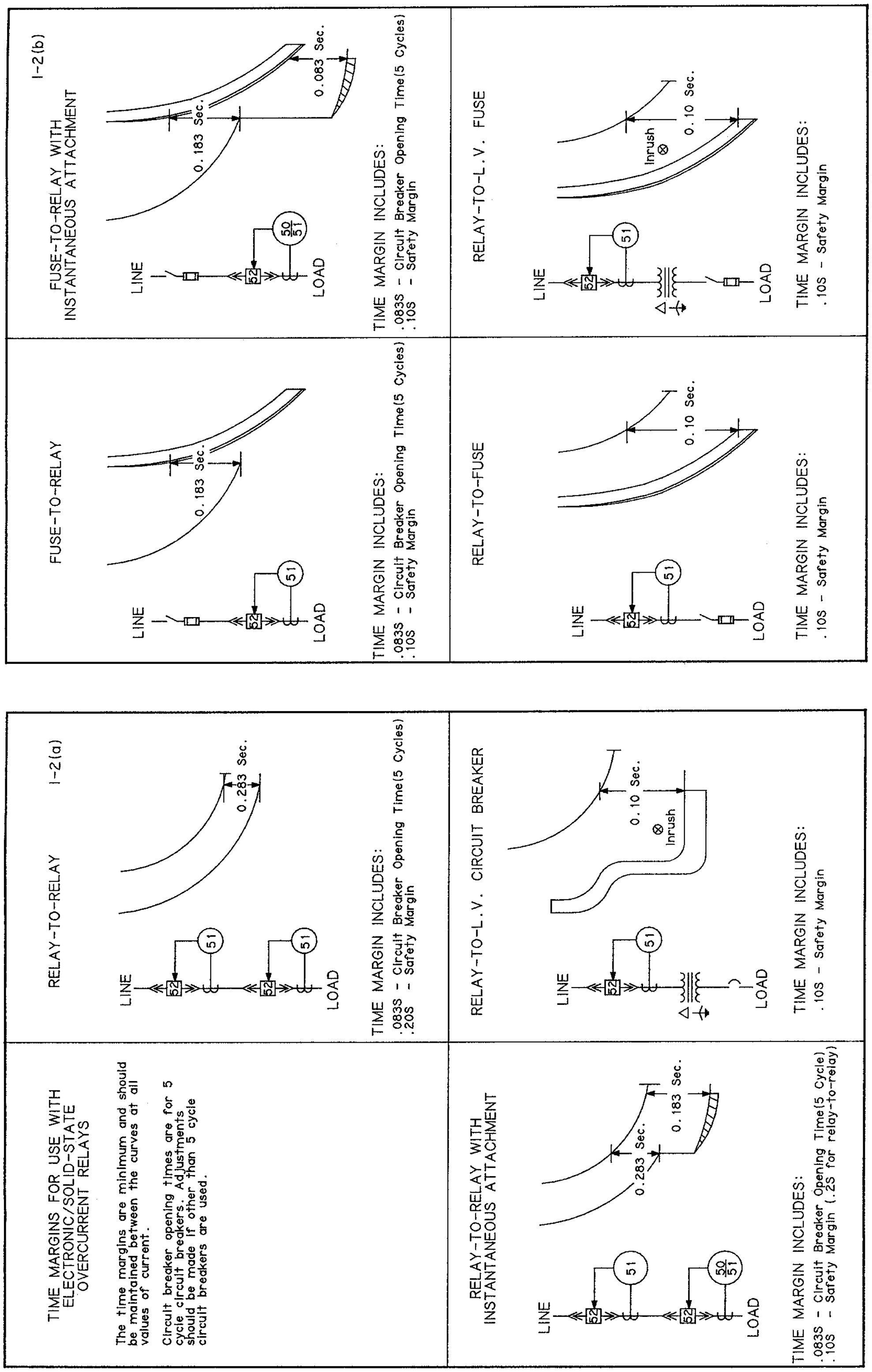
4 Trip Dials for Micrologic 6.0, 6.0A, 6.0P, 6.0H

