Cal Poly Power System Design & Analysis

Senior Project
2011

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Abstract

This scope of this project encompasses the design and analysis of the Cal Poly Power System at the distribution level using the SKM software environment. The purpose is to accurately model the power system in software so theoretical calculations and analysis can be executed. This requires sufficient preliminary research to obtain data for the main buildings on campus, sound interpretation of one line diagrams, designing the system within the software using realistic values and then performing analysis to model real world situations. The data collected is under maximum load conditions for a specified time period using medium voltage parameters. The analysis performed includes load flow, fault analysis (short circuit) and an arc flash study. Using this data facilities personnel can implement future protective devices in vulnerable areas of the power system, recognize and alleviate large load conditions using generators or alternative energy solutions, wear proper personal protective equipment (PPE), and analyze the impact of adding or removing machines or cables from the system. After the completion of this project I learned about typical power system design and protection schemes used to isolate faults. Troubleshooting a large power system is another important skill I developed from this endeavor. Additionally, this project has provided me with real world knowledge regarding power system devices like transformers, and allowed me to learn a new powerful software tool used in industry today.

Introduction

The systems involved with supplying power to society are broad and complex, and are broken down into subcategories including generation, transmission and distribution. For this project, the focus is on the design of a power system at the distribution level. When building a power system, some main considerations are efficiency, reliability, cost and safety. Implementing a power system in a software environment enables engineers to address all of these parameters that define the success of a power distribution system. For efficiency, a Load Flow analysis can be done to gauge how much power each load is using and if adding an extra transformer or substation is both economical and cost efficient. In regards to safety, an Arc Flash study can be conducted to provide data that correlates to what suitable PPE technicians should where when working on equipment. Using Fault Analysis, the issue of reliability can be easily addressed and resolved in regards to future power failures and disturbances. Reliability is a major concern for power systems, and entails how a system responds to unexpected disruptions and how long it takes to alleviate these issues. Without an adequately designed power system that strongly considers reliability, buildings and whole sections of a system can be without power for extended periods of time. Considering the importance of power to hospitals and individuals on life support, power is not only necessary but essential to our lives.

Background

In order to understand and appreciate a power system, basic terminologies and concepts must be defined. Fault analysis is a critical tool that power engineers use to address the reliability of power systems. A fault is defined as a short circuit that occurs when equipment insulation or mechanical parts fail. Some typical sources of faults are lightening strikes, momentary tree contact or a natural cause. These faults can cause currents to form that are several orders of magnitude larger than normal operating currents and cause thermal damage to equipment. There are two major classes of faults: symmetrical and asymmetrical. Symmetrical faults are when all three phases of the transmission line are affected equally. These rarely occur in nature. Asymmetrical faults are far more common and encompass line to line, single line to ground, and double line to ground faults. This project will provide data for these faults, and help give a better understanding of the reliability of the Cal Poly power system.

An arc flash is an electrical explosion that results from a low impedance connection to ground. This is important for the safety of electricians and equipment. An electrical technical can inadvertently provide a low impedance path to ground and cause an arc flash in the vicinity. Extremely high temperature, pressure, and intense light in the form of an explosion can result in serious injury or death. SKM software can provide suggestions based on gathered data using an Arc Flash study on what proper PPE to wear and how long it takes to clear an arc flash occurrence.

Load flow is how power is distributed with a power system. As will be shown in this project, understanding how power is used in the power system can provide engineers with alternatives to help prevent overloading. For example, with the construction and implementation of new structures and buildings within the Cal Poly campus, such as Poly Canyon Village, additional transformers were implemented to help alleviate the added load on pre-existing equipment.

Materials and Requirements

The major requirement of this senior project is to accurately model the Cal Poly Power System. Since this is purely a design project, the materials consist of elements within the SKM software environment. Those elements used in the design and their quantities are listed below:

- **Buses:** 111
- **Transformers:** 89
- **Static Loads:** 85
- **Cables:** 55
- **Utility:** 1 (PG&E)
- **Switches:** 17

Additional materials used consisted of various one-line diagrams to get a more accurate picture of the power system layout.

Research

Preliminary research needed to complete this project required acquisition of extensive data from the faculties department. Using the facilities database, every metered building was queried for load values in kilowatts. Cal Poly meters the demand of every building and records it within a database every fifteen minutes. Since the purposes of this project was to obtain a worst case scenario, the largest value within the specified time period of Fall 2010 quarter was used to represent each load. To be more specific, the dates queried were September 20, 2010 through December 10, 2010. Please refer to the Appendix "Maximum Load and Transformer Data" for the excel sheet. Some of the campus is left unmetered, and mainly concerns buildings on the "Feeder Z." The campus is sectionalized by Feeders S, T, V, W and Z. Unfortunately Feeder Z contains loads that are not metered, and are therefore left out of my design.

Impedances and other cable data were also obtained through the facilities database. The database provided the length and size of each cable, while other remaining data was applied using the SKM library. This library will be discussed in further detail within the "Design and Construction" section.

The campus periodically performs arc flash studies for reliability and safety. The excel sheets generated from these studies provided impedance values for transformers as a percentage. These impedance values were read by trained personnel directly from nameplates on the transformers. Additional data including KVA ratings and turns ratios were obtained from one line diagrams. The transformer data is for only the medium and high voltage transformers. Low voltage transformers were excluded from the design to reduce complexity and overcrowding.

Some transformers on the diagrams are rated for two values. For example, the Agriculture Science Bldg 11 has the two ratings 500/667 kVA. This is because a fan can be turned on to assist

the transformer in dissipating heat more efficiently and therefore operating at a higher power. The appropriate ratings was used depending on what is more typical of the transformer at the given load condition. Since I are interested in max loads, usually the fan assisted ratings are used. Also, some building in the design will show multiple transformers, but the facilities database only generates one value for the load. To maintain accuracy, I allocated a percentage of the load to each transformer based on the KVA rating of the transformer. The larger the transformer the greater percentage of load it was assigned.

Sierra Madre has a co-generator which helps alleviate the load conditions of the building. This is why the value used to represent this load is negative, implying it is supplying power to the system rather than consuming it.

Throughout the project data was continuously verified to maintain accuracy. Cable and transformer values that were not found in the database were verified in the field by facilities personnel. Once the majority of the data was accumulated in excel sheets the design could be implemented.

Design and Construction

After the necessary data was acquired, the next phase of the project was design and implementation of the power system. Initially, the design was going to utilize software called PowerWorld. Since the design was at the distribution level, I found it more suitable to use ETAP. However, the school had access to only a student version of this software which was limited to 20 buses. Since this power system needs over 100 buses, this software would not suffice. SKM supplied Cal Poly with a fully licensed version to their software with few limitations and up to 200 buses. SKM has a very similar user interface as ETAP, allowing for quick connections and shortcuts that decrease design time dramatically in comparison to PowerWorld. I taught myself how to use this software by studying tutorials and videos found online at http://www.skm.com/af.shtml. The software is fairly intuitive so even beginners will find it easy to pick up the basics.

In order for facilities personnel to easily identify particular segments of the power system within SKM, the overall layout was similar to various one line diagrams. The design is segmented into "Main Buildings," "Poly Canyon," "Cerro Vista," and "Dormitories." The utility (PG&E) comes into the system at 70kV. Two transformers separately drop down the voltage to 12.47kV and are applied to the "upper substation" and "middle substation." The upper substation feeds the main buildings. The middle substation feeds Poly Canyon directly, but is also connected to the "lower substation" via a transformer that drops the 12.47kV to 4.16kV. The lower substation goes on to feed Cerro Vista and the Dormitories.

It is important to understand why there are two transformers to drop down the voltage from 70kV to 12.47kV. In the past, there was only the transformer "XF2-0076." This transformer is about 20 years old, and with the building of Poly Canyon may not be able to handle the increased load. To

alleviate the burden on this transformer, a new transformer "XF2-0079" was implemented. The old transformer alone would be able to handle Poly Canyon, but it would operate too close to its limit under normal conditions. A general rule is to operate away from 10 kVA because when large spikes occur the transformer will overheat and potentially blow up.

Each load is attached to a transformer through a bus and then to a switch, which is also represented as a bus. For each bus, I needed to use the correct voltage for the turns ratio of each transformer. Typical values are 208/120 V and 480/277 V. Since three phase power can be phase or line to line, it is important to maintain consistency on voltage type. I used voltage line to line, meaning from phase to phase instead of phase to neutral. Many of the connections on the secondary side (load side) are Y connected with a Delta connection on the primary side. Refer to the diagram below showing the Y connection of a typical transformer on the secondary side:

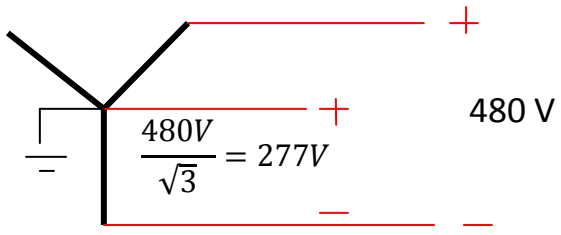

Figure 1: Secondary Y side connection

The 480V would be used in this case, but there are also 208/120 V turn transformers which would utilize $208V_{L\text{-}L}$.

SKM has the option to use a library to find typical values of standard cables. The data that was consistent within all cables in the system were as follows:

- **Insulation:** EPR
- **Installation:** Duct

- **Duct Material:** non magnetic, PVC
- **Voltage:** 15kV
- **Application:** 3 phase

The library specified the above information, while length and size varied per cable. Please refer to the Appendix section, "Cable Data" for the excel spreadsheet. Libraries were also useful for transformers, where impedance values could be estimated by SKM based on the following parameters: Oil Air, Forced Air or Dry. This was necessary when new transformer nameplates were not yet verified in the field.

A useful feature when designing large systems is to indicated whether elements are "incomplete/complete" and "in service/out of service." When I was building the power system some data would be missing for particular elements. I would specify "incomplete" to remember to go back after I acquire the data. Changing the view to "data state color" would turn all incomplete elements green. Also, changing a device to "in service" or "out of service" was not only useful in building normally open (N.O) switches, but also in troubleshooting the power system. Once the layout in SKM was done the analysis could be started. Errors in the design will become apparent during the analysis and will be addressed in the following section.

Analysis

There are three types of analysis performed on the power system: load flow, short circuit (fault) and arc flash. This was done by first selecting "balanced system studies" and then specifying demand load, load flow and short circuit. SKM then ran the studies and notified me of warnings and errors. The final study performed for this project generated zero errors and zero warnings. It is important to note that this by no means indicates whether the system is constructed correctly. It is more of an indicator of correct syntax. After the study was complete, selecting "data block format" and choosing "load flow," "bus fault currents (comprehensive)" and "arc flash" shows the data right on the one line diagram. This is especially helpful for troubleshooting purposes as will be discussed later. SKM also generates "crystal reports" which conveniently organizes particular data in report form. Please refer to the Appendix "Load Flow Data," "Fault Data," and "Arc Flash Data" for the crystal reports.

During analysis generating load flow data block format directly on the one line diagram helped me analyze error in the design. There was 100% voltage drop from the PG&E utility bus which was obviously incorrect. Having designed the whole power system before testing each segment made it much more difficult to find the source of the error. This was a good learning experience, and next time I will test as I build to save time in the long run. In order to find the source of the error, I had to isolate different parts of the power system to find out what was working, and what wasn't. Initially switch PD-0014 and PD-0013 were used to isolate the main buildings off the upper substation from the dormitories, Cerro Vista and Poly Canyon off the middle and lower substations. I made the PD-0014 out of service to disconnect the upper substation and found that the power system was functioning properly. So immediately I knew that there was an issue with the elements off of the upper substation. I continued to add switches to the system to slowly narrow down the

source of error. I finally isolated the error to S045-14-A bus and found that I inadvertently selected 144 MW instead of kW. I selected to leave in switches for future use. If an individual wants to troubleshoot a particular portion of the power system it is much easier to open strategically placed switches to perform analysis. This will disconnect particular loads and allow for isolation of the system.

There are multiple normally open switches (N.O) in the power system which allow for redundancy. Normally open switches sectionalize segments of the power system to isolate power outages caused by short circuit faults. Every switch has fault current indicators (FCI) that signals if a fault current was seen after breakers open. If so, the Supervisory Control And Data Acquisition (SCADA) is notified which locates the fault occurrence by analyzing all the FCI inputs in the power system. Once this has occurred, the SCADA opens and closes necessary switches to sectionalize the fault occurrence, allowing power to flow to black out areas. Next, electrical personal are notified to fix the fault occurrence. This differs from the utility companies that normally utilize automatic reclosers to continually reclose a breaker after a fault has occurred. Usually, after 10 seconds a fault will be cleared so simply reclosing the breaker works. Sometimes, the fault doesn't clear after multiple tries and has to be locked out and employee personnel sent to location of fault. An example of how the power system will respond to a particular fault will be explained in the "Results" section.

Results

The power system has an error that is creating skewed results. The possible sources of error and the results are explained below. The full data reports can be found in the appendix.

Load Flow

The most important data regarding Load Flow analysis concerns voltage drop across the buses. SKM calculates a percentage voltage drop, which is done by dividing "Design" volts by "LF." The voltage drops in the system varied from 3.97% to 17.49%. The lowest voltage drop was across the PG&E bus, which is acceptable given the bus is 70kV and a drop of 3kV is insignificant. The highest voltage drop came at the bus feeding the "Dining Complex" building 019. The typical voltage drops in a power system should remain below 5%, indicating my power system has an error. The reason that large voltage drops can be attributed to the large demand from the loads which are overloading the transformers. The large main transformers feeding off of the PG&E to the main buildings has an 8.3% voltage drop, indicating that the transformer is being overloaded. Considering this is the worst case scenario, large voltage drops and losses in the lines are not too surprising. In reality, it is highly unlikely that all the loads will be at peak usage at the same time. Therefore, the power system may in actuality be error free, but there is no way to be one hundred percent certain. Load Flow also displays results for the cables. The kW lost in these cables are extremely high. The source of this error remains unknown. The transformer voltage drops are reasonable and vary depending on the size. Transformers which have large kVA ratings tend to have greater loss, especially if they are being overloaded by large loads.

Fault Analysis

The reports show symmetrical and asymmetrical fault occurrences. Since asymmetrical faults are most common they are examined more closely. Poly Canyon has the largest short circuit currents at 77kA for three phase and 83kA for single line to ground. It is important to understand how the system would respond to a fault of this magnitude in real life.

First, whenever a fault is detected the breaker trips to protect from overcurrent. Next, the SCADA identifies the fault and isolates it by tripping the appropriate switches and then reclosing the breaker to allow for power to flow to the buildings. For example, let's consider a fault at Poly Canyon at "Estrella Building 171E." Although the one line shows three buildings attached to switch "S171-16-B," there are actually individual breakers for each building going to each transformer separately. In the situation of a fault on the secondary side of the transformer, the breaker for that building would trip. There is no alternative path to supply power to the building once this breaker trips, and therefore the fault must be alleviated by manually fixing it to bring power to the building. Let's consider another example of a fault at Poly Canyon, but this time on the main line "T07." First the breaker would trip (modeled by PD-007) which would effectively remove power to switches "S171-16-C" and "S171-16-B." Then SCADA will try to isolate the source of the fault, and hopefully realize the source is "T07." After this, SCADA will isolate the fault by removing the switches (not shown on the one line) on the left and right end of "T07." Once this is verified, then SCADA will reclose breaker PD-007 effectively providing power to switch "S171-16-C" and close "N.O 7" which will provide power to switch "S171-16-B."

Arc Flash Study

Switches are the only protective devices in the system. Therefore, the arc flash study is broad without specifics. The Bolted and Arcing Fault currents read as high as 20kA. Trip delay time of 2 seconds is calculated for all buses. The most important results taken from this study is SKM's recommended personal protective equipment (PPE) for the safety for electricians. A warning label can be printed for each transformer with suggested precautions such as working distance, attire and equipment. Each label displays the danger category of each transformer based on IEEE standards.