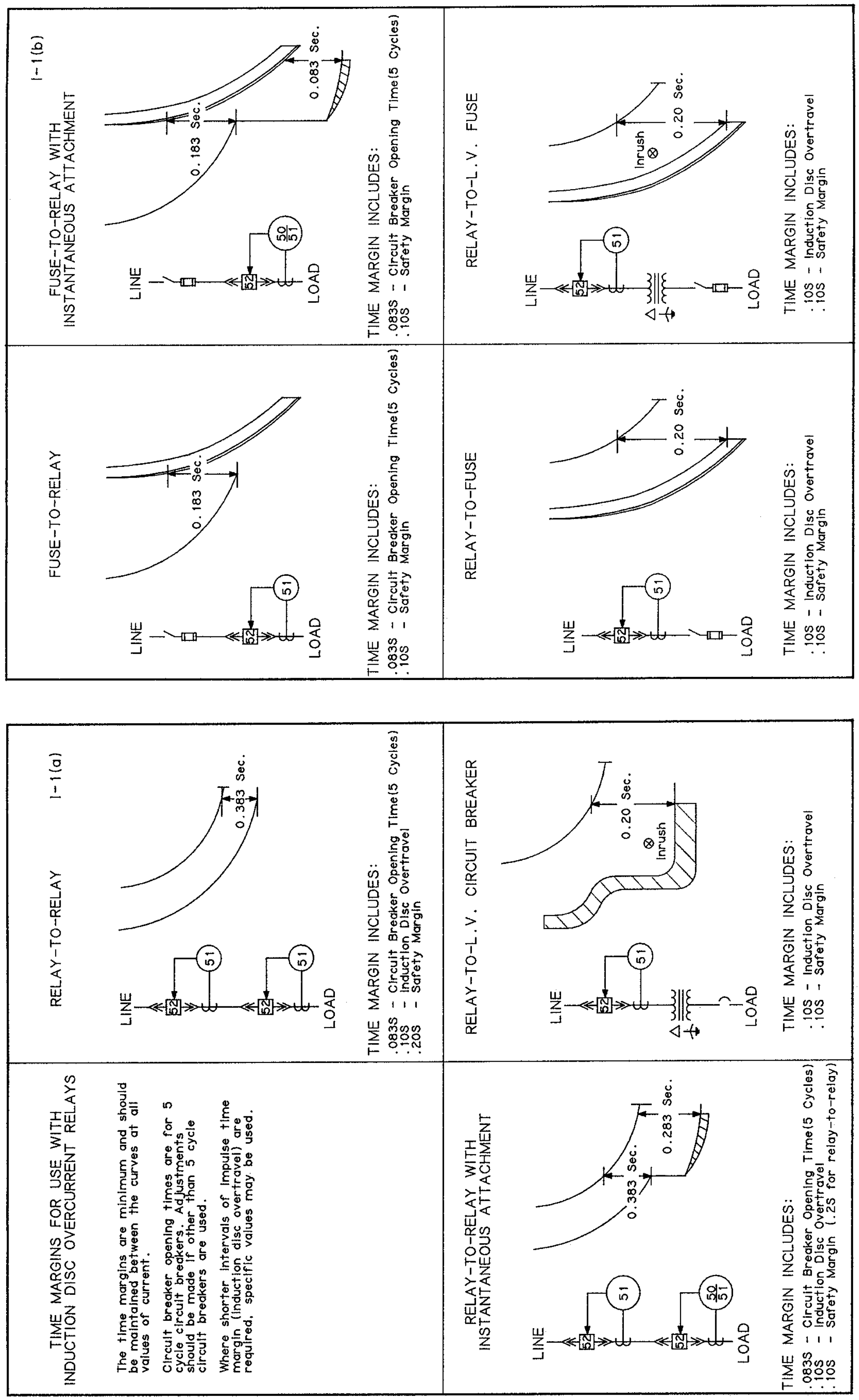
5 Trip Dials for LX, LXI, and MX

6 Trip Dials for Electronic Trip ET1.0 & ET1.0I

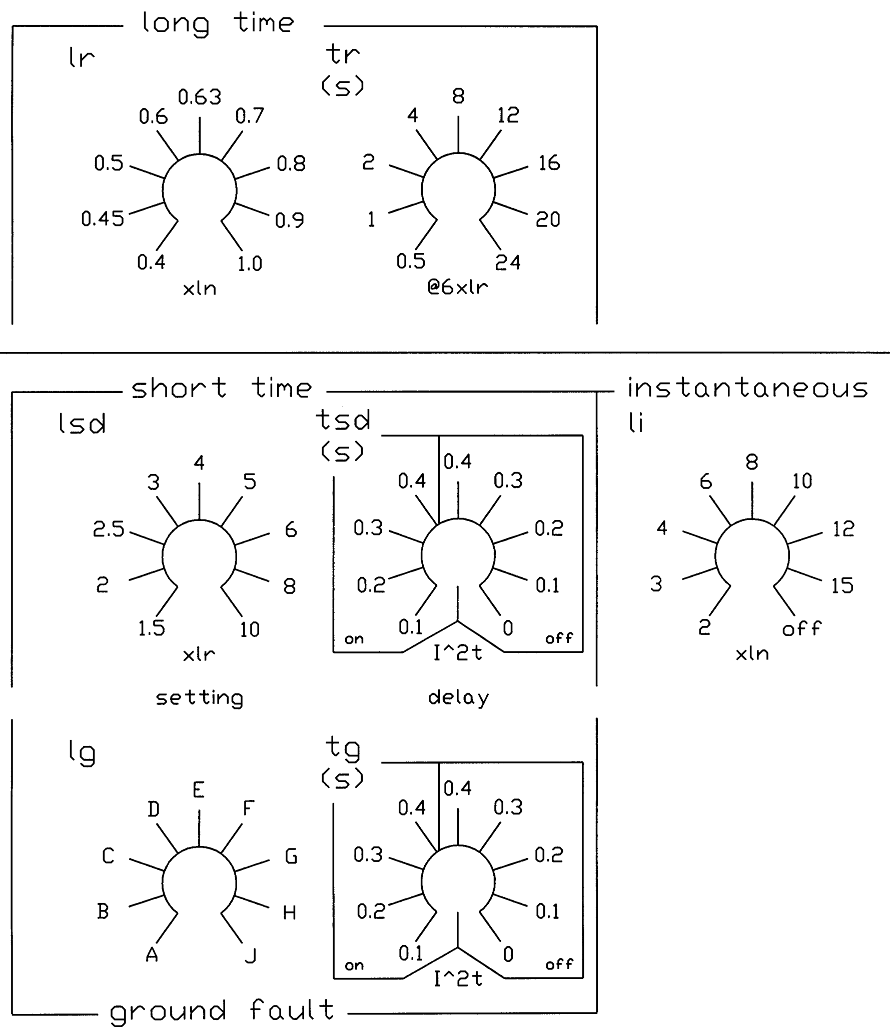
7 Trip Dials for Molded Case Breakers

8 Setpoint file for MULTILIN SR469 relays


TIME MARGINS FOR USE WITH ELECTRONIC/SOLID-STATE OVERCURRENT RELAYS
The time margins are minimum and should be maintained between the curves at all values of current.
Circuit breaker opening times are for 5 cycle circuit breakers. Adjustments should be made if other than 5 cycle circuit breakers are used.
RELAY-TO-RELAY
I-2(a)
LINE
52
51
LOAD
0.283 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycles)
.20S - Safety Margin
RELAY-TO-RELAY WITH INSTANTANEOUS ATTACHMENT
50
51
0.283 Sec.
0.183 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycle)
.10S - Safety Margin (.2S for relay-to-relay)
RELAY-TO-L.V. CIRCUIT BREAKER
0.10 Sec.
Inrush
TIME MARGIN INCLUDES:
.10S - Safety Margin
FUSE-TO-RELAY
0.183 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycles)
.10S - Safety Margin
FUSE-TO-RELAY WITH INSTANTANEOUS ATTACHMENT
I-2(b)
0.183 Sec.
0.083 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycles)
.10S - Safety Margin
RELAY-TO-FUSE
0.10 Sec.
TIME MARGIN INCLUDES:
.10S - Safety Margin
RELAY-TO-L.V. FUSE
0.10 Sec.
Inrush
TIME MARGIN INCLUDES:
.10S - Safety Margin