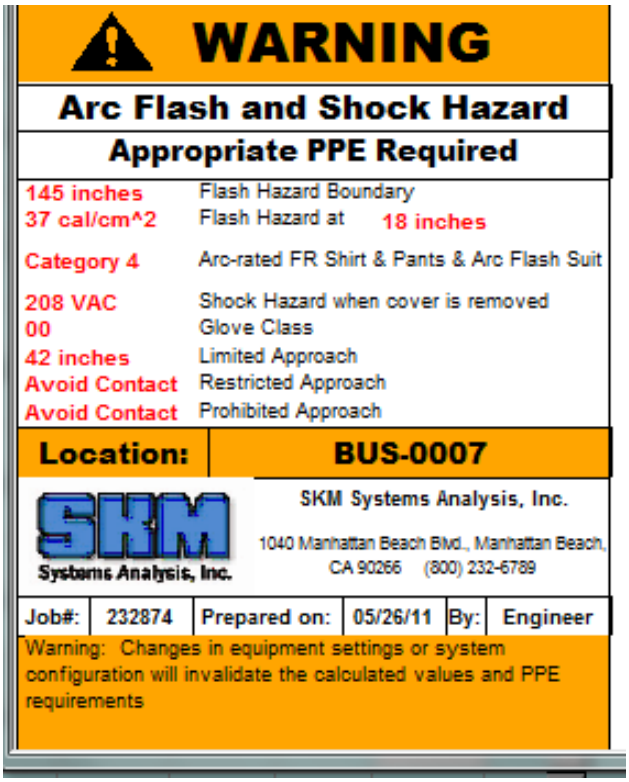

Figure 2: Custom Warning Label

Conclusion

In this project a majority of my effort was spent designing the Cal Poly System in an accurate and efficient manner. This required ample research, a sound understanding and interpretation of one line diagrams, and knowledge on how to design within the SKM software environment. Although there are still some errors skewing the final results, the experience proved to be both informative and educational. It is not surprising that the load flow results show large voltage drops given the high demand from the system. While the large cable losses are still present, I believe the design in SKM accurately represents the Cal Poly Power System to the best of my abilities. There is much room for improvement and modifications to the system which will be further explained in the "Future Work" section. The most important skills that I learned from the completion of this project was how to analyze one line diagrams and use SKM to model large power systems. These tools can be easily transferred over to the job field when working with utilities or building distributions systems for campuses.

Future Work

I believe my work can be used as a stepping stone for future work conducted on the Cal Poly Power System. Since all the data and design is already complete, a student can build off of the design to integrate alternative energy sources, protective devices or countless other theoretical modifications. Additionally, the software can be used as a teaching tool in power system courses. Students can perform hand calculations on particular segments of the power system and then use the software to verify their results. Now that the basic structure of the Cal Poly Power System is within a manageable software program, the possibilities for future work are vast.

Citations

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Appendix A

Maximum Load Conditions

Data Collection: Fall 2010 (Sept. 20 - Dec. 10)

Building	Power (kW)	Date	Time	Transformer		
				Rating (kVA)	Turns (V)	Z (%)
Main Buildings (Primary 12470V)						
Dinning Complex - 019	296	28-Sep	12:09	500	208Y/120	6.05
Eng. South Central - 040	1059	28-Sep	12:39	2000	480Y/277	5.96
Tennis Courts/Pool	104	18-Nov	18:05	300	480Y/277	5.1
Physical Ed./Mott - 042	172	20-Sep	10:02	300	208Y/120	5.2
Parking Structure - 130	87	18-Nov	19:35	225	480Y/277	4.7
Street Lighting	-	-	-	-	-	-
Davidson Music - 045	144	3-Dec	12:29	500	208Y/120	5.5
Performing Arts A - 006	88	10-Dec	20:30	1333	208Y/120	5.74
Performing Arts B- 006	88	10-Dec	20:30	1333	480Y/277	5.62
Performing Arts C- 006	175	10-Dec	20:30	2000	480Y/277	5.72
University Union - 065	367	14-Oct	11:25	1000	208Y/120	5.8
Admin/Faculty (East) - 025	216	29-Nov	11:41	1000	480Y/120	5.37
Computer Science N - 014	36	27-Sep	14:08	750	480	5.7
Computer Science - 014	49	27-Sep	14:08	1000	208Y/120	5.82
Graphic Arts - 026	194	2-Nov	14:10	750	208Y/120	6.08
Engineering West A- 021	243	30-Nov	16:57	750	480Y/277	5.26
Engineering West B- 021	41	13-Oct	13:55	225	208Y/120	4.9
Health Center - 027	30	30-Nov	10:12	225	208Y/120	O.A 5
Health Center - 027	79	29-Sep	15:24	300	208Y/120	6.09
President's Residence - 051	27	17-Nov	22:50	112.5	208Y/120	5.1
Children's Center - 133	62	29-Sep	16:24	112.5	208Y/120	4.9
Rec. Center Offices - 043	233	28-Sep	10:08	1500	480Y/277	Dry 5.75
Student Services - 124	87	3-Nov	14:40	300	480Y/277	5.3
Chase Hall/Trailers - 115	17	30-Nov	11:12	75	480Y/277	3
Mustang Stad. (West) - 061	302	27-Oct	18:51	750	208Y/120	5.68
Mustang Stad. (East) - -061	41	10-Nov	9:29	300	208Y/120	6.08
ATL - 007	102	4-Nov	13:11	750	480/277	5.18
Engineering III - 041	160	-	-	1125	277/480	5.59
Agriculture Eng. - 008	103	29-Sep	12:54	300	208Y/120	4.61

Food Processing - 024	154	28-Sep	13:54	300	208Y/120	5.2
Farm Shop - 009	36	24-Sep	6:19	150	208Y/120	5.1
Agriculture Science - 011	154	28-Sep	15:24	500	208Y/120	5.21
Bonderson - 197	15	-	-	1000	480Y/277	5.5
Engineering IV - 192	618	28-Sep	13:24	2000	480Y/277	5.39
Engineering - 013	213	21-Oct	17:00	1000/1333	480Y/277	7.62
Kennedy Library A- 035	277	7-Dec	14:16	1000	480Y/277	6.1
Kennedy Library B- 035	139	7-Dec	14:16	500	480Y/277	6.2
Architecture/Environ. - 005	129	23-Nov	14:23	750	480Y/277	5.9
Dexter Building - 034	184	9-Nov	12:29	667	480Y/277	8.1
Math/Econ. Rm 112 - 038	111	27-Sep	14:38	225	208Y/120	6.06
Bus. Admin/ Education - 002	101	29-Nov	16:11	225	208Y/120	5.3
Bus. Admin/ Education - 003	278	29-Sep	12:09	1000	480Y/277	5.71
Fisher Science B- 033	109	21-Oct	15:30	500	480Y/277	4.63
Fisher Science A- 033	130	21-Oct	15:30	667	208Y/120	5.01
Science North - 053	182	27-Sep	15:23	666	480Y/277	5.86
Faculty (North)- 047, 015	141	27-Sep	14:38	500	208Y/120	5.34
English - 022	179	27-Sep	12:08	300	208Y/120	6.04
Welding Shop - 058	29	28-Sep	13:54	500	480Y/277	4.9
Public Safety - 074	17	15-Nov	14:00	150	208Y/120	5.1
Manufacturing Shop - 036	88	28-Sep	14:54	500	480Y/277	4.9
Agriculture Erhart - 010	54	13-Oct	12:09	112.5	208Y/120	5.2
Math/Econ. Rm 102 - 038	82	21-Oct	6:00	150	208Y/120	5.14
Engineering East B - 20	94	18-Nov	14:19	1000	480Y/277	5.28
Engineering East C - 20	28	18-Nov	14:19	300	208Y/120	6.03
Science Building - 052	137	19-Nov	9:35	750	480Y/277	5.63
Computer Sci North - 014	86	27-Sep	14:08	750	480V	5.7
Dairy Unit /Rodeo- 018	279	28-Sep	14:39	750	480Y/277	5.52
Dairy Unit A- 018	173	15-Oct	21:11	500	208Y/120	4.8
Dairy Unit F- 018	5	15-Oct	8:26	37.5	240/120	2.5
New Poultry - 150	84	10-Nov	14:15	500	208Y/120	4.26
Aero Unit - 004	62	6-Nov	14:57	500	480Y/277	3.8
Sports Complex Stad- 160	594	5-Nov	18:42	1500	480Y/277	5.65
Sports Complex Rest- 160	198	5-Nov	18:42	500	480Y/277	1.99
Dormitories (Primary 4160V)						
North Mountain - 101-104	40	29-Sep	2:24	225	480V	5.84
Santa Lucia - 106, 81, 31	146	27-Sep	13:53	225	208Y/120	7.24
Trinity Hall - 105	134	27-Sep	18:08	225	208Y/120	7.28
Sequoia Hall - 108	128	29-Sep	20:54	225	208Y/120	7.47
Muir Hall - 107	133	26-Sep	20:37	225	208Y/120	7.36
Teneya Hall - 110	107	1-Oct	13:40	225	208Y/120	7.47

Fremont Hall - 109	124	27-Sep	17:08	225	208Y/120	7.23
Sierra Madre/CoGen - 113	-206	28-Nov	10:26	500	208Y/120	4.59
Yosemite - 114, 134	227	21-Nov	16:51	225	208Y/120	3.1
Vista Grande Rest. - 112	126	2-Nov	12:25	500	480Y/277	7.69
Cerro Vista (Primary 4160V)						
Cerro Vista A - 170	100	-	-	500	208Y/120	O.A 5
Cerro Vista D- 170	100	-	-	500	208Y/120	O.A 5
Cerro Vista C- 170	200	-	-	1000	208Y/120	O.A 5
Poly Canyon (Primary 12470V)						
Village Parking - 271	79	3-Oct	19:27	1000	480Y/277	O.A 5
Canyon Parking - 371	92	7-Nov	23:28	300	480Y/277	O.A 5
Aliso - 171A	183	26-Sep	14:07	750	480Y/277	O.A 5
Gypsum - 171G	124	21-Oct	18:30	500	208Y/120	O.A 5
Huasna - 171H	148	4-Oct	18:42	750	208Y/120	O.A 5
Inyo - 171I	95	29-Sep	18:24	500	208Y/120	O.A 5
Buena Vista - 171B	154	1-Dec	19:58	500	208Y/120	O.A 5
Dover - 171D	78	18-Oct	18:43	500	208Y/120	O.A 5
Estrella - 171E	127	6-Dec	18:01	500	208Y/120	O.A 5
Foxen - 171F	79	12-Oct	19:39	500	208Y/120	O.A 5
Corralitos - 171C	163	1-Nov	18:54	500	208Y/120	O.A 5

Appendix B

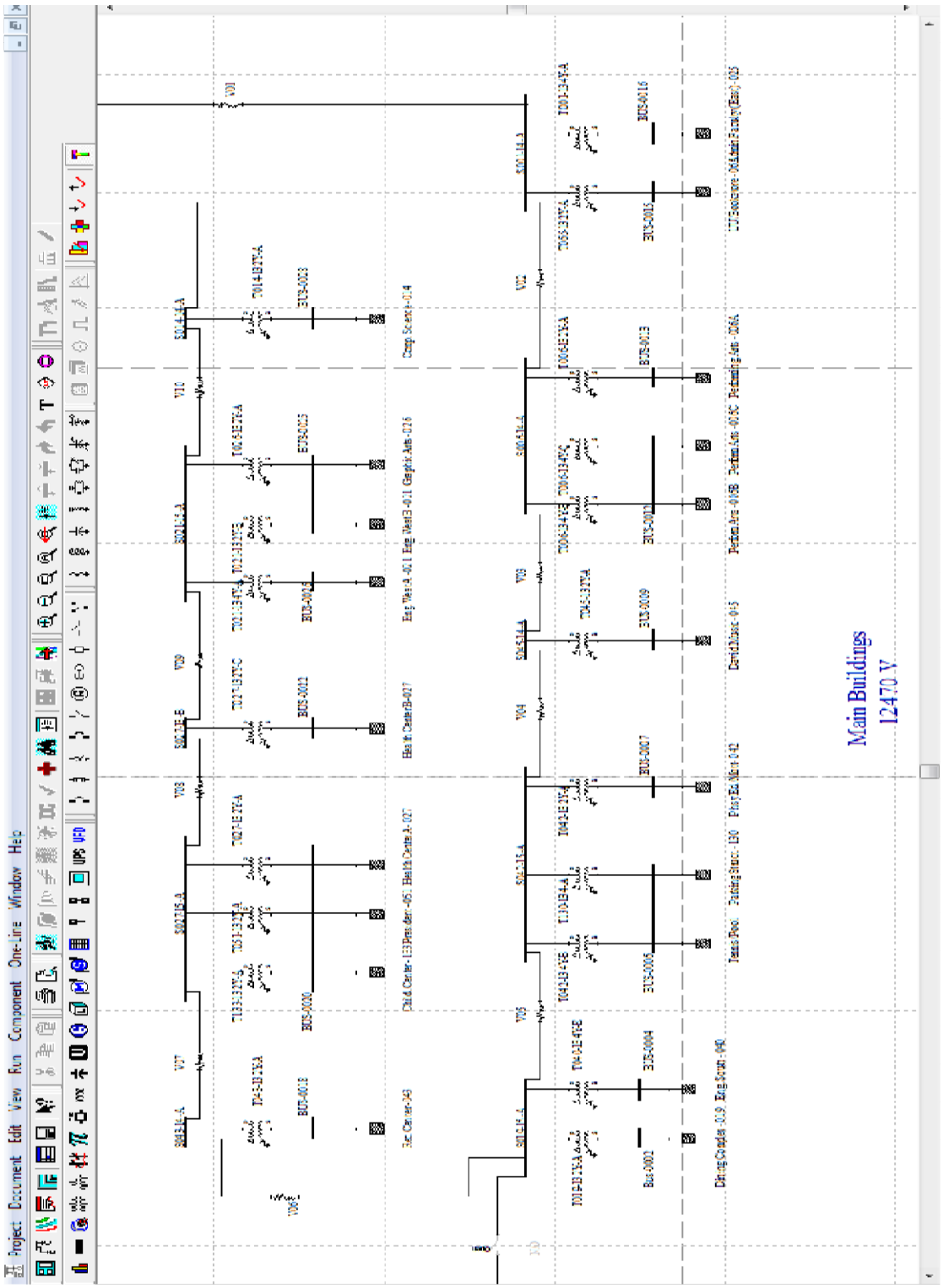
Cable Values

Typical Cable :	Insulation	Installation	Duct Material	Voltage (MV)	Application
	EPR	Duct	non-magnetic, PVC	15kV	3 phase

Cable Data:	From	To	Length (Ft)	Size (AWG/kcmil)	Conductors in Parallel/Phase
V05	S019-15-A	S042-15-A	800	350	1
V04	S042-15-A	S045-14-A	650	350	1
V03	S045-14-A	S006-14-A	700	350	1
V02	S006-14-A	S001-14-A	600	350	1
V06	S019-15-A	S043-14-A	825	350	1
V07	S043-14-A	S027-15-A	450	350	1
V08	S027-15-A	S027-13-B	1040	350	1
V09	S027-13-B	S021-15-A	550	350	1
V10	S021-15-A	S014-14-A	15	350	1
V12	S014-14-A	S124-15-A	360	350	1
V13	S124-15-A	S061-14-A	300	350	1
W15	S124-15-A	S002-14-A	520	350	1
W14	S002-14-A	S034-14-A	780	350	1
W13	S034-14-A	S035-14-A	420	350	1
W12	S035-14-A	S013-14-A	260	350	1
W11	S013-14-A	S011-13-A	420	350	1
W10	S011-13-A	S009-13-A	980	350	1
W09	S009-13-A	S008-15-A	240	350	1
W16	S013-14-A	S201-13-A	310	350	1
W08	S008-15-A	S038-15-A	465	350	1
W02	S033-13-A	S047-14-A	375	350	1
W03	S047-14-A	S022-14-A	255	350	1
W04	S022-14-A	S058-15-A	210	350	1
W05	S058-15-A	S038-15-A	500	350	1
W06	S038-15-A	S052-15-A	230	350	1
W07	S019-15-A	S052-15-A	210	350	1
D01,D02	S101-43-A	S106-45-A	1120	350	1

D03	S106-45-A	S108-44-A	640	350	1
D04	S108-44-A	S110-44-A	700	350	1
G03	S110-44-A	S113-44-A	680	350	1
G02	S113-44-A	S112-44-A	25	350	1
S05	S171-16-A	S171-16-B	960	350	1
T07	S171-16-B	S171-16-C	1140	4/O	1
Dorm Loop 1	S101-43-A	52-D	105	350	1
Dorm Loop 2	S112-44-A	52-G	1320	350	1
14P	-	-	260	2/O	1
Cerro Vista 4P	-	-	525	4/O	1
Cerro Vista 2P	-	-	380	4/O	1
Poly Canyon 1	S171-16-A	52-T	1270	350	1
Poly Canyon 2	S171-16-C	52-S	1365	350	1
V01	S001-14-A	52-V	880	350	1
To Upper-Sub	S033-13-A	52-W	545	350	1
Z09	-	-	260	350	1
Z10	-	-	260	350	1
Z07, Z06	-	-	60	350	1
Z02	-	-	425	350	1
Z01	S160-13-A	52-Z	1520	350	1
CBL-0047	-	-	80	350	1
CBL-0045	-	-	80	350	1
CBL-0044	-	-	200	4/O	1
CBL-0046	-	-	200	4/O	1
CBL-0048	-	-	120	750	2
CBL-0042	-	-	120	750	2

Appendix C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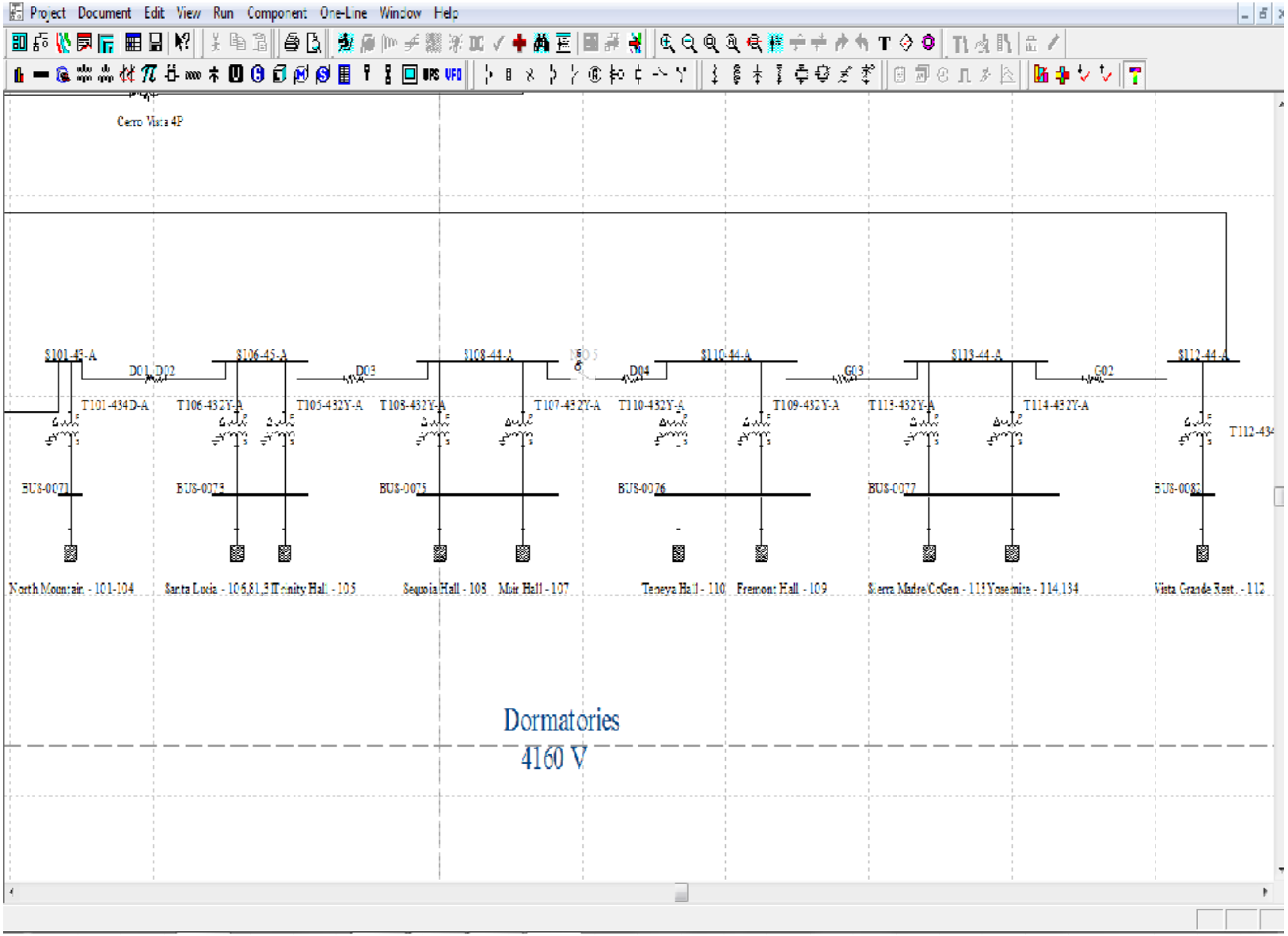
Main Buildings
12470 V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Cerro Vista 4P
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S106-45-A
S108-44-A
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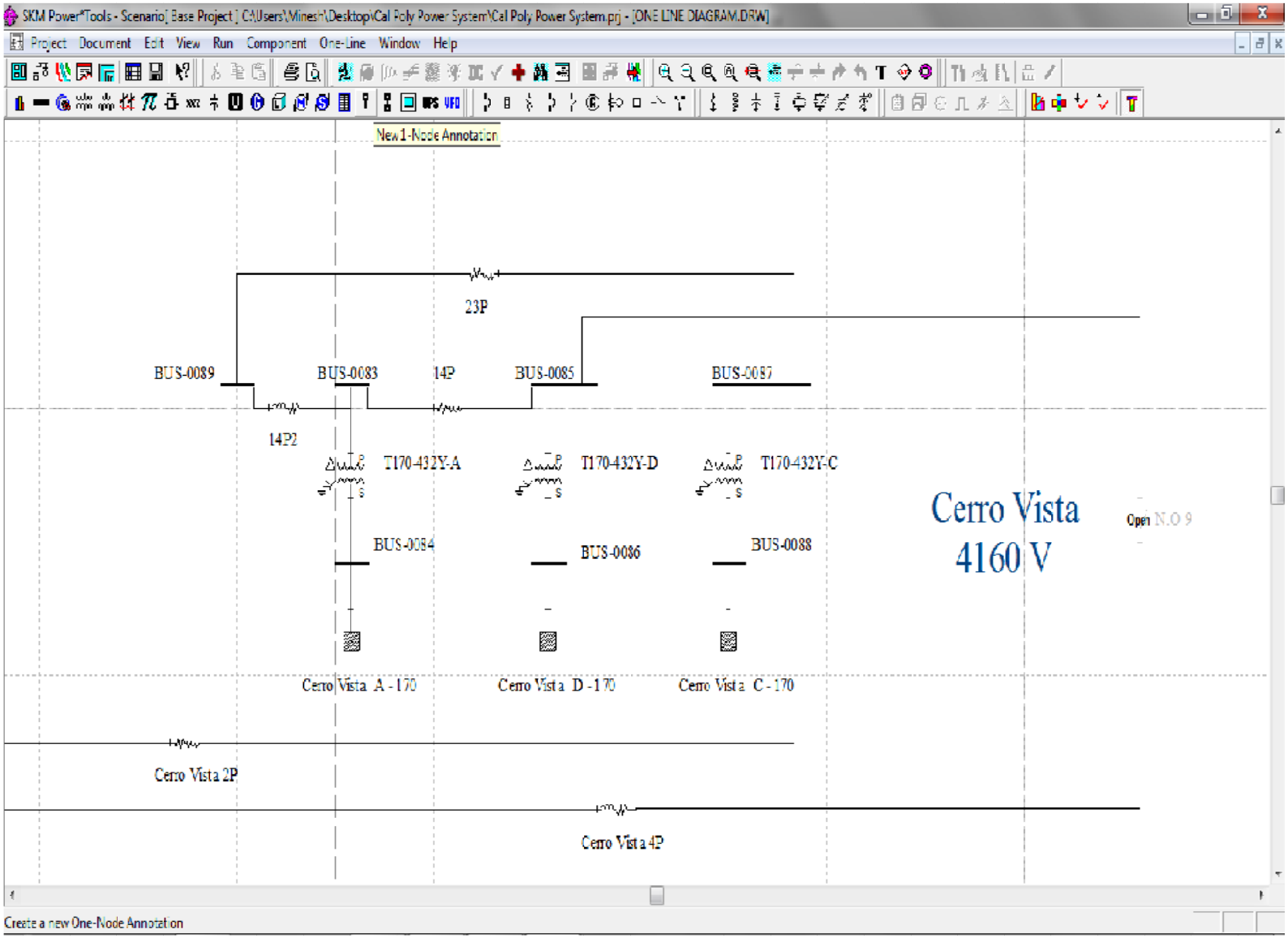
S112-44-A
D01 D02
D03
D04
G03
G02
T101-434D-A
T106-432Y-A
T105-432Y-A
T108-432Y-A
T107-432Y-A
T110-432Y-A
T109-432Y-A
T113-432Y-A
T114-432Y-A
T112-434
BUS-0071
BUS-0073
BUS-0075
BUS-0076
BUS-0077
BUS-0082
North Mountain - 101-104
Santa Lucia - 106,81,3 Trinity Hall - 105
Sequoia Hall - 108
Muir Hall - 107
Tenaya Hall - 110
Fremont Hall - 109
Sierra Madre CoGen - 113 Yosemite - 114,134
Vista Grande Rest. - 112
Dormatories
4160 V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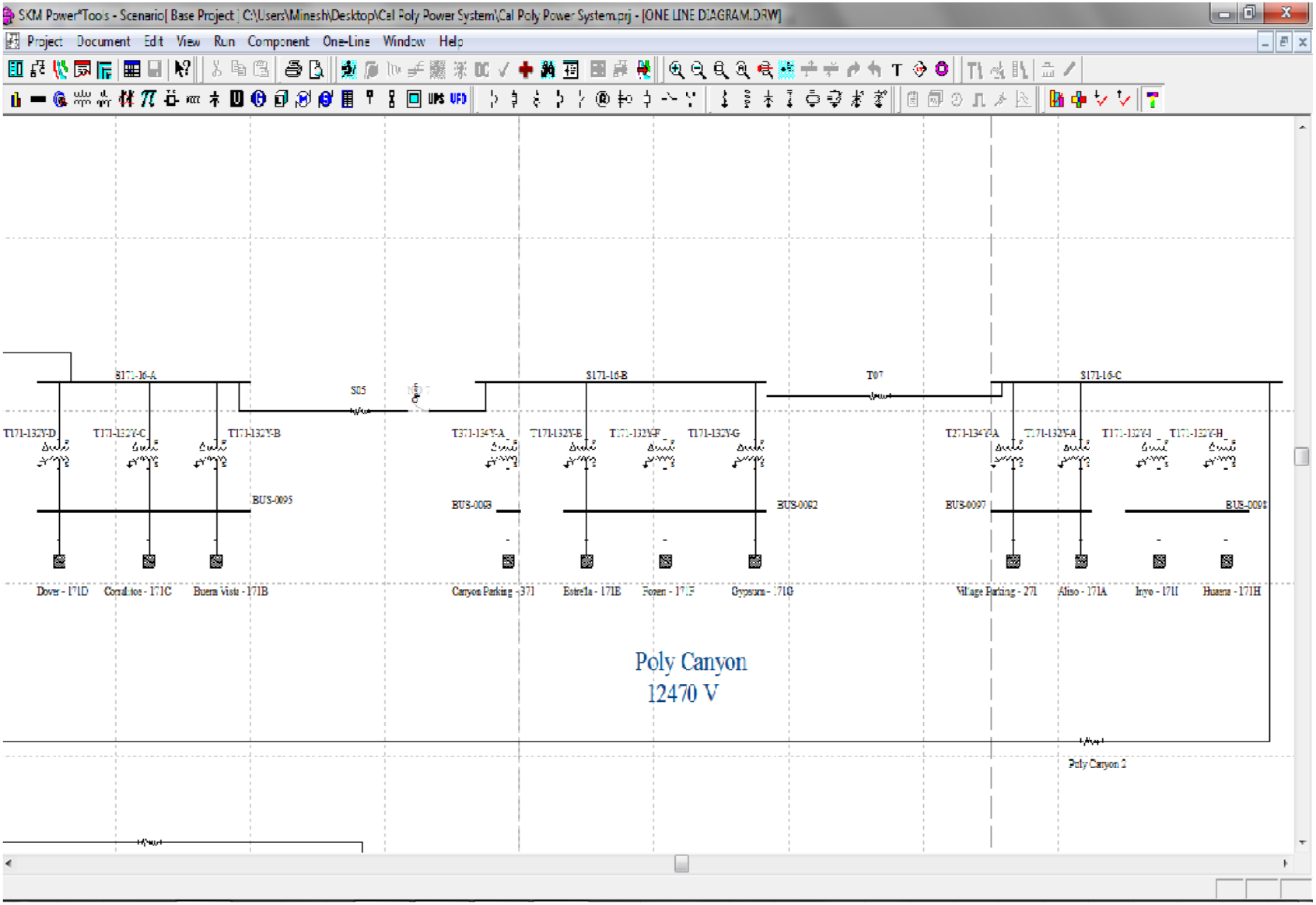
New 1-Node Annotation
23P
BUS-0089
BUS-0083
14P
BUS-0085
BUS-0087
14P2
T170-432Y-A
T170-432Y-D
T170-432Y-C
Cerro Vista
4160 V
Open N.O 9
BUS-0084
BUS-0086
BUS-0088
Cerro Vista A - 170
Cerro Vista D - 170
Cerro Vista C - 170
Cerro Vista 2P
Cerro Vista 4P
Create a new One-Node Annotation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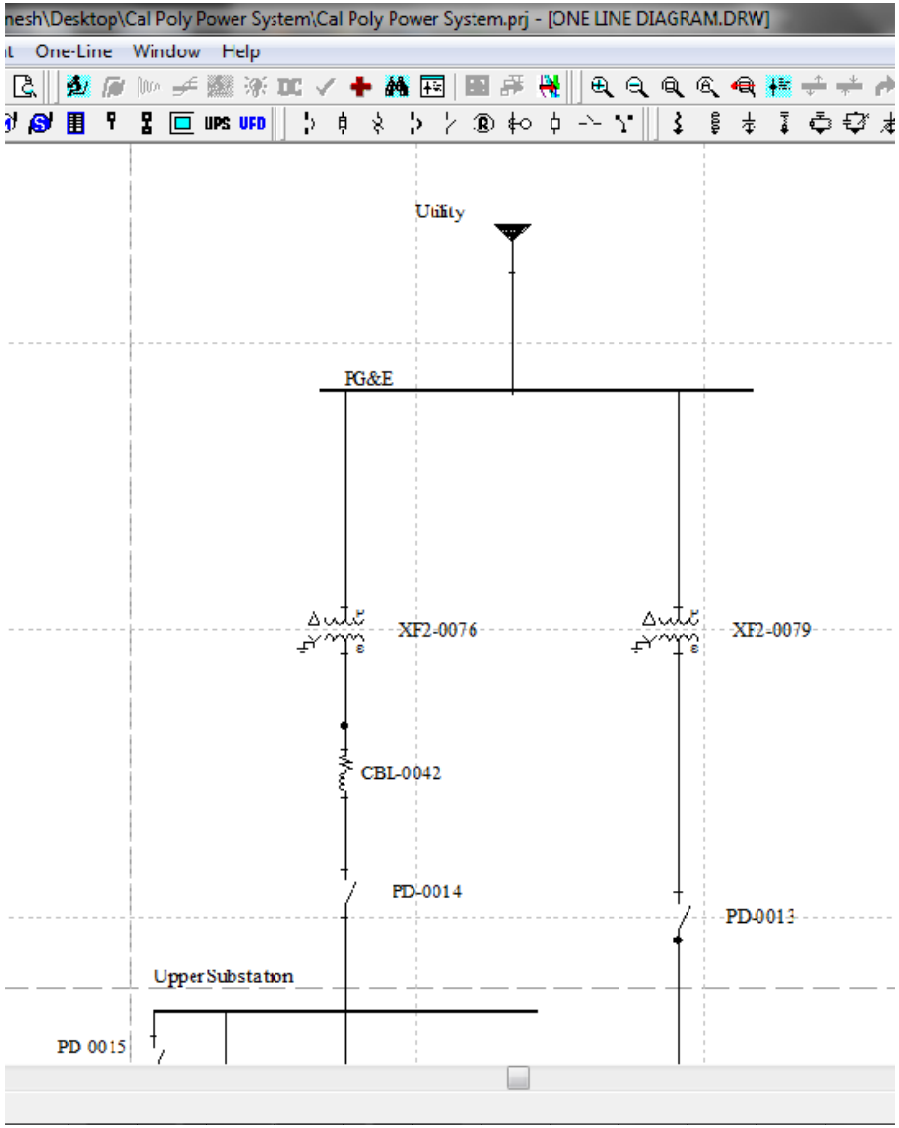
S171-16-A
S171-16-B
S171-16-C
S05
T07
T171-132Y-D
T171-132Y-C
T171-132Y-B
T371-134Y-A
T171-132Y-E
T171-132Y-F
T171-132Y-G
T271-134Y-A
T171-132Y-A
T171-132Y-I
T171-132Y-H
BUS-0095
BUS-0093
BUS-0092
BUS-0097
BUS-0091
Dover - 171D
Corralitos - 171C
Buena Vista - 171B
Canyon Parking - 371
Estrella - 171E
Foxen - 171F
Gypsum - 171G
Village Parking - 271
Aliso - 171A
Inyo - 171I
Huasna - 171H
Poly Canyon
12470 V
Poly Canyon 2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One-Line
Window
Help
UPS
UFD
Utility
PG&E
XF2-0076
XF2-0079
CBL-0042
PD-0014
PD-0013
Upper Substation
PD 0015