TIME MARGINS FOR USE WITH INDUCTION DISC OVERCURRENT RELAYS
The time margins are minimum and should be maintained between the curves at all values of current.
Circuit breaker opening times are for 5 cycle circuit breakers. Adjustments should be made if other than 5 cycle circuit breakers are used.
Where shorter intervals of impulse time margin (induction disc overtravel) are required, specific values may be used.
RELAY-TO-RELAY
I-1(a)
LINE
52
51
LOAD
0.383 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycles)
.10S - Induction Disc Overtravel
.20S - Safety Margin
FUSE-TO-RELAY
0.183 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycles)
.10S - Safety Margin
FUSE-TO-RELAY WITH INSTANTANEOUS ATTACHMENT
I-1(b)
50
51
0.083 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycles)
.10S - Safety Margin
RELAY-TO-RELAY WITH INSTANTANEOUS ATTACHMENT
0.383 Sec.
0.283 Sec.
TIME MARGIN INCLUDES:
.083S - Circuit Breaker Opening Time(5 Cycles)
.10S - Induction Disc Overtravel
.10S - Safety Margin (.2S for relay-to-relay)
RELAY-TO-L.V. CIRCUIT BREAKER
0.20 Sec.
Inrush
TIME MARGIN INCLUDES:
.10S - Induction Disc Overtravel
.10S - Safety Margin
RELAY-TO-FUSE
0.20 Sec.
TIME MARGIN INCLUDES:
.10S - Induction Disc Overtravel
.10S - Safety Margin
RELAY-TO-L.V. FUSE
Inrush
0.20 Sec.
TIME MARGIN INCLUDES:
.10S - Induction Disc Overtravel
.10S - Safety Margin

TRIP ADJUSTMENT DIALS FOR MICROLOGIC 6.0, 6.0A, 6.0P, & 6.0H TRIP UNITS

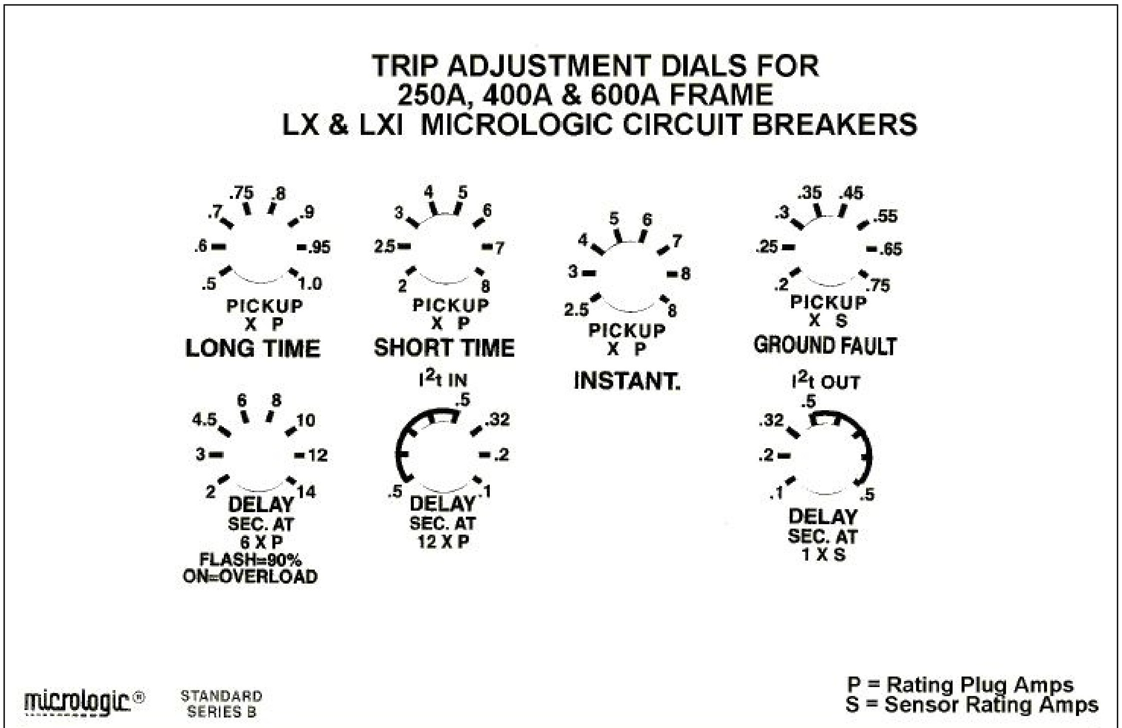


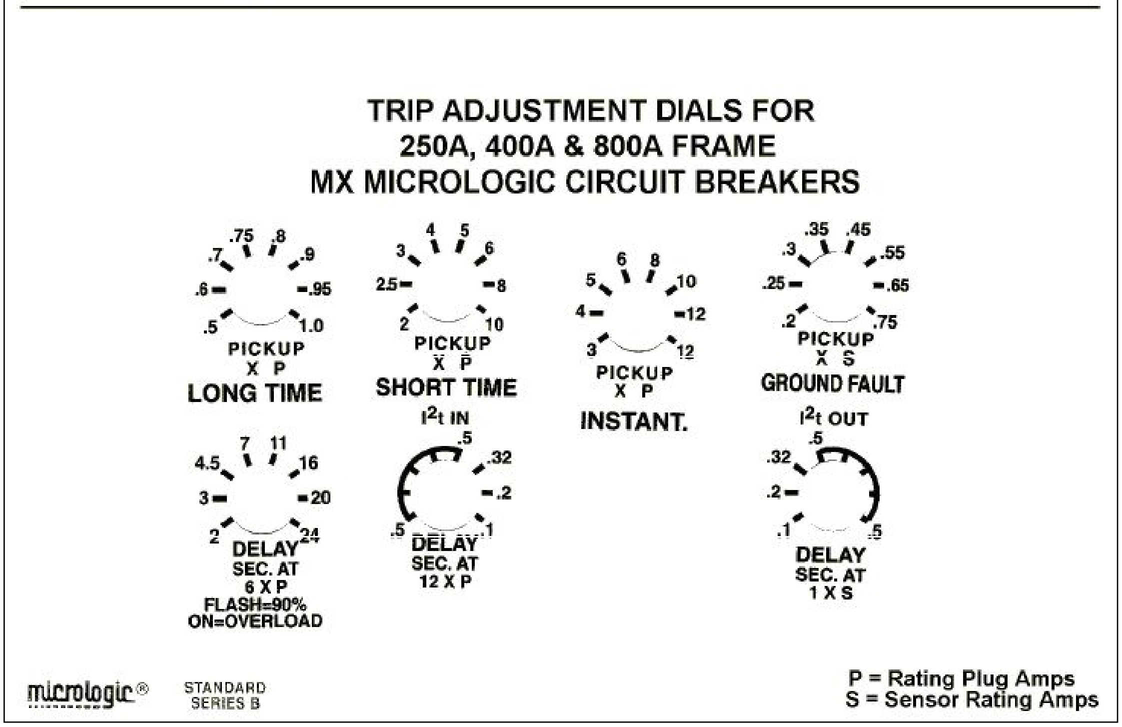
Notes

In = sensor
Ir = long time pickup setting
tr = long time delay setting
Isd = short time pickup setting
tsd = short time delay setting
Ii = instantaneous setting
Ig = ground fault pickup setting
tg = ground fault delay setting

1) Eight interchangeable rating plugs are available to limit the long-time pickup setting range for greater versatility. (Type A is the standard plug and corresponds to settings shown above.)