Project: Cal Poly Power System
Scenario: Base Project

Appendix D

Load Flow Summary Report

Load Flow Study Settings

Include Source Impedance	Yes	**Load Acceleration Factor**	1.00
Solution Method	Exact (Iterative)	**Bus Voltage Drop %**	5.00
Load Specification	Connected Load	**Branch Voltage Drop %**	3.00
Generation Acceleration Factor	1.00		

Swing Generators

Source	In/Out Service	Vpu	Angle	kW	kvar	VD%	Utility Impedance
Utility	In	1.00	0.00	12,681.2	12,141.7	3.97	0.15 +*j* 0.15

Buses

Bus Name	In/Out Service	Design Volts	LF Volts	Angle Degree	PU Volts	%VD
Bus-0002	In	208	171	-8.13	0.82	17.63
BUS-0004	In	480	399	-8.00	0.83	16.86
BUS-0006	In	480	406	-6.85	0.85	15.41
BUS-0007	In	208	173	-7.63	0.83	16.84
BUS-0009	In	208	177	-6.74	0.85	15.00
BUS-0012	In	480	415	-6.02	0.86	13.57
BUS-0013	In	208	180	-5.97	0.86	13.51
BUS-0015	In	208	176	-7.13	0.85	15.32
BUS-0016	In	480	412	-6.47	0.86	14.24
BUS-0018	In	480	411	-6.37	0.86	14.46
BUS-0020	In	208	177	-6.56	0.85	15.09
BUS-0022	In	208	176	-6.77	0.85	15.40
BUS-0025	In	208	177	-6.67	0.85	15.14
BUS-0026	In	480	406	-6.90	0.85	15.47
BUS-0028	In	208	179	-5.96	0.86	13.89

Bus Name	In/Out Service	Design Volts	LF Volts	Angle Degree	PU Volts	%VD
BUS-0030	In	480	408	-6.54	0.85	15.08
BUS-0032	In	208	175	-7.01	0.84	15.72
BUS-0034	In	208	174	-7.22	0.84	16.27
BUS-0035	In	480	407	-6.81	0.85	15.19
BUS-0037	In	480	403	-7.22	0.84	15.96
BUS-0038	In	208	173	-7.62	0.83	17.02
BUS-0040	In	480	408	-6.71	0.85	15.05
BUS-0042	In	480	408	-6.79	0.85	15.03
BUS-0044	In	480	412	-6.25	0.86	14.24
BUS-0048	In	208	176	-6.77	0.85	15.18
BUS-0049	In	480	415	-5.80	0.87	13.47
BUS-0052	In	208	177	-6.46	0.85	14.69
BUS-0054	In	208	175	-7.04	0.84	15.64
BUS-0056	In	208	179	-6.33	0.86	13.99
BUS-0057	In	480	413	-6.34	0.86	14.04
BUS-0059	In	208	177	-6.67	0.85	14.68
BUS-0060	In	480	409	-6.75	0.85	14.76
BUS-0063	In	208	172	-8.00	0.83	17.32
BUS-0065	In	480	414	-6.08	0.86	13.71
BUS-0066	In	208	179	-6.06	0.86	13.75
BUS-0068	In	208	174	-7.32	0.84	16.39
BUS-0071	In	480	439	-2.60	0.91	8.53
BUS-0073	In	208	181	-4.58	0.87	12.83
BUS-0075	In	208	182	-4.46	0.87	12.64
BUS-0076	In	208	181	-4.26	0.87	12.80
BUS-0077	In	208	186	-1.93	0.90	10.43
BUS-0082	In	480	430	-3.25	0.89	10.50
BUS-0083	In	4,160	3,813	-2.15	0.92	8.34
BUS-0084	In	208	188	-2.72	0.91	9.38
BUS-0085	In	4,160	3,812	-2.15	0.92	8.36
BUS-0086	In	208	188	-2.72	0.91	9.41
BUS-0087	In	4,160	3,818	-2.17	0.92	8.22
BUS-0088	In	208	189	-2.76	0.91	9.23
BUS-0089	In	4,160	3,815	-2.16	0.92	8.30
BUS-0092	In	208	192	-2.09	0.92	7.69
BUS-0093	In	480	441	-2.31	0.92	8.19
BUS-0095	In	208	192	-2.21	0.92	7.85
BUS-0097	In	480	443	-2.18	0.92	7.81
BUS-0098	In	208	192	-2.03	0.92	7.52
BUS-0106	In	12,470	11,661	-1.49	0.94	6.49
BUS-0107	In	4,160	3,823	-2.18	0.92	8.10
BUS-0108	In	12,470	11,661	-1.49	0.94	6.49

Bus Name	In/Out Service	Design Volts	LF Volts	Angle Degree	PU Volts	%VD
BUS-0109	In	4,160	3,853	-2.04	0.93	7.37
BUS-0111	In	480	413	-6.18	0.86	13.92
BUS-0112	In	208	179	-6.07	0.86	13.80
BUS-0114	In	240	208	-5.88	0.87	13.34
BUS-0115	In	208	177	-6.76	0.85	14.79
BUS-0116	In	480	407	-7.05	0.85	15.20
BUS-0118	In	208	179	-6.16	0.86	13.72
BUS-0119	In	480	410	-6.71	0.85	14.58
BUS-0120	In	480	416	-6.00	0.87	13.44
BUS-0132	In	12,470	11,663	-1.49	0.94	6.47
BUS-0133	In	12,470	10,874	-5.69	0.87	12.80
Lower Substation	In	4,160	3,852	-2.05	0.93	7.39
Lower Substation0	In	4,160	3,822	-2.18	0.92	8.13
Middle Substation	In	12,470	11,662	-1.49	0.94	6.48
PG&E	In	70,000	67,223	-0.05	0.96	3.97
S001-14-A	In	12,470	10,848	-5.71	0.87	13.00
S002-14-A	In	12,470	10,790	-5.75	0.87	13.47
S006-14-A	In	12,470	10,835	-5.72	0.87	13.11
S008-15-A	In	12,470	10,820	-5.73	0.87	13.23
S009-13-A	In	12,470	10,817	-5.73	0.87	13.26
S011-13-A	In	12,470	10,801	-5.74	0.87	13.38
S013-14-A	In	12,470	10,795	-5.75	0.87	13.43
S014-14-A	In	12,470	10,775	-5.77	0.86	13.59
S018-15-A	In	12,470	10,857	-5.71	0.87	12.94
S019-15-A	In	12,470	10,791	-5.76	0.87	13.46
S021-15-A	In	12,470	10,775	-5.77	0.86	13.59
S022-14-A	In	12,470	10,843	-5.72	0.87	13.05
S027-13-B	In	12,470	10,779	-5.77	0.86	13.56
S027-15-A	In	12,470	10,781	-5.77	0.86	13.55
S033-13-A	In	12,470	10,858	-5.71	0.87	12.93
S034-14-A	In	12,470	10,792	-5.75	0.87	13.46
S035-14-A	In	12,470	10,793	-5.75	0.87	13.44
S038-15-A	In	12,470	10,828	-5.73	0.87	13.16
S042-15-A	In	12,470	10,807	-5.74	0.87	13.34
S043-14-A	In	12,470	10,784	-5.77	0.86	13.52
S045-14-A	In	12,470	10,820	-5.73	0.87	13.23
S047-14-A	In	12,470	10,849	-5.71	0.87	13.00
S052-15-A	In	12,470	10,828	-5.73	0.87	13.17
S058-15-A	In	12,470	10,838	-5.72	0.87	13.08
S061-14-A	In	12,470	10,774	-5.77	0.86	13.60
S101-43-A	In	4,160	3,851	-2.05	0.93	7.42
S106-45-A	In	4,160	3,840	-2.06	0.92	7.69

Bus Name	In/Out Service	Design Volts	LF Volts	Angle Degree	PU Volts	%VD
S108-44-A	In	4,160	3,837	-2.07	0.92	7.76
S110-44-A	In	4,160	3,806	-2.14	0.91	8.52
S112-44-A	In	4,160	3,809	-2.13	0.92	8.45
S113-44-A	In	4,160	3,808	-2.13	0.92	8.45
S124-15-A	In	12,470	10,774	-5.77	0.86	13.60
S150-13-A	In	12,470	10,857	-5.71	0.87	12.93
S160-13-A	In	12,470	10,859	-5.71	0.87	12.92
S171-16-A	In	12,470	11,659	-1.49	0.93	6.50
S171-16-B	In	12,470	11,651	-1.49	0.93	6.57
S171-16-C	In	12,470	11,655	-1.49	0.93	6.54
S201-13-A	In	12,470	10,795	-5.75	0.87	13.43
Upper Substation	In	12,470	10,872	-5.70	0.87	12.82

Cables

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
BUS-0083	14P	In	0.02	100.4	76.9	126.5	19.1	0.79
BUS-0085				0.0	0.0	0.0	9.4	
BUS-0083	14P2	In	-0.04	-200.8	-153.7	252.9	38.3	0.79
BUS-0089				0.1	0.0	0.1	18.7	
BUS-0085	Cerro Vista 4P	In	0.00	0.0	0.0	0.0	0.0	0.00
Lower Substation				0.0	0.0	0.0	0.0	
BUS-0089	23P	In	-0.07	-200.9	-153.8	253.0	38.3	0.79
BUS-0087				0.2	0.1	0.2	18.7	
BUS-0107	CBL-0045	In	0.03	789.6	931.8	1,221.3	184.4	0.65
Lower Substation0				0.3	0.3	0.4	52.9	
BUS-0109	CBL-0047	In	0.02	595.3	485.9	768.4	115.1	0.77
Lower Substation				0.1	0.1	0.2	33.0	
BUS-0132	CBL-0048	In	0.01	2,717.2	2,475.2	3,675.6	182.0	0.74
Middle Substation				0.1	0.2	0.2	17.9	
BUS-0133	CBL-0042	In	0.02	9,847.6	7,723.7	12,515.2	664.5	0.79
Upper Substation				1.6	2.6	3.1	65.6	
Lower Substation	Dorm Loop 1	In	0.03	595.2	485.8	768.2	115.1	0.77
S101-43-A				0.2	0.2	0.2	33.0	
Lower Substation0	Cerro Vista 2P	In	0.09	402.2	307.9	506.5	76.5	0.79
BUS-0087				0.4	0.3	0.5	28.9	
Middle Substation	CBL-0044	In	0.01	792.0	957.8	1,242.9	61.5	0.64
BUS-0106				0.1	0.1	0.2	23.2	

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
Middle Substation BUS-0108	CBL-0046	In	0.01	596.3 0.1	496.4 0.0	775.8 0.1	38.4 14.5	0.77
Middle Substation S171-16-A	Poly Canyon 1	In	0.02	397.1 0.1	305.7 0.1	501.1 0.1	24.8 7.1	0.79
Middle Substation S171-16-C	Poly Canyon 2	In	0.06	931.7 0.5	715.0 0.5	1,174.5 0.7	58.1 16.7	0.79
S002-14-A S124-15-A	W15	In	0.00	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.00
S006-14-A S001-14-A	V02	In	-0.11	-3,661.8 4.2	-2,896.5 4.2	4,668.8 5.9	248.8 71.3	0.78
S008-15-A S009-13-A	W09	In	0.03	2,538.4 0.8	1,978.5 0.8	3,218.4 1.1	171.7 49.2	0.79
S009-13-A S011-13-A	W10	In	0.12	2,501.3 3.2	1,949.8 3.2	3,171.5 4.5	169.3 48.5	0.79
S011-13-A S013-14-A	W11	In	0.05	2,328.0 1.2	1,814.6 1.2	2,951.7 1.7	157.8 45.2	0.79
S013-14-A S035-14-A	W12	In	0.02	1,229.2 0.2	962.5 0.2	1,561.2 0.3	83.5 26.2	0.79
S013-14-A S201-13-A	W16	In	0.00	262.7 0.0	200.7 0.0	330.6 0.0	17.7 5.1	0.79
S018-15-A S061-14-A	Z09	In	0.00	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.00
S018-15-A S201-13-A	Z10	In	0.00	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.00
S019-15-A S042-15-A	V05	In	-0.12	-2,787.1 3.3	-2,214.5 3.9	3,559.8 5.1	190.5 52.5	0.78
S021-15-A S014-14-A	V10	In	0.00	499.7 0.0	389.1 0.0	633.3 0.0	33.9 9.7	0.79
S022-14-A S047-14-A	W03	In	-0.05	-3,605.0 1.7	-2,812.8 1.7	4,572.5 2.4	243.5 69.8	0.79
S027-13-B S021-15-A	V09	In	0.03	982.1 0.3	764.5 0.3	1,244.6 0.4	66.7 19.1	0.79
S027-15-A S027-13-B	V08	In	0.02	1,062.0 0.2	826.7 0.2	1,345.8 0.3	72.1 6.9	0.79
S034-14-A S002-14-A	W14	In	0.01	382.0 0.1	298.9 0.1	485.1 0.1	26.0 7.4	0.79