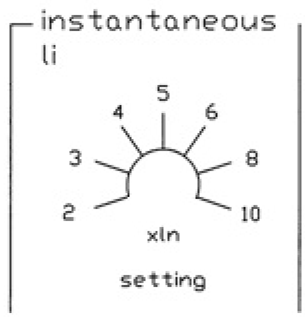
2) P and H trip units also have protective relay features and selectable long-time delay bands such as I^4 T. These settings are programmed in through a keypad or computer link.



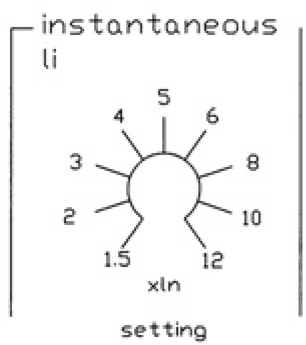


***The maximum instantaneous setting for new LX 600A frame breakers is 7**

TRIP ADJUSTMENT DIAL FOR M-FRAME, ET1.0



TRIP ADJUSTMENT DIAL FOR P- AND R-FRAME, ET1.0I

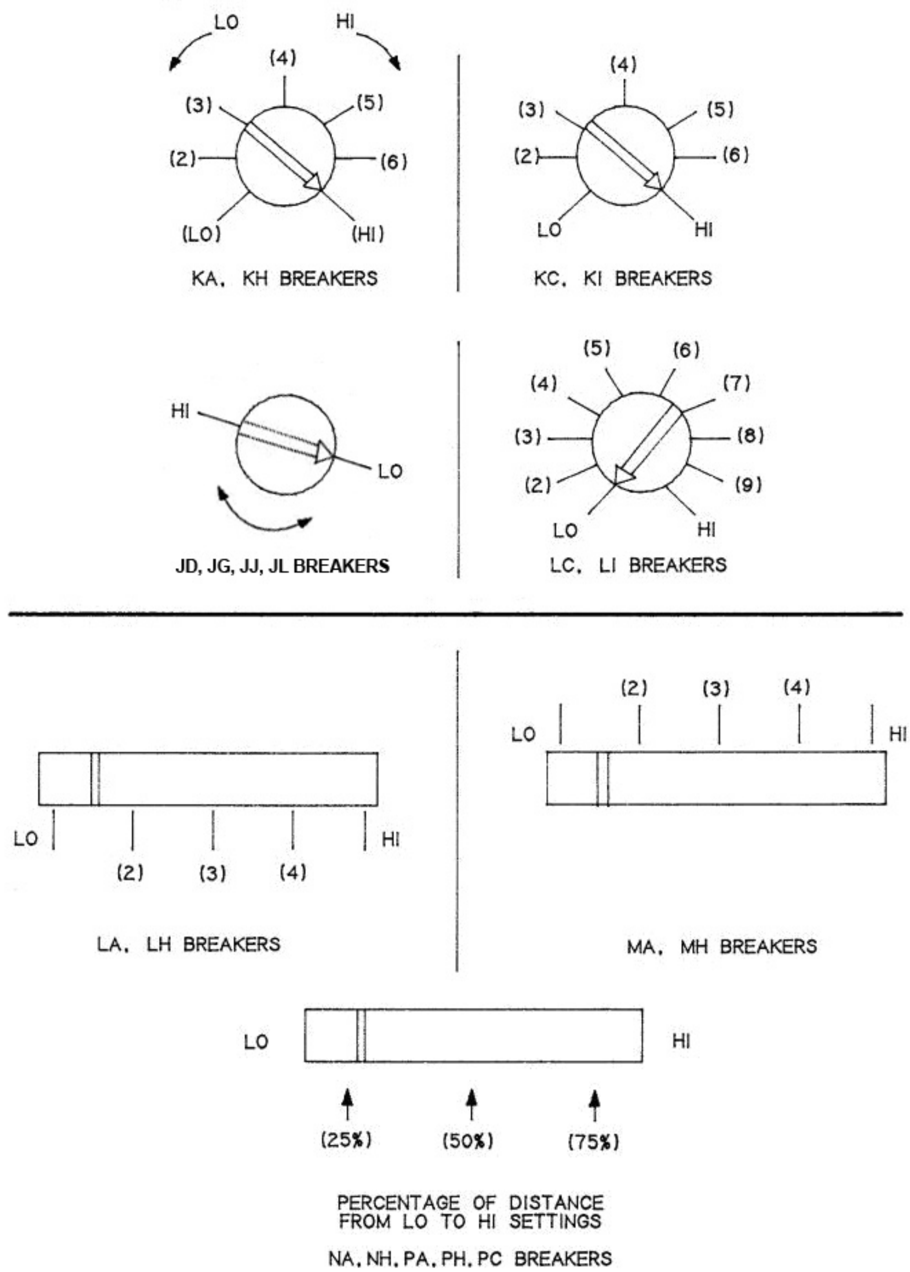


Notes

Ii = instantaneous setting

MOLDED CASE CIRCUIT BREAKERS

MAGNETIC (INSTANTANEOUS) TRIP ADJUSTMENT DIALS
(ON FRONT OF BREAKER)



NOTE: THE "LO" AND "HI" MARKINGS APPEAR ON THE DIAL FACES. THE MARKINGS IN PARENTHESES DO NOT.