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
S035-14-A	W13	In	0.01	680.8	536.5	866.8	46.4	0.79
S034-14-A				0.1	0.1	0.1	13.3	
S038-15-A	W08	In	0.06	2,800.0	2,184.6	3,551.4	189.4	0.79
S008-15-A				1.9	1.9	2.7	54.3	
S038-15-A	W05	In	-0.08	-3,284.2	-2,558.1	4,162.9	222.0	0.79
S058-15-A				2.8	2.8	3.9	63.6	
S042-15-A	V04	In	-0.11	-3,157.9	-2,509.2	4,033.4	215.5	0.78
S045-14-A				3.4	4.1	5.3	59.4	
S043-14-A	V06	In	-0.06	-1,415.9	-1,098.7	1,792.2	95.9	0.79
S019-15-A				0.9	0.9	1.2	27.5	
S043-14-A	V07	In	0.03	1,182.2	919.5	1,497.7	80.2	0.79
S027-15-A				0.3	0.3	0.5	23.0	
S045-14-A	V03	In	-0.12	-3,306.3	-2,626.1	4,222.3	225.3	0.78
S006-14-A				4.0	4.0	5.7	64.6	
S047-14-A	W02	In	-0.07	-3,931.9	-3,067.4	4,986.8	265.4	0.79
S033-13-A				3.0	3.0	4.2	76.1	
S052-15-A	W07	In	0.00	0.0	0.0	0.0	0.0	0.00
S019-15-A				0.0	0.0	0.0	0.0	
S052-15-A	W06	In	0.00	-345.9	-263.7	434.9	23.2	0.80
S038-15-A				0.0	0.0	0.0	6.6	
S058-15-A	W04	In	-0.04	-3,421.3	-2,663.0	4,335.5	230.9	0.79
S022-14-A				1.3	1.3	1.8	66.2	
S061-14-A	V13	In	-0.01	-345.9	-271.2	439.5	23.6	0.79
S124-15-A				0.0	0.0	0.0	6.8	
S101-43-A	D01, D02	In	0.26	554.8	454.8	717.4	107.6	0.77
S106-45-A				1.5	1.5	2.1	30.8	
S106-45-A	D03	In	0.07	266.9	218.2	344.7	51.8	0.77
S108-44-A				0.2	0.2	0.3	14.9	
S108-44-A	D04	In	0.00	0.0	0.0	0.0	0.0	0.00
S110-44-A				0.0	0.0	0.0	0.0	
S110-44-A	G03	In	-0.07	-235.5	-190.6	302.9	46.0	0.78
S113-44-A				0.2	0.2	0.2	13.2	
S112-44-A	Dorm Loop 2	In	-0.31	-385.3	-621.8	731.5	110.9	0.53
Lower Substation0				1.8	1.8	2.6	31.8	
S113-44-A	G02	In	0.00	-258.2	-522.6	582.9	88.4	0.44
S112-44-A				0.0	0.0	0.0	25.3	
S124-15-A	V12	In	-0.01	-450.6	-352.0	571.8	30.6	0.79

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
S014-14-A				0.0	0.0	0.1	8.8	
S150-13-A	Z07/Z06	In	0.00	460.6	361.1	585.3	31.1	0.79
S018-15-A				0.0	0.0	0.0	8.9	
S160-13-A	Z02	In	0.01	545.0	425.4	691.3	36.8	0.79
S150-13-A				0.1	0.1	0.1	10.5	
S160-13-A	Z01	In	-0.11	-1,403.8	-1,092.0	1,778.5	94.6	0.79
Upper Substation				1.5	1.5	2.2	27.1	
S171-16-A	S05	In	0.00	0.0	0.0	0.0	0.0	0.00
S171-16-B				0.0	0.0	0.0	0.0	
S171-16-B	T07	In	-0.03	-424.0	-325.6	534.6	26.5	0.79
S171-16-C				0.2	0.1	0.2	10.0	
Upper Substation	V01	In	0.19	4,261.0	3,368.1	5,431.4	288.4	0.78
S001-14-A				8.2	8.2	11.6	82.7	
Upper Substation	To Upper Sub	In	0.11	4,179.7	3,259.4	5,300.3	281.5	0.79
S033-13-A				4.9	4.9	6.9	80.7	

2-Winding Transformers

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
BUS-0083	T170-432Y-A	In	1.04	100.4	76.9	126.4	19.0	0.79
BUS-0084				0.4	1.9	1.9	27.6	
BUS-0085	T170-432Y-D	In	1.04	100.4	76.9	126.4	19.0	0.79
BUS-0086				0.4	1.9	1.9	27.6	
BUS-0087	T170-432Y-C	In	1.01	200.7	153.7	252.8	38.0	0.79
BUS-0088				0.7	3.7	3.8	27.5	
BUS-0106	XF2-0077	In	1.61	791.9	957.8	1,242.7	62.0	0.64
BUS-0107				2.3	26.0	26.1	35.4	
BUS-0108	XF2-0078	In	0.89	596.2	496.4	775.8	38.0	0.77
BUS-0109				0.9	10.5	10.5	22.1	
PG&E	XF2-0079	In	2.50	2,725.3	2,610.7	3,774.0	32.0	0.72
BUS-0132				8.1	135.5	135.8	39.3	
PG&E	XF2-0076	In	8.83	9,955.9	9,531.0	13,782.6	118.0	0.72
BUS-0133				108.2	1,807.3	1,810.6	143.5	
S001-14-A	T065-132Y-A	In	2.32	369.9	292.0	471.3	25.0	0.78
BUS-0015				2.9	16.8	17.0	54.2	

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
S001-14-A	T001-134Y-A	In	1.24	216.9	167.2	273.9	15.0	0.79
BUS-0016				0.9	5.2	5.3	31.5	
S002-14-A	T002-132Y-A	In	2.80	102.3	80.9	130.5	7.0	0.78
BUS-0034				1.3	5.2	5.4	67.0	
S002-14-A	T003-134Y-A	In	1.72	279.7	217.9	354.5	19.0	0.79
BUS-0035				1.7	9.4	9.6	41.0	
S006-14-A	T006-134Y-B	In	0.46	107.5	79.3	133.6	7.0	0.80
BUS-0012				0.2	1.0	1.0	11.5	
S006-14-A	T006-134Y-C	In	0.46	155.9	120.4	196.9	10.0	0.79
BUS-0012				0.2	1.5	1.5	11.3	
S006-14-A	T006-132Y-A	In	0.39	88.1	66.7	110.5	6.0	0.80
BUS-0013				0.1	0.7	0.7	9.5	
S008-15-A	T008-132Y-A	In	2.41	137.7	108.3	175.2	9.0	0.79
BUS-0054				1.5	6.1	6.3	67.3	
S008-15-A	T024-132Y-A	In	2.41	122.1	96.0	155.3	8.0	0.79
BUS-0054				1.3	5.4	5.6	59.7	
S009-13-A	T009-132Y-A	In	1.43	36.3	27.9	45.8	2.0	0.79
BUS-0052				0.3	0.9	0.9	35.2	
S011-13-A	T011-132Y-A	In	1.80	155.1	120.7	196.6	11.0	0.79
BUS-0048				1.1	5.2	5.4	45.4	
S011-13-A	T197-134Y-A	In	0.09	15.0	11.3	18.8	1.0	0.80
BUS-0049				0.0	0.0	0.0	2.2	
S013-14-A	T013-134Y-A	In	1.60	270.6	204.4	339.1	18.0	0.80
BUS-0042				1.4	8.7	8.8	29.4	
S013-14-A	T192-134-A	In	1.60	564.3	445.9	719.3	38.0	0.78
BUS-0042				2.5	18.4	18.6	41.5	
S014-14-A	T014-132Y-A	In	0.30	49.1	37.0	61.5	3.0	0.80
BUS-0028				0.1	0.3	0.3	7.1	
S018-15-A	T018-112S-F	In	0.40	5.0	3.8	6.3	0.0	0.80
BUS-0114				0.0	0.0	0.0	19.2	
S018-15-A	T018-134Y-A	In	1.85	174.3	135.8	220.9	12.0	0.79
BUS-0115				1.3	6.0	6.2	50.8	
S018-15-A	T018-134Y-B	In	2.26	281.3	221.5	358.1	19.0	0.79
BUS-0116				2.3	12.2	12.4	54.8	
S019-15-A	T019-132Y-A	In	4.17	301.1	245.9	388.7	21.0	0.77
Bus-0002				5.1	23.9	24.4	89.8	
S019-15-A	T040-134Y-E	In	3.40	1,069.3	869.1	1,377.9	74.0	0.78
BUS-0004				10.3	74.9	75.6	79.6	

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
S021-15-A BUS-0025	T021-132Y-B	In	1.55	66.7 0.5	46.9 1.9	81.5 1.9	4.0 41.9	0.82
S021-15-A BUS-0025	T026-132Y-A	In	1.55	170.8 1.0	137.1 5.1	219.0 5.2	12.0 33.8	0.78
S021-15-A BUS-0026	T021-134Y-A	In	1.88	244.7 1.7	191.1 8.9	310.5 9.1	17.0 47.9	0.79
S022-14-A BUS-0063	T022-132Y-A	In	4.27	182.5 3.5	148.6 14.3	235.3 14.7	13.0 90.2	0.78
S027-13-B BUS-0022	T027-132Y-C	In	1.84	79.6 0.6	61.9 2.7	100.9 2.8	5.0 38.9	0.79
S027-15-A BUS-0020	T133-132Y-A	In	1.55	31.0 0.2	23.1 0.8	38.6 0.9	2.0 39.7	0.80
S027-15-A BUS-0020	T051-132Y-A	In	1.55	29.8 0.2	22.2 0.8	37.1 0.8	2.0 38.2	0.80
S027-15-A BUS-0020	T027-132Y-A	In	1.55	59.1 0.4	47.3 1.7	75.7 1.7	4.0 38.9	0.78
S033-13-A BUS-0056	T033-132Y-A	In	1.06	130.5 0.5	100.1 2.6	164.5 2.7	9.0 28.3	0.79
S033-13-A BUS-0057	T033-134Y-B	In	1.11	109.5 0.5	84.0 2.3	138.0 2.3	7.0 31.7	0.79
S034-14-A BUS-0037	T034-132Y-A	In	2.50	185.8 1.8	146.9 8.9	236.8 9.1	13.0 41.0	0.78
S034-14-A BUS-0038	T038-132Y-B	In	3.56	112.9 1.9	90.5 7.3	144.7 7.5	8.0 74.3	0.78
S035-14-A BUS-0040	T035-134Y-A	In	1.60	239.3 1.3	191.0 7.5	306.2 7.6	16.0 35.4	0.78
S035-14-A BUS-0040	T035-134Y-B	In	1.60	121.1 0.8	89.6 3.7	150.6 3.8	8.0 34.8	0.80
S035-14-A BUS-0040	T005-134Y-A	In	1.60	187.8 1.1	145.2 5.8	237.4 5.9	13.0 36.6	0.79
S038-15-A BUS-0068	T038-132Y-A	In	3.22	79.0 1.3	63.6 4.5	101.4 4.7	5.0 77.8	0.78
S038-15-A BUS-0068	T010-132Y-A	In	3.22	59.2 1.0	46.3 3.3	75.2 3.5	4.0 76.9	0.79
S042-15-A BUS-0006	T042-134Y-B	In	2.07	105.7 1.0	83.7 4.0	134.8 4.1	7.0 51.9	0.78
S042-15-A BUS-0006	T130-134-A	In	2.07	87.1 0.8	66.8 3.2	109.7 3.3	6.0 56.3	0.79

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
S042-15-A	T042-132Y-A	In	3.50	174.7	140.3	224.1	12.0	0.78
BUS-0007				2.7	11.3	11.6	86.2	
S043-14-A	T043-132Y-A	In	0.94	233.7	179.1	294.4	16.0	0.79
BUS-0018				0.7	4.4	4.4	22.7	
S045-14-A	T045-132Y-A	In	1.77	145.0	112.8	183.7	10.0	0.79
BUS-0009				1.0	4.8	4.9	42.4	
S047-14-A	T047-132Y-A	In	1.67	141.9	110.2	179.7	10.0	0.79
BUS-0059				0.9	4.5	4.6	41.3	
S047-14-A	T053-134Y-A	In	1.76	183.2	142.6	232.2	12.0	0.79
BUS-0060				1.2	6.1	6.3	40.1	
S052-15-A	T014-134D-B	In	0.75	92.5	69.6	115.8	6.0	0.80
BUS-0111				0.3	1.3	1.4	17.8	
S052-15-A	T052-134Y-A	In	0.75	93.7	70.5	117.2	6.0	0.80
BUS-0111				0.3	1.3	1.4	18.0	
S052-15-A	T020-134Y-B	In	0.75	131.6	102.2	166.7	9.0	0.79
BUS-0111				0.3	1.9	1.9	19.2	
S052-15-A	T020-123Y-C	In	0.63	28.1	21.3	35.3	2.0	0.80
BUS-0112				0.1	0.3	0.3	13.5	
S058-15-A	T036-132Y-A	In	0.63	58.6	44.6	73.7	4.0	0.80
BUS-0065				0.1	0.7	0.7	16.9	
S058-15-A	T058-134Y-A	In	0.63	58.6	44.6	73.7	4.0	0.80
BUS-0065				0.1	0.7	0.7	16.9	
S058-15-A	T074-132Y-A	In	0.67	17.1	12.9	21.4	1.0	0.80
BUS-0066				0.1	0.2	0.2	16.4	
S061-14-A	T061-132Y-A	In	2.12	96.6	70.5	119.6	6.0	0.81
BUS-0032				0.9	3.8	3.9	46.1	
S061-14-A	T061-134Y-B	In	2.12	249.2	200.8	320.0	17.0	0.78
BUS-0032				1.9	10.2	10.4	49.4	
S101-43-A	T101-434D-A	In	1.11	40.2	30.8	50.6	8.0	0.79
BUS-0071				0.2	0.8	0.8	24.3	
S106-45-A	T106-432Y-A	In	5.14	143.6	117.9	185.8	28.0	0.77
BUS-0073				3.2	12.6	13.0	89.5	
S106-45-A	T105-432Y-A	In	5.14	142.8	117.3	184.8	28.0	0.77
BUS-0073				3.2	12.6	13.0	89.0	
S108-44-A	T108-432Y-A	In	4.88	132.4	108.2	171.0	26.0	0.77
BUS-0075				2.8	11.0	11.4	82.4	
S108-44-A	T107-432Y-A	In	4.88	134.3	109.8	173.5	26.0	0.77
BUS-0075				2.9	11.2	11.6	83.6	

From Bus To Bus	Component Name	In/Out Service	%VD	kW Loss	kvar Loss	kVA Loss	LF Amps Rating %	PF
S110-44-A BUS-0076	T110-432Y-A	In	4.28	115.8 2.2	93.7 8.5	149.0 8.8	23.0 72.4	0.78
S110-44-A BUS-0076	T109-432Y-A	In	4.28	119.6 2.3	96.9 8.8	153.9 9.1	23.0 74.8	0.78
S112-44-A BUS-0082	T112-434Y-A	In	2.06	127.0 1.0	99.2 4.7	161.1 4.8	24.0 35.2	0.79
S113-44-A BUS-0077	T113-432Y-A	In	1.98	10.3 0.9	199.4 4.3	199.6 4.4	30.0 43.6	0.05
S113-44-A BUS-0077	T114-432Y-A	In	1.98	12.3 0.7	132.5 2.8	133.0 2.9	20.0 64.6	0.09
S124-15-A BUS-0030	T115-134Y-A	In	1.48	33.3 0.3	23.2 0.8	40.5 0.9	2.0 62.6	0.82
S124-15-A BUS-0030	T124-134Y-A	In	1.48	71.5 0.5	57.6 1.9	91.8 2.0	5.0 35.4	0.78
S150-13-A BUS-0118	XF2-0086	In	0.78	84.3 0.3	64.2 1.2	106.0 1.3	6.0 24.3	0.80
S160-13-A BUS-0119	T160-134Y-B	In	1.66	396.4 2.6	289.7 12.4	490.9 12.7	26.0 112.8	0.81
S160-13-A BUS-0119	T160-134Y-A	In	1.66	400.3 2.0	329.9 13.2	518.7 13.4	28.0 39.7	0.77
S160-13-A BUS-0120	T004-134Y-A	In	0.51	62.1 0.1	47.1 0.6	78.0 0.6	4.0 17.9	0.80
S171-16-A BUS-0095	T171-132Y-C	In	1.35	132.3 0.7	101.9 3.1	167.0 3.2	8.0 35.7	0.79
S171-16-A BUS-0095	T171-132Y-B	In	1.35	132.3 0.7	101.9 3.1	167.0 3.2	8.0 35.7	0.79
S171-16-A BUS-0095	T171-132Y-D	In	1.35	132.3 0.7	101.9 3.1	167.0 3.2	8.0 35.7	0.79
S171-16-B BUS-0092	T171-132Y-E	In	1.13	110.5 0.5	84.7 2.2	139.2 2.2	7.0 29.8	0.79
S171-16-B BUS-0092	T171-132Y-F	In	1.13	110.5 0.5	84.7 2.2	139.2 2.2	7.0 29.8	0.79
S171-16-B BUS-0092	T171-132Y-G	In	1.13	110.5 0.5	84.7 2.2	139.2 2.2	7.0 29.8	0.79
S171-16-B BUS-0093	T371-134Y-A	In	1.62	92.6 0.6	71.5 2.5	117.0 2.6	6.0 41.8	0.79
S171-16-C BUS-0097	T271-134Y-A	In	1.27	77.2 0.4	55.2 1.7	94.9 1.7	5.0 33.8	0.81