SETTINGS SHOWN ARE FOR ILLUSTRATION ONLY

SAWS LEON CREEK 08312010.469
C:\DOCUMENTS AND SETTINGS\ALL USERS\DOCUMENTS\GE POWER MANAGEMENT\469PC
DEVICE DEFINITION
ORDER CODE: 469
VERSION: 5.1X
SERIAL NUMBER: (NONE)
DESCRIPTION: BLOWER MOTOR
TEXT COLOR

---

469 SETUP

PREFERENCES

Default Message Cycle Time	2.0 s
Default Message Timeout	300 s
Average Motor Load Calculation Period	15 min
Temperature Display Units	Celsius
Trace Memory Trigger Position	25 %
Trace Memory Buffers	8 x 28 cycles
Display Update Interval	0.4 s
Motor Load Filter Interval	0 cycles

MESSAGE SCRATCHPAD

First Scratchpad Message	
Second Scratchpad Message	
Third Scratchpad Message	
Fourth Scratchpad Message	
Fifth Scratchpad Message	

COMMUNICATION

Ethernet Subnet Mask	255.255.255. 0
DeviceNet MAC ID	1
DeviceNet Baud Rate	125 kbps
Front RS232 baud rate	19200 baud
Slave Address	254
Computer RS485 Baud Rate	9600 baud
Computer RS485 Parity	None
Auxiliary RS485 Baud Rate	9600 baud
Auxiliary RS485 Parity	None

SYSTEM SETUP

CURRENT SENSING

Phase CT Primary	250 A
Motor Full Load Amps	109 A
Ground CT Type	5 A Secondary
Ground CT Primary	50 A
Phase Differential CT Type	None

VOLTAGE SENSING

VoltageTransformer Connection Type	Wye
Voltage Transformer Ratio	35.00 :1
Motor Nameplate Voltage	4160 V

POWER SYSTEM

Nominal System Frequency	60 Hz
System Phase Sequence	ABC

REDUCED VOLTAGE

Reduced Voltage Starting	On/Yes
Control Relays for Reduced Voltage Starting	Auxiliary 2
Transition On	Current Only
Reduced Voltage Start Level	120 % FLA
Reduced Voltage Start Timer	30 s
Incomplete Sequence Trip Relays	Trip

DIGITAL INPUTS

STARTER

Starter Status Switch	Start Aux b

OUTPUT RELAYS

TRIP RELAY

Force R1 Operate Time	0 s

ALARM RELAY

Force R4 Operate Time	0 s

AUX RELAY 2

Force R2 Output Operate Time	0 s

AUX RELAY 3

Force R3 Operate Time	0 s

SAWS LEON CREEK 08312010.469
C:\DOCUMENTS AND SETTINGS\ALL USERS\DOCUMENTS\GE POWER MANAGEMENT\469PC
DEVICE DEFINITION
ORDER CODE: 469
VERSION: 5.1X
SERIAL NUMBER: (NONE)
DESCRIPTION: BLOWER MOTOR
TEXT COLOR

BLOCK START RELAY

Force R5 Operate Time	0 s

PROTECTION

THERMAL MODEL

469 THERMAL MODEL

Curve Style	Standard
Overload Pickup Level	1.15 FLA
Cool Time Constant Running	15 min
Cool Time Constant Stopped	30 min
Hot/Cold Safe Stall Ratio	1.00
Thermal Capacity Alarm Relays	Alarm
Thermal Capacity Alarm Level	75 % used
Overload Trip Relays	Trip

OVERLOAD CURVE

Standard Overload Curve Number	2

MECHANICAL JAM

Mechanical Jam Trip	Latched
Mechanical Jam Trip Relays	Trip
Mechanical Jam Pickup	2.50 xFLA
Mechanical Jam Delay	5 s

UNDERCURRENT

Block Undercurrent from Start	0 s

CURRENT UNBALANCE

Current Unbalance Alarm	Unlatched
Current Unbalance Alarm Relays	Alarm
Current Unbalance Alarm Pickup	15 %
Current Unbalance Alarm Delay	5 s
Current Unbalance Alarm Events	On/Yes
Current Unbalance Trip	Latched
Current Unbalance Trip Relays	Trip
Current Unbalance Trip Pickup	20 %
Current Unbalance Trip Delay	10 s

GROUND FAULT

Ground Fault Trip	Latched
Ground Fault Trip Relays	Trip
Ground Fault Trip Pickup	0.30 CT
Intentional GF Trip Delay	10 ms

JOGGING BLOCK

Jogging Block	On/Yes
Maximum Starts/Hour Permissible	3
Time Between Starts	10 min

RTD TEMPERATURE

RTD TYPES

Stator RTD Type	100 Ohm Platinum
Bearing RTD Type	100 Ohm Platinum
Ambient RTD Type	100 Ohm Platinum
Other RTD Type	100 Ohm Platinum

RTD #1

RTD #1 Application	None

RTD #2

RTD #2 Application	Stator
RTD #2 Name	

RTD #3

RTD #3 Application	Stator
RTD #3 Name	

RTD #4

RTD #4 Application	None

RTD #5

SAWS LEON CREEK 08312010.469
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DEVICE DEFINITION
ORDER CODE: 469
VERSION: 5.1X
SERIAL NUMBER: (NONE)
DESCRIPTION: BLOWER MOTOR
TEXT COLOR

RTD #5 (continued from last page)

RTD #5 Application	Stator
RTD #5 Name	

RTD #6

RTD #6 Application	Stator
RTD #6 Name	

RTD #7

RTD #7 Application	Bearing
RTD #7 Name	

RTD #8

RTD #8 Application	Bearing
RTD #8 Name	

RTD #9

RTD #9 Application	Bearing
RTD #9 Name	

RTD #10

RTD #10 Application	Bearing
RTD #10 Name	

RTD #11

RTD #11 Application	Other
RTD #11 Name	

RTD #12

RTD #12 Application	Ambient
RTD #12 Name	

POWER ELEMENTS

POWER FACTOR

Block Power Factor Element from Start	1 s

REACTIVE POWER

Block kvar Element from Start	1 s

UNDERPOWER

Block Underpower From Start	0 s

REVERSE POWER

Block Reverse Power From Start	0 s

TORQUE SETUP

Stator Resistance	0.004 mOhm
Pole Pairs	2
Torque Unit	Newton-meter

OVERTORQUE SETUP

Overtorque Alarm Relays	Alarm
Overtorque Alarm Level	4000.0 Nm
Overtorque Alarm Delay	1.0 s

CURRENT DEMAND

Current Demand Period	15 min

KW DEMAND

kW Demand Period	15 min

KVAR DEMAND

kvar Demand Period	15 min

KVA DEMAND

kVA Demand Period	15 min

ANALOG OUTPUTS

Analog Output 1 Selection	None
Analog Output 2 Selection	None
Analog Output 3 Selection	None

SAWS LEON CREEK 08312010.469
C:\DOCUMENTS AND SETTINGS\ALL USERS\DOCUMENTS\GE POWER MANAGEMENT\469PC
DEVICE DEFINITION
ORDER CODE: 469
VERSION: 5.1X
SERIAL NUMBER: (NONE)
DESCRIPTION: BLOWER MOTOR
TEXT COLOR

ANALOG OUTPUTS (continued from last page)

Analog Output 4 Selection	None

TWO SPEED MOTOR

SPEED 2 OVERLOAD

Speed2 Standard Overload Curve Number	4

SPEED 2 UNDERCURRENT

Block Speed2 Undercurrent from Start	0 s
Speed2 Undercurrent Alarm Pickup	0.70 FLA
Speed2 Undercurrent Alarm Delay	1 s
Speed2 Undercurrent Trip Pickup	0.70 FLA
Speed2 Undercurrent Trip Delay	1 s

SPEED 2 ACCELERATION

Speed2 Acceleration Timer From Start	10.0 s
Acceleration Timer From Speed One to Two	10.0 s

APPENDIX E: SYSTEM STUDY ONE-LINE DIAGRAMS

NOTES:

1) SCA – MAXIMUM AVAILABLE THREE–PHASE RMS SYMMETRICAL SHORT–CIRCUIT AMPERES.
2) ▭ – BUS IDENTIFICATION NUMBER USED BY COMPUTER PROGRAM WHEN PERFORMING SHORT–CIRCUIT ANALYSIS.
3) ⬡ – DEVICE IDENTIFICATION NUMBER USED BY COMPUTER PROGRAM WHEN PERFORMING TIME–CURRENT COORDINATION ANALYSIS.
4) ALL LOW–VOLTAGE CABLES WERE CONSIDERED TO BE TYPE THHN, SINGLE CONDUCTOR COPPER, RUN IN STEEL CONDUIT, UNLESS OTHERWISE NOTED.
5) ALL DEVICES WERE CONSIDERED TO BE THREE–POLE UNLESS OTHERWISE NOTED.
6) AF DENOTES AMPERE FRAME RATING
AS DENOTES AMPERE SENSOR RATING
AP DENOTES AMPERE PLUG RATING
AT DENOTES AMPERE TRIP RATING
7) L DENOTES LONG TIME FUNCTION
S DENOTES SHORT TIME FUNCTION
I DENOTES INSTANTANEOUS FUNCTION
G DENOTES GROUND FUNCTION
8) KVAm – CONNECTED MOTOR KVA USED FOR FAULT CALCULATIONS (1 HP = 1 KVAm).
9) (TCC#) TIME–CURRENT CURVE SERIES CIRCUITS ILLUSTRATED IN REPORT.
10) (*) – DENOTES ASSUMED INFORMATION.