Project: Cal Poly Power System
Scenario: Base Project

Appendix E

DAPPER Fault Contribution Complete Report

Comprehensive Short Circuit Study Settings

Three Phase Fault	Yes	**Faulted Bus**	All Buses
Single Line to Ground	Yes	**Bus Voltages**	First Bus From Fault
Line to Line Fault	No	**Branch Currents**	First Branch From Fault
Line to Line to Ground	No	**Phase or Sequence**	Report phase quantities
Motor Contribution	Yes	**Fault Current Calculation**	Initial Symmetrical RMS (with 1/2 Cycle Asym)
Transformer Tap	Yes	**Asym Fault Current at Time**	0.50 **Cycles**
Xformer Phase Shift	Yes		

				Initial Symmetrical Amps				Asymmetrical Amps				Init Sym Neutral Amps	
Bus Name	**Contributions**			**3 Phase**	**SLG**	**LLG**	**LL**	**3 Phase**	**SLG**	**LLG**	**LL**	**SLG**	**LLG**
Bus-0002				**20,433**	**21,035**	**0**	**0**	**25,115**	**25,891**	**0**	**0**		
	T019-132Y-A	2W-XFMR	In	20,433	21,035	0	0	25,115	25,891	0	0	21,035	
BUS-0004				**28,504**	**31,386**	**0**	**0**	**36,970**	**41,190**	**0**	**0**		
	T040-134Y-E	2W-XFMR	In	28,504	31,386	0	0	36,970	41,190	0	0	31,386	
BUS-0006				**11,180**	**11,589**	**0**	**0**	**13,324**	**13,812**	**0**	**0**		
	T130-134-A	2W-XFMR	In	5,016	5,200	0	0	5,978	6,197	0	0	5,200	
	T042-134Y-B	2W-XFMR	In	6,164	6,389	0	0	7,346	7,615	0	0	6,389	
BUS-0007				**14,664**	**14,964**	**0**	**0**	**17,587**	**17,950**	**0**	**0**		
	T042-132Y-A	2W-XFMR	In	14,664	14,964	0	0	17,587	17,950	0	0	14,964	
BUS-0009				**22,374**	**23,066**	**0**	**0**	**27,554**	**28,429**	**0**	**0**		
	T045-132Y-A	2W-XFMR	In	22,374	23,066	0	0	27,554	28,429	0	0	23,066	
BUS-0012				**42,306**	**48,536**	**0**	**0**	**54,458**	**63,058**	**0**	**0**		
	T006-134Y-B	2W-XFMR	In	17,100	19,618	0	0	22,012	25,488	0	0	19,618	
	T006-134Y-C	2W-XFMR	In	25,209	28,920	0	0	32,449	37,574	0	0	28,920	
BUS-0013				**50,342**	**53,909**	**0**	**0**	**65,163**	**70,123**	**0**	**0**		

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
	T006-132Y-A	2W-XFMR	In	50,342	53,909	0	0	65,163	70,123	0	0	53,909	
BUS-0015				**39,482**	**41,608**	**0**	**0**	**50,557**	**53,403**	**0**	**0**		
	T065-132Y-A	2W-XFMR	In	39,482	41,608	0	0	50,557	53,403	0	0	41,608	
BUS-0016				**18,255**	**19,307**	**0**	**0**	**23,363**	**24,771**	**0**	**0**		
	T001-134Y-A	2W-XFMR	In	18,255	19,307	0	0	23,363	24,771	0	0	19,307	
BUS-0018				**23,490**	**25,458**	**0**	**0**	**30,099**	**32,939**	**0**	**0**		
	T043-132Y-A	2W-XFMR	In	23,490	25,458	0	0	30,099	32,939	0	0	25,458	
BUS-0020				**22,013**	**22,738**	**0**	**0**	**25,601**	**26,449**	**0**	**0**		
	T051-132Y-A	2W-XFMR	In	5,395	5,573	0	0	6,274	6,482	0	0	5,573	
	T133-132Y-A	2W-XFMR	In	5,615	5,800	0	0	6,531	6,747	0	0	5,800	
	T027-132Y-A	2W-XFMR	In	11,006	11,369	0	0	12,800	13,224	0	0	11,369	
BUS-0022				**12,588**	**12,824**	**0**	**0**	**15,069**	**15,363**	**0**	**0**		
	T027-132Y-C	2W-XFMR	In	12,588	12,824	0	0	15,069	15,363	0	0	12,824	
BUS-0025				**38,046**	**40,313**	**0**	**0**	**46,480**	**49,469**	**0**	**0**		
	T021-132Y-B	2W-XFMR	In	10,325	10,940	0	0	12,613	13,425	0	0	10,940	
	T026-132Y-A	2W-XFMR	In	27,736	29,389	0	0	33,884	36,064	0	0	29,389	
BUS-0026				**14,274**	**15,004**	**0**	**0**	**17,762**	**18,765**	**0**	**0**		
	T021-134Y-A	2W-XFMR	In	14,274	15,004	0	0	17,762	18,765	0	0	15,004	
BUS-0028				**38,548**	**40,872**	**0**	**0**	**48,546**	**51,834**	**0**	**0**		
	T014-132Y-A	2W-XFMR	In	38,548	40,872	0	0	48,546	51,834	0	0	40,872	
BUS-0030				**8,698**	**8,967**	**0**	**0**	**10,193**	**10,517**	**0**	**0**		
	T115-134Y-A	2W-XFMR	In	2,666	2,749	0	0	3,124	3,224	0	0	2,749	
	T124-134Y-A	2W-XFMR	In	6,037	6,223	0	0	7,074	7,299	0	0	6,223	
BUS-0032				**40,173**	**42,752**	**0**	**0**	**49,111**	**52,553**	**0**	**0**		
	T061-132Y-A	2W-XFMR	In	10,931	11,632	0	0	13,363	14,299	0	0	11,632	
	T061-134Y-B	2W-XFMR	In	29,251	31,129	0	0	35,759	38,266	0	0	31,129	
BUS-0034				**10,919**	**11,095**	**0**	**0**	**12,894**	**13,109**	**0**	**0**		
	T002-132Y-A	2W-XFMR	In	10,919	11,095	0	0	12,894	13,109	0	0	11,095	
BUS-0035				**16,997**	**18,024**	**0**	**0**	**21,426**	**22,874**	**0**	**0**		
	T003-134Y-A	2W-XFMR	In	16,997	18,024	0	0	21,426	22,874	0	0	18,024	
BUS-0037				**8,800**	**9,063**	**0**	**0**	**10,971**	**11,327**	**0**	**0**		
	T034-132Y-A	2W-XFMR	In	8,800	9,063	0	0	10,971	11,327	0	0	9,063	
BUS-0038				**9,615**	**9,749**	**0**	**0**	**11,361**	**11,523**	**0**	**0**		
	T038-132Y-B	2W-XFMR	In	9,615	9,749	0	0	11,361	11,523	0	0	9,749	
BUS-0040				**30,525**	**33,896**	**0**	**0**	**37,675**	**42,132**	**0**	**0**		
	T035-134Y-B	2W-XFMR	In	6,623	7,355	0	0	8,175	9,142	0	0	7,355	

Bus Name	---------Contributions---------			----------Initial Symmetrical Amps----------				----------Asymmetrical Amps----------				---Init Sym Neutral Amps---	
				3 Phase	SLG	LLG	LL	3 Phase	SLG	LLG	LL	SLG	LLG
	T005-134Y-A	2W-XFMR	In	10,440	11,594	0	0	12,886	14,410	0	0	11,594	
	T035-134Y-A	2W-XFMR	In	13,464	14,951	0	0	16,618	18,584	0	0	14,951	
BUS-0042				**39,471**	**45,244**	**0**	**0**	**49,960**	**58,040**	**0**	**0**		
	T013-134Y-A	2W-XFMR	In	12,647	14,497	0	0	16,008	18,597	0	0	14,497	
	T192-134-A	2W-XFMR	In	26,826	30,750	0	0	33,955	39,446	0	0	30,750	
BUS-0044				**29,011**	**32,042**	**0**	**0**	**36,153**	**40,253**	**0**	**0**		
	T007-134Y-A	2W-XFMR	In	12,139	13,408	0	0	15,128	16,843	0	0	13,408	
	T041-134Y-A	2W-XFMR	In	16,873	18,637	0	0	21,027	23,412	0	0	18,637	
BUS-0048				**23,395**	**24,180**	**0**	**0**	**28,741**	**29,752**	**0**	**0**		
	T011-132Y-A	2W-XFMR	In	23,395	24,180	0	0	28,741	29,752	0	0	24,180	
BUS-0049				**17,672**	**18,731**	**0**	**0**	**22,408**	**23,872**	**0**	**0**		
	T197-134Y-A	2W-XFMR	In	17,672	18,731	0	0	22,408	23,872	0	0	18,731	
BUS-0052				**7,696**	**7,777**	**0**	**0**	**8,938**	**9,030**	**0**	**0**		
	T009-132Y-A	2W-XFMR	In	7,696	7,777	0	0	8,938	9,030	0	0	7,777	
BUS-0054				**29,244**	**30,442**	**0**	**0**	**35,093**	**36,531**	**0**	**0**		
	T024-132Y-A	2W-XFMR	In	13,743	14,306	0	0	16,491	17,167	0	0	14,306	
	T008-132Y-A	2W-XFMR	In	15,501	16,137	0	0	18,602	19,364	0	0	16,137	
BUS-0056				**31,614**	**32,950**	**0**	**0**	**39,658**	**41,356**	**0**	**0**		
	T033-132Y-A	2W-XFMR	In	31,614	32,950	0	0	39,658	41,356	0	0	32,950	
BUS-0057				**11,373**	**11,770**	**0**	**0**	**14,048**	**14,536**	**0**	**0**		
	T033-134Y-B	2W-XFMR	In	11,373	11,770	0	0	14,048	14,536	0	0	11,770	
BUS-0059				**23,040**	**23,749**	**0**	**0**	**28,439**	**29,317**	**0**	**0**		
	T047-132Y-A	2W-XFMR	In	23,040	23,749	0	0	28,439	29,317	0	0	23,749	
BUS-0060				**11,891**	**12,330**	**0**	**0**	**14,907**	**15,468**	**0**	**0**		
	T053-134Y-A	2W-XFMR	In	11,891	12,330	0	0	14,907	15,468	0	0	12,330	
BUS-0063				**12,752**	**12,968**	**0**	**0**	**15,318**	**15,572**	**0**	**0**		
	T022-132Y-A	2W-XFMR	In	12,752	12,968	0	0	15,318	15,572	0	0	12,968	
BUS-0065				**19,634**	**20,875**	**0**	**0**	**24,189**	**25,734**	**0**	**0**		
	T036-132Y-A	2W-XFMR	In	9,817	10,437	0	0	12,095	12,867	0	0	10,437	
	T058-134Y-A	2W-XFMR	In	9,817	10,437	0	0	12,095	12,867	0	0	10,437	
BUS-0066				**7,706**	**7,785**	**0**	**0**	**8,955**	**9,042**	**0**	**0**		
	T074-132Y-A	2W-XFMR	In	7,706	7,785	0	0	8,955	9,042	0	0	7,785	
BUS-0068				**13,014**	**13,243**	**0**	**0**	**15,055**	**15,309**	**0**	**0**		
	T010-132Y-A	2W-XFMR	In	5,541	5,638	0	0	6,409	6,518	0	0	5,638	
	T038-132Y-A	2W-XFMR	In	7,474	7,605	0	0	8,646	8,792	0	0	7,605	
BUS-0071				**4,192**	**0**	**0**	**0**	**5,003**	**0**	**0**	**0**		

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
	T101-434D-A	2W-XFMR	In	4,192	0	0	0	5,003	0	0	0		
BUS-0073				**14,513**	**15,291**	**0**	**0**	**17,247**	**18,146**	**0**	**0**		
	T105-432Y-A	2W-XFMR	In	7,236	7,625	0	0	8,600	9,048	0	0	7,625	
	T106-432Y-A	2W-XFMR	In	7,276	7,667	0	0	8,647	9,098	0	0	7,667	
BUS-0075				**14,133**	**14,915**	**0**	**0**	**16,711**	**17,637**	**0**	**0**		
	T108-432Y-A	2W-XFMR	In	7,014	7,402	0	0	8,293	8,753	0	0	7,402	
	T107-432Y-A	2W-XFMR	In	7,119	7,513	0	0	8,417	8,884	0	0	7,513	
BUS-0076				**14,246**	**15,039**	**0**	**0**	**16,817**	**17,763**	**0**	**0**		
	T110-432Y-A	2W-XFMR	In	7,007	7,397	0	0	8,271	8,737	0	0	7,397	
	T109-432Y-A	2W-XFMR	In	7,239	7,642	0	0	8,546	9,027	0	0	7,642	
BUS-0077				**32,892**	**37,154**	**0**	**0**	**39,871**	**45,041**	**0**	**0**		
	T114-432Y-A	2W-XFMR	In	13,155	14,860	0	0	15,946	18,014	0	0	14,860	
	T113-432Y-A	2W-XFMR	In	19,743	22,302	0	0	23,933	27,036	0	0	22,302	
BUS-0082				**6,557**	**6,921**	**0**	**0**	**8,073**	**8,528**	**0**	**0**		
	T112-434Y-A	2W-XFMR	In	6,557	6,921	0	0	8,073	8,528	0	0	6,921	
BUS-0083				**4,724**	**5,036**	**0**	**0**	**5,293**	**5,509**	**0**	**0**		
	14P	CABLE	In	0	0	0	0	0	0	0	0		
	T170-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	14P2	CABLE	In	4,724	5,036	0	0	5,293	5,509	0	0	5,036	
BUS-0084				**21,403**	**23,144**	**0**	**0**	**25,749**	**28,039**	**0**	**0**		
	T170-432Y-A	2W-XFMR	In	21,403	23,144	0	0	25,749	28,039	0	0	23,144	
BUS-0085				**4,552**	**4,764**	**0**	**0**	**4,967**	**5,084**	**0**	**0**		
	Cerro Vista 4P	CABLE	In	0	0	0	0	0	0	0	0		
	T170-432Y-D	2W-XFMR	In	0	0	0	0	0	0	0	0		
	14P	CABLE	In	4,552	4,764	0	0	4,967	5,084	0	0	4,764	
BUS-0086				**21,242**	**23,020**	**0**	**0**	**25,292**	**27,672**	**0**	**0**		
	T170-432Y-D	2W-XFMR	In	21,242	23,020	0	0	25,292	27,672	0	0	23,020	
BUS-0087				**5,197**	**5,846**	**0**	**0**	**6,573**	**7,335**	**0**	**0**		
	23P	CABLE	In	0	0	0	0	0	0	0	0		
	T170-432Y-C	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Cerro Vista 2P	CABLE	In	5,197	5,846	0	0	6,573	7,335	0	0	5,846	
BUS-0088				**36,084**	**40,806**	**0**	**0**	**46,239**	**52,382**	**0**	**0**		
	T170-432Y-C	2W-XFMR	In	36,084	40,806	0	0	46,239	52,382	0	0	40,806	
BUS-0089				**4,899**	**5,326**	**0**	**0**	**5,687**	**6,040**	**0**	**0**		
	14P2	CABLE	In	0	0	0	0	0	0	0	0		
	23P	CABLE	In	4,899	5,326	0	0	5,687	6,040	0	0	5,326	