REV. LEVEL	DATE	DESCRIPTION	DRAWN	CHKD.
5				
4				
3				
2	07/12/11		BMH	SM
1	06/17/11		BMH	SM
-	01/24/11		HEH	SM

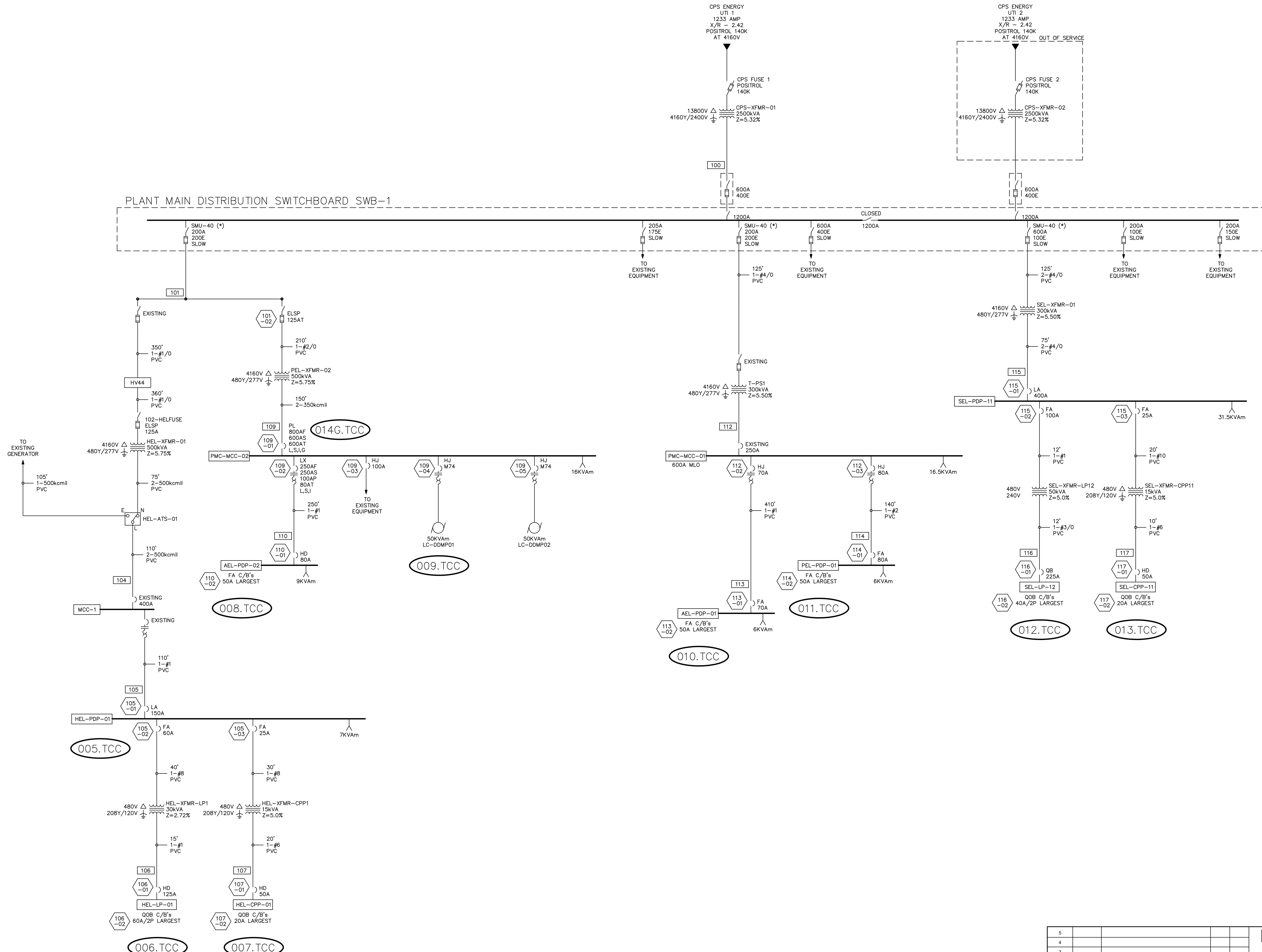
SQUARE D by Schneider Electric

Square D
Engineering Services
SUITE B–325
2365 HARRODSBURG ROAD
LEXINGTON, KENTUCKY 40504

TITLE: SAWS LEON CREEK WRC, SAN ANTONIO, TX

ONE - LINE DIAGRAM — SCALE: NTS

DWG. NO. D-ML-10-660-1



REV. LEVEL	DATE	DESCRIPTION	DRAWN	CHKD.
5				
4				
3				
2	07/12/11		BMH	SM
1	06/17/11		BMH	SM
-	01/24/11		HEH	SM

SQUARE D by Schneider Electric

Square D
Engineering Services
SUITE B-325
2365 HARRODSBURG ROAD
LEXINGTON, KENTUCKY 40504

TITLE
SAWS LEON CREEK WRC
SAN ANTONIO, TX

ONE - LINE DIAGRAM
SCALE NTS
DWG. NO. D-ML-10-660-2