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
BUS-0092				**61,929**	**67,634**	**0**	**0**	**75,497**	**82,734**	**0**	**0**		
	T171-132Y-E	2W-XFMR	In	20,643	22,545	0	0	25,166	27,578	0	0	22,545	
	T171-132Y-F	2W-XFMR	In	20,643	22,545	0	0	25,166	27,578	0	0	22,545	
	T171-132Y-G	2W-XFMR	In	20,643	22,545	0	0	25,166	27,578	0	0	22,545	
BUS-0093				**6,729**	**6,875**	**0**	**0**	**8,065**	**8,243**	**0**	**0**		
	T371-134Y-A	2W-XFMR	In	6,729	6,875	0	0	8,065	8,243	0	0	6,875	
BUS-0095				**62,499**	**68,085**	**0**	**0**	**76,977**	**83,915**	**0**	**0**		
	T171-132Y-B	2W-XFMR	In	20,833	22,695	0	0	25,659	27,972	0	0	22,695	
	T171-132Y-C	2W-XFMR	In	20,833	22,695	0	0	25,659	27,972	0	0	22,695	
	T171-132Y-D	2W-XFMR	In	20,833	22,695	0	0	25,659	27,972	0	0	22,695	
BUS-0097				**20,456**	**21,812**	**0**	**0**	**25,381**	**27,092**	**0**	**0**		
	T271-134Y-A	2W-XFMR	In	5,846	6,233	0	0	7,253	7,743	0	0	6,233	
	T171-132Y-A	2W-XFMR	In	14,615	15,583	0	0	18,133	19,356	0	0	15,583	
BUS-0098				**54,281**	**58,457**	**0**	**0**	**67,623**	**72,946**	**0**	**0**		
	T171-132Y-I	2W-XFMR	In	21,714	23,384	0	0	27,051	29,180	0	0	23,384	
	T171-132Y-H	2W-XFMR	In	32,570	35,076	0	0	40,576	43,770	0	0	35,076	
BUS-0106				**4,354**	**4,597**	**0**	**0**	**5,415**	**5,997**	**0**	**0**		
	XF2-0077	2W-XFMR	In	0	0	0	0	0	0	0	0		
	CBL-0044	CABLE	In	4,354	4,597	0	0	5,415	5,997	0	0	4,597	
BUS-0107				**5,457**	**6,339**	**0**	**0**	**7,418**	**8,758**	**0**	**0**		
	CBL-0045	CABLE	In	0	0	0	0	0	0	0	0		
	XF2-0077	2W-XFMR	In	5,457	6,339	0	0	7,418	8,758	0	0	6,339	
BUS-0108				**4,354**	**4,597**	**0**	**0**	**5,415**	**5,997**	**0**	**0**		
	XF2-0078	2W-XFMR	In	0	0	0	0	0	0	0	0		
	CBL-0046	CABLE	In	4,354	4,597	0	0	5,415	5,997	0	0	4,597	
BUS-0109				**5,350**	**6,195**	**0**	**0**	**7,283**	**8,571**	**0**	**0**		
	CBL-0047	CABLE	In	0	0	0	0	0	0	0	0		
	XF2-0078	2W-XFMR	In	5,350	6,195	0	0	7,283	8,571	0	0	6,195	
BUS-0111				**35,243**	**35,704**	**0**	**0**	**44,106**	**45,007**	**0**	**0**		
	T014-134D-B	2W-XFMR	In	10,514	7,031	0	0	13,158	8,863	0	0		
	T052-134Y-A	2W-XFMR	In	10,645	11,840	0	0	13,322	14,925	0	0	14,744	
	T020-134Y-B	2W-XFMR	In	15,134	16,833	0	0	18,940	21,219	0	0	20,961	
BUS-0112				**12,748**	**12,969**	**0**	**0**	**15,301**	**15,566**	**0**	**0**		
	T020-123Y-C	2W-XFMR	In	12,748	12,969	0	0	15,301	15,566	0	0	12,969	
BUS-0114				**3,460**	**3,478**	**0**	**0**	**3,818**	**3,837**	**0**	**0**		
	T018-112S-F	2W-XFMR	In	3,460	3,478	0	0	3,818	3,837	0	0	3,478	

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
BUS-0115				**25,316**	**26,201**	**0**	**0**	**31,177**	**32,293**	**0**	**0**		
	T018-134Y-A	2W-XFMR	In	25,316	26,201	0	0	31,177	32,293	0	0	26,201	
BUS-0116				**13,882**	**14,502**	**0**	**0**	**17,456**	**18,273**	**0**	**0**		
	T018-134Y-B	2W-XFMR	In	13,882	14,502	0	0	17,456	18,273	0	0	14,502	
BUS-0118				**28,168**	**29,267**	**0**	**0**	**34,684**	**36,067**	**0**	**0**		
	XF2-0086	2W-XFMR	In	28,168	29,267	0	0	34,684	36,067	0	0	29,267	
BUS-0119				**39,006**	**44,253**	**0**	**0**	**48,956**	**55,799**	**0**	**0**		
	T160-134Y-B	2W-XFMR	In	18,974	21,527	0	0	23,814	27,143	0	0	21,527	
	T160-134Y-A	2W-XFMR	In	20,049	22,745	0	0	25,163	28,680	0	0	22,745	
BUS-0120				**13,519**	**14,098**	**0**	**0**	**16,658**	**17,383**	**0**	**0**		
	T004-134Y-A	2W-XFMR	In	13,519	14,098	0	0	16,658	17,383	0	0	14,098	
BUS-0132				**4,387**	**4,648**	**0**	**0**	**5,503**	**6,139**	**0**	**0**		
	CBL-0048	CABLE	In	0	0	0	0	0	0	0	0		
	XF2-0079	2W-XFMR	In	4,387	4,648	0	0	5,503	6,139	0	0	4,648	
BUS-0133				**4,404**	**4,632**	**0**	**0**	**5,520**	**6,119**	**0**	**0**		
	CBL-0042	CABLE	In	0	79	0	0	0	104	0	0		
	XF2-0076	2W-XFMR	In	4,404	4,553	0	0	5,520	6,015	0	0	4,632	
Lower Substation				**5,310**	**6,116**	**0**	**0**	**7,168**	**8,365**	**0**	**0**		
	Cerro Vista 4P	CABLE	In	0	0	0	0	0	0	0	0		
	Dorm Loop 1	CABLE	In	0	0	0	0	0	0	0	0		
	CBL-0047	CABLE	In	5,310	6,116	0	0	7,168	8,365	0	0	6,116	
Lower Substation0				**5,416**	**6,256**	**0**	**0**	**7,299**	**8,543**	**0**	**0**		
	Dorm Loop 2	CABLE	In	0	0	0	0	0	0	0	0		
	Cerro Vista 2P	CABLE	In	0	0	0	0	0	0	0	0		
	CBL-0045	CABLE	In	5,416	6,256	0	0	7,299	8,543	0	0	6,256	
Middle Substation				**4,381**	**4,639**	**0**	**0**	**5,492**	**6,121**	**0**	**0**		
	Poly Canyon 1	CABLE	In	0	0	0	0	0	0	0	0		
	Poly Canyon 2	CABLE	In	0	0	0	0	0	0	0	0		
	CBL-0046	CABLE	In	0	0	0	0	0	0	0	0		
	CBL-0044	CABLE	In	0	0	0	0	0	0	0	0		
	CBL-0048	CABLE	In	4,381	4,639	0	0	5,492	6,121	0	0	4,639	
PG&E				**3,800**	**3,194**	**0**	**0**	**3,807**	**3,200**	**0**	**0**		
	XF2-0076	2W-XFMR	In	0	11	0	0	0	11	0	0		
	XF2-0079	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Utility	UTILITY	In	3,800	3,185	0	0	3,807	3,191	0	0	3,194	
S001-14-A				**4,293**	**4,458**	**0**	**0**	**5,280**	**5,732**	**0**	**0**		

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
	V02	CABLE	In	0	0	0	0	0	0	0	0		
	T065-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T001-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V01	CABLE	In	4,293	4,458	0	0	5,280	5,732	0	0	4,458	
S002-14-A				**3,812**	**3,749**	**0**	**0**	**4,382**	**4,402**	**0**	**0**		
	W15	CABLE	In	0	0	0	0	0	0	0	0		
	T002-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T003-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W14	CABLE	In	3,812	3,749	0	0	4,382	4,402	0	0	3,749	
S006-14-A				**4,224**	**4,352**	**0**	**0**	**5,136**	**5,507**	**0**	**0**		
	V03	CABLE	In	0	0	0	0	0	0	0	0		
	T006-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T006-134Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T006-134Y-C	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V02	CABLE	In	4,224	4,352	0	0	5,136	5,507	0	0	4,352	
S008-15-A				**4,131**	**4,207**	**0**	**0**	**4,958**	**5,222**	**0**	**0**		
	W09	CABLE	In	0	0	0	0	0	0	0	0		
	T024-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T008-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W08	CABLE	In	4,131	4,207	0	0	4,958	5,222	0	0	4,207	
S009-13-A				**4,105**	**4,168**	**0**	**0**	**4,907**	**5,147**	**0**	**0**		
	W10	CABLE	In	0	0	0	0	0	0	0	0		
	T009-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W09	CABLE	In	4,105	4,168	0	0	4,907	5,147	0	0	4,168	
S011-13-A				**4,000**	**4,016**	**0**	**0**	**4,711**	**4,862**	**0**	**0**		
	W11	CABLE	In	0	0	0	0	0	0	0	0		
	T011-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T197-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W10	CABLE	In	4,000	4,016	0	0	4,711	4,862	0	0	4,016	
S013-14-A				**3,957**	**3,953**	**0**	**0**	**4,633**	**4,750**	**0**	**0**		
	W12	CABLE	In	0	0	0	0	0	0	0	0		
	W16	CABLE	In	0	0	0	0	0	0	0	0		
	T013-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T192-134-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W11	CABLE	In	3,957	3,953	0	0	4,633	4,750	0	0	3,953	
S014-14-A				**3,751**	**3,669**	**0**	**0**	**4,295**	**4,292**	**0**	**0**		

Bus Name	Contributions			Initial Symmetrical Amps: 3 Phase	SLG	LLG	LL	Asymmetrical Amps: 3 Phase	SLG	LLG	LL	Init Sym Neutral Amps: SLG	LLG
	V12	CABLE	In	0	0	0	0	0	0	0	0		
	T014-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V10	CABLE	In	3,751	3,669	0	0	4,295	4,292	0	0	3,669	
S018-15-A				**4,164**	**4,263**	**0**	**0**	**5,018**	**5,325**	**0**	**0**		
	Z09	CABLE	In	0	0	0	0	0	0	0	0		
	Z10	CABLE	In	0	0	0	0	0	0	0	0		
	T018-112S-F	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T018-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T018-134Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Z07/Z06	CABLE	In	4,164	4,263	0	0	5,018	5,325	0	0	4,263	
S019-15-A				**3,966**	**3,969**	**0**	**0**	**4,666**	**4,805**	**0**	**0**		
	W07	CABLE	In	0	0	0	0	0	0	0	0		
	V06	CABLE	In	0	0	0	0	0	0	0	0		
	T019-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T040-134Y-E	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V05	CABLE	In	3,966	3,969	0	0	4,666	4,805	0	0	3,969	
S021-15-A				**3,753**	**3,671**	**0**	**0**	**4,298**	**4,295**	**0**	**0**		
	V10	CABLE	In	0	0	0	0	0	0	0	0		
	T021-132Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T026-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T021-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V09	CABLE	In	3,753	3,671	0	0	4,298	4,295	0	0	3,671	
S022-14-A				**4,262**	**4,407**	**0**	**0**	**5,219**	**5,626**	**0**	**0**		
	W04	CABLE	In	0	78	0	0	0	99	0	0		
	T022-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W03	CABLE	In	4,262	4,329	0	0	5,219	5,527	0	0	4,407	
S027-13-B				**3,805**	**3,743**	**0**	**0**	**4,385**	**4,412**	**0**	**0**		
	V09	CABLE	In	0	0	0	0	0	0	0	0		
	T027-132Y-C	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V08	CABLE	In	3,805	3,743	0	0	4,385	4,412	0	0	3,743	
S027-15-A				**3,838**	**3,789**	**0**	**0**	**4,441**	**4,490**	**0**	**0**		
	V08	CABLE	In	0	0	0	0	0	0	0	0		
	T051-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T133-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T027-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V07	CABLE	In	3,838	3,789	0	0	4,441	4,490	0	0	3,789	

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
S033-13-A				**4,334**	**4,520**	**0**	**0**	**5,370**	**5,870**	**0**	**0**		
	W02	CABLE	In	0	78	0	0	0	102	0	0		
	T033-134Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T033-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	To Upper Sub	CABLE	In	4,334	4,442	0	0	5,370	5,768	0	0	4,520	
S034-14-A				**3,888**	**3,856**	**0**	**0**	**4,512**	**4,581**	**0**	**0**		
	W14	CABLE	In	0	0	0	0	0	0	0	0		
	T038-132Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T034-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W13	CABLE	In	3,888	3,856	0	0	4,512	4,581	0	0	3,856	
S035-14-A				**3,930**	**3,916**	**0**	**0**	**4,586**	**4,684**	**0**	**0**		
	W13	CABLE	In	0	0	0	0	0	0	0	0		
	T035-134Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T005-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T035-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W12	CABLE	In	3,930	3,916	0	0	4,586	4,684	0	0	3,916	
S038-15-A				**4,183**	**4,285**	**0**	**0**	**5,060**	**5,376**	**0**	**0**		
	W08	CABLE	In	0	0	0	0	0	0	0	0		
	W06	CABLE	In	0	77	0	0	0	97	0	0		
	T010-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T038-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W05	CABLE	In	4,183	4,208	0	0	5,060	5,279	0	0	4,285	
S042-15-A				**4,063**	**4,111**	**0**	**0**	**4,833**	**5,049**	**0**	**0**		
	V05	CABLE	In	0	0	0	0	0	0	0	0		
	T130-134-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T042-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T042-134Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V04	CABLE	In	4,063	4,111	0	0	4,833	5,049	0	0	4,111	
S043-14-A				**3,882**	**3,851**	**0**	**0**	**4,518**	**4,596**	**0**	**0**		
	V07	CABLE	In	0	0	0	0	0	0	0	0		
	T043-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V06	CABLE	In	3,882	3,851	0	0	4,518	4,596	0	0	3,851	
S045-14-A				**4,145**	**4,234**	**0**	**0**	**4,980**	**5,268**	**0**	**0**		
	V04	CABLE	In	0	0	0	0	0	0	0	0		
	T045-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V03	CABLE	In	4,145	4,234	0	0	4,980	5,268	0	0	4,234	

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
S047-14-A				**4,291**	**4,452**	**0**	**0**	**5,279**	**5,722**	**0**	**0**		
	W03	CABLE	In	0	78	0	0	0	100	0	0		
	T047-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T053-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W02	CABLE	In	4,291	4,374	0	0	5,279	5,622	0	0	4,452	
S052-15-A				**4,158**	**4,246**	**0**	**0**	**5,011**	**5,300**	**0**	**0**		
	W07	CABLE	In	0	0	0	0	0	0	0	0		
	T020-123Y-C	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T014-134D-B	2W-XFMR	In	0	143	0	0	0	179	0	0		
	T052-134Y-A	2W-XFMR	In	0	59	0	0	0	74	0	0		
	T020-134Y-B	2W-XFMR	In	0	84	0	0	0	105	0	0		
	W06	CABLE	In	4,158	4,170	0	0	5,011	5,204	0	0	4,246	
S058-15-A				**4,239**	**4,370**	**0**	**0**	**5,171**	**5,549**	**0**	**0**		
	W05	CABLE	In	0	78	0	0	0	98	0	0		
	T074-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T036-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T058-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W04	CABLE	In	4,239	4,292	0	0	5,171	5,451	0	0	4,370	
S061-14-A				**3,690**	**3,587**	**0**	**0**	**4,196**	**4,159**	**0**	**0**		
	Z09	CABLE	In	0	0	0	0	0	0	0	0		
	T061-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T061-134Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V13	CABLE	In	3,690	3,587	0	0	4,196	4,159	0	0	3,587	
S101-43-A				**5,258**	**6,015**	**0**	**0**	**7,024**	**8,110**	**0**	**0**		
	D01, D02	CABLE	In	0	0	0	0	0	0	0	0		
	T101-434D-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Dorm Loop 1	CABLE	In	5,258	6,015	0	0	7,024	8,110	0	0	6,015	
S106-45-A				**4,747**	**5,095**	**0**	**0**	**5,808**	**6,165**	**0**	**0**		
	D03	CABLE	In	0	0	0	0	0	0	0	0		
	T105-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T106-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	D01, D02	CABLE	In	4,747	5,095	0	0	5,808	6,165	0	0	5,095	
S108-44-A				**4,489**	**4,674**	**0**	**0**	**5,303**	**5,448**	**0**	**0**		
	D04	CABLE	In	0	0	0	0	0	0	0	0		
	T108-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T107-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	D03	CABLE	In	4,489	4,674	0	0	5,303	5,448	0	0	4,674	

Bus Name	Contributions			Initial Symmetrical Amps 3 Phase	Initial Symmetrical Amps SLG	Initial Symmetrical Amps LLG	Initial Symmetrical Amps LL	Asymmetrical Amps 3 Phase	Asymmetrical Amps SLG	Asymmetrical Amps LLG	Asymmetrical Amps LL	Init Sym Neutral Amps SLG	Init Sym Neutral Amps LLG
S110-44-A				**4,500**	**4,655**	**0**	**0**	**5,263**	**5,370**	**0**	**0**		
	D04	CABLE	In	0	0	0	0	0	0	0	0		
	T110-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T109-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	G03	CABLE	In	4,500	4,655	0	0	5,263	5,370	0	0	4,655	
S112-44-A				**4,789**	**5,122**	**0**	**0**	**5,811**	**6,141**	**0**	**0**		
	G02	CABLE	In	0	0	0	0	0	0	0	0		
	T112-434Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Dorm Loop 2	CABLE	In	4,789	5,122	0	0	5,811	6,141	0	0	5,122	
S113-44-A				**4,778**	**5,104**	**0**	**0**	**5,789**	**6,109**	**0**	**0**		
	G03	CABLE	In	0	0	0	0	0	0	0	0		
	T114-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T113-432Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	G02	CABLE	In	4,778	5,104	0	0	5,789	6,109	0	0	5,104	
S124-15-A				**3,718**	**3,624**	**0**	**0**	**4,241**	**4,218**	**0**	**0**		
	W15	CABLE	In	0	0	0	0	0	0	0	0		
	V13	CABLE	In	0	0	0	0	0	0	0	0		
	T115-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T124-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	V12	CABLE	In	3,718	3,624	0	0	4,241	4,218	0	0	3,624	
S150-13-A				**4,171**	**4,273**	**0**	**0**	**5,031**	**5,345**	**0**	**0**		
	Z07/Z06	CABLE	In	0	0	0	0	0	0	0	0		
	XF2-0086	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Z02	CABLE	In	4,171	4,273	0	0	5,031	5,345	0	0	4,273	
S160-13-A				**4,219**	**4,345**	**0**	**0**	**5,127**	**5,493**	**0**	**0**		
	Z02	CABLE	In	0	0	0	0	0	0	0	0		
	T004-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T160-134Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T160-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Z01	CABLE	In	4,219	4,345	0	0	5,127	5,493	0	0	4,345	
S171-16-A				**4,235**	**4,409**	**0**	**0**	**5,177**	**5,611**	**0**	**0**		
	S05	CABLE	In	0	0	0	0	0	0	0	0		
	T171-132Y-B	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-C	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-D	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Poly Canyon 1	CABLE	In	4,235	4,409	0	0	5,177	5,611	0	0	4,409	

Bus Name	---------Contributions---------			----------Initial Symmetrical Amps---------- 3 Phase	SLG	LLG	LL	----------Asymmetrical Amps---------- 3 Phase	SLG	LLG	LL	---Init Sym Neutral Amps--- SLG	LLG
												4,622	
S171-16-B				**4,079**	**4,178**	**0**	**0**	**4,805**	**5,052**	**0**	**0**		
	S05	CABLE	In	0	0	0	0	0	0	0	0		
	T371-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-E	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-F	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-G	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T07	CABLE	In	4,079	4,178	0	0	4,805	5,052	0	0	4,178	
S171-16-C				**4,224**	**4,392**	**0**	**0**	**5,155**	**5,576**	**0**	**0**		
	T07	CABLE	In	0	0	0	0	0	0	0	0		
	T271-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-I	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-H	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T171-132Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	Poly Canyon 2	CABLE	In	4,224	4,392	0	0	5,155	5,576	0	0	4,392	
S201-13-A				**3,925**	**3,908**	**0**	**0**	**4,577**	**4,671**	**0**	**0**		
	Z10	CABLE	In	0	0	0	0	0	0	0	0		
	T007-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	T041-134Y-A	2W-XFMR	In	0	0	0	0	0	0	0	0		
	W16	CABLE	In	3,925	3,908	0	0	4,577	4,671	0	0	3,908	
Upper Substation				**4,398**	**4,622**	**0**	**0**	**5,509**	**6,101**	**0**	**0**		
	V01	CABLE	In	0	0	0	0	0	0	0	0		
	Z01	CABLE	In	0	0	0	0	0	0	0	0		
	To Upper Sub	CABLE	In	0	79	0	0	0	104	0	0		
	CBL-0042	CABLE	In	4,398	4,543	0	0	5,509	5,997	0	0		

Arc Flash Evaluation Report

Arc Flash Evaluation Study Options

Standard:	IEEE 1584	**Max Arcing Duration:**	2.0 seconds
Unit:	English	**Include Transformer Phase Shift:**	No
Clear Fault Threshold:	80 %	**Define Grounded as SLG/3P Fault >= :**	5.0 %
Check Upstream Miscoordination:	No		

---------- Flash Boundary Calculation Adjustment Option ----------

For voltage above 1 kV and trip time <= 0.1s, use 1.5 cal/cm^2 *(6.276 J/cm^2) for flash boundary calculation.

---------- Incident Energy Report Option for Equipment Below 240 V ----------

Report calculated incident energy from equation

---------- Generator and Synchronous Motor Decay Option ----------

---------- Induction Motor Decay Option ----------

Include induction motors for 5 cycles.

---------- Fuse Current Limiting Option ----------

Specify fuses as current limiting in the protective device library, manufacturer's equipment-specific Incident Energy equations will be used if available.

---------- Report Option ----------

Report Bus Results

Report main device

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
Bus-0002	0.208	MaxTripTime @2.0s	21.04	7.33	0.00	0.00	2.000	0.000	PNL	25	169.75	18.00	47.49	Category Dangerous! - No FR Category Found
BUS-0004	0.480	MaxTripTime @2.0s	29.58	16.56	0.00	0.00	2.000	0.000	PNL	25	290.24	18.00	114.51	Category Dangerous! - No FR Category Found
BUS-0006	0.480	MaxTripTime @2.0s	11.51	7.39	0.00	0.00	2.000	0.000	PNL	25	170.63	18.00	47.89	Category Dangerous! - No FR Category Found
BUS-0007	0.208	MaxTripTime @2.0s	15.07	5.80	0.00	0.00	2.000	0.000	PNL	25	145.47	18.00	36.86	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0009	0.208	MaxTripTime @2.0s	22.99	7.80	0.00	0.00	2.000	0.000	PNL	25	176.83	18.00	50.78	Category Dangerous! - No FR Category Found
BUS-0012	0.480	MaxTripTime @2.0s	43.43	22.99	0.00	0.00	2.000	0.000	PNL	25	360.27	18.00	163.27	Category Dangerous! - No FR Category Found
BUS-0013	0.208	MaxTripTime @2.0s	51.67	13.78	0.00	0.00	2.000	0.000	PNL	25	257.19	18.00	93.91	Category Dangerous! - No FR Category Found
BUS-0015	0.208	MaxTripTime @2.0s	40.46	11.61	0.00	0.00	2.000	0.000	PNL	25	229.67	18.00	77.99	Category Dangerous! - No FR Category Found
BUS-0016	0.480	MaxTripTime @2.0s	18.70	11.20	0.00	0.00	2.000	0.000	PNL	25	224.27	18.00	75.01	Category Dangerous! - No FR Category Found
BUS-0018	0.480	MaxTripTime @2.0s	24.40	14.05	0.00	0.00	2.000	0.000	PNL	25	260.49	18.00	95.89	Category Dangerous! - No FR Category Found
BUS-0020	0.208	MaxTripTime @2.0s	22.73	7.74	0.00	0.00	2.000	0.000	PNL	25	175.90	18.00	50.35	Category Dangerous! - No FR Category Found
BUS-0022	0.208	MaxTripTime @2.0s	12.96	5.22	0.00	0.00	2.000	0.000	PNL	25	135.66	18.00	32.87	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
BUS-0025	0.208	MaxTripTime @2.0s	39.50	11.41	0.00	0.00	2.000	0.000	PNL	25	227.15	18.00	76.59	Category Dangerous! - No FR Category Found
BUS-0026	0.480	MaxTripTime @2.0s	14.80	9.16	0.00	0.00	2.000	0.000	PNL	25	196.55	18.00	60.41	Category Dangerous! - No FR Category Found
BUS-0028	0.208	MaxTripTime @2.0s	40.02	11.52	0.00	0.00	2.000	0.000	PNL	25	228.52	18.00	77.35	Category Dangerous! - No FR Category Found
BUS-0030	0.480	MaxTripTime @2.0s	8.99	5.99	0.00	0.00	2.000	0.000	PNL	25	148.49	18.00	38.13	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0032	0.208	MaxTripTime @2.0s	41.82	11.88	0.00	0.00	2.000	0.000	PNL	25	233.21	18.00	79.98	Category Dangerous! - No FR Category Found
BUS-0034	0.208	MaxTripTime @2.0s	11.26	4.73	0.00	0.00	2.000	0.000	PNL	25	127.08	18.00	29.53	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0035	0.480	MaxTripTime @2.0s	17.65	10.66	0.00	0.00	2.000	0.000	PNL	25	217.09	18.00	71.11	Category Dangerous! - No FR Category Found
BUS-0037	0.480	MaxTripTime @2.0s	9.08	6.04	0.00	0.00	2.000	0.000	PNL	25	149.37	18.00	38.50	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0038	0.208	MaxTripTime @2.0s	9.90	4.32	0.00	0.00	2.000	0.000	PNL	25	119.77	18.00	26.79	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0040	0.480	MaxTripTime @2.0s	31.79	17.61	0.00	0.00	2.000	0.000	PNL	25	302.28	18.00	122.41	Category Dangerous! - No FR Category Found
BUS-0042	0.480	MaxTripTime @2.0s	41.19	21.97	0.00	0.00	2.000	0.000	PNL	25	349.69	18.00	155.48	Category Dangerous! - No FR Category Found
BUS-0044	0.480	MaxTripTime @2.0s	30.20	16.86	0.00	0.00	2.000	0.000	PNL	25	293.66	18.00	116.74	Category Dangerous! - No FR Category Found

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
BUS-0048	0.208	MaxTripTime @2.0s	24.12	8.07	0.00	0.00	2.000	0.000	PNL	25	180.81	18.00	52.67	Category Dangerous! - No FR Category Found
BUS-0049	0.480	MaxTripTime @2.0s	18.26	10.97	0.00	0.00	2.000	0.000	PNL	25	221.28	18.00	73.37	Category Dangerous! - No FR Category Found
BUS-0052	0.208	MaxTripTime @2.0s	7.91	3.69	0.00	0.00	2.000	0.000	PNL	25	107.97	18.00	22.60	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0054	0.208	MaxTripTime @2.0s	30.10	9.43	0.00	0.00	2.000	0.000	PNL	25	200.32	18.00	62.32	Category Dangerous! - No FR Category Found
BUS-0056	0.208	MaxTripTime @2.0s	32.39	9.93	0.00	0.00	2.000	0.000	PNL	25	207.22	18.00	65.88	Category Dangerous! - No FR Category Found
BUS-0057	0.480	MaxTripTime @2.0s	11.66	7.48	0.00	0.00	2.000	0.000	PNL	25	171.88	18.00	48.47	Category Dangerous! - No FR Category Found
BUS-0059	0.208	MaxTripTime @2.0s	23.64	7.96	0.00	0.00	2.000	0.000	PNL	25	179.13	18.00	51.87	Category Dangerous! - No FR Category Found
BUS-0060	0.480	MaxTripTime @2.0s	12.20	7.77	0.00	0.00	2.000	0.000	PNL	25	176.33	18.00	50.55	Category Dangerous! - No FR Category Found
BUS-0063	0.208	MaxTripTime @2.0s	13.10	5.26	0.00	0.00	2.000	0.000	PNL	25	136.30	18.00	33.13	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0065	0.480	MaxTripTime @2.0s	20.16	11.94	0.00	0.00	2.000	0.000	PNL	25	233.94	18.00	80.39	Category Dangerous! - No FR Category Found
BUS-0066	0.208	MaxTripTime @2.0s	7.92	3.69	0.00	0.00	2.000	0.000	PNL	25	107.99	18.00	22.61	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0068	0.208	MaxTripTime @2.0s	13.38	5.34	0.00	0.00	2.000	0.000	PNL	25	137.66	18.00	33.67	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
BUS-0071	0.480	MaxTripTime @2.0s	4.22	3.14	0.00	0.00	2.000	0.000	PNL	25	113.63	18.00	24.58	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0073	0.208	MaxTripTime @2.0s	14.76	5.72	0.00	0.00	2.000	0.000	PNL	25	144.04	18.00	36.27	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0075	0.208	MaxTripTime @2.0s	14.45	5.63	0.00	0.00	2.000	0.000	PNL	25	142.65	18.00	35.70	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0076	0.208	MaxTripTime @2.0s	14.59	5.67	0.00	0.00	2.000	0.000	PNL	25	143.28	18.00	35.96	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0077	0.208	MaxTripTime @2.0s	34.05	10.28	0.00	0.00	2.000	0.000	PNL	25	212.05	18.00	68.42	Category Dangerous! - No FR Category Found
BUS-0082	0.480	MaxTripTime @2.0s	6.67	4.64	0.00	0.00	2.000	0.000	PNL	25	125.59	18.00	28.96	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0083	4.160	MaxTripTime @2.0s	5.24	5.14	0.00	0.00	2.000	0.000	SWG	104	354.59	36.00	11.07	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0084	0.208	MaxTripTime @2.0s	21.94	7.55	0.00	0.00	2.000	0.000	PNL	25	173.06	18.00	49.02	Category Dangerous! - No FR Category Found
BUS-0085	4.160	MaxTripTime @2.0s	5.18	5.08	0.00	0.00	2.000	0.000	SWG	104	350.09	36.00	10.93	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0086	0.208	MaxTripTime @2.0s	21.89	7.54	0.00	0.00	2.000	0.000	PNL	25	172.87	18.00	48.93	Category Dangerous! - No FR Category Found
BUS-0087	4.160	MaxTripTime @2.0s	5.40	5.30	0.00	0.00	2.000	0.000	SWG	104	366.56	36.00	11.43	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0088	0.208	MaxTripTime @2.0s	36.67	10.83	0.00	0.00	2.000	0.000	PNL	25	219.46	18.00	72.39	Category Dangerous! - No FR Category Found

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
BUS-0089	4.160	MaxTripTime @2.0s	5.30	5.20	0.00	0.00	2.000	0.000	SWG	104	359.08	36.00	11.20	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0092	0.208	MaxTripTime @2.0s	62.92	15.83	0.00	0.00	2.000	0.000	PNL	25	281.72	18.00	109.05	Category Dangerous! - No FR Category Found
BUS-0093	0.480	MaxTripTime @2.0s	6.78	4.70	0.00	0.00	2.000	0.000	PNL	25	126.68	18.00	29.38	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0095	0.208	MaxTripTime @2.0s	63.11	15.86	0.00	0.00	2.000	0.000	PNL	25	282.12	18.00	109.31	Category Dangerous! - No FR Category Found
BUS-0097	0.480	MaxTripTime @2.0s	20.64	12.18	0.00	0.00	2.000	0.000	PNL	25	237.02	18.00	82.13	Category Dangerous! - No FR Category Found
BUS-0098	0.208	MaxTripTime @2.0s	54.79	14.36	0.00	0.00	2.000	0.000	PNL	25	264.27	18.00	98.19	Category Dangerous! - No FR Category Found
BUS-0111	0.480	MaxTripTime @2.0s	36.73	19.93	0.00	0.00	2.000	0.000	PNL	25	327.89	18.00	139.89	Category Dangerous! - No FR Category Found
BUS-0112	0.208	MaxTripTime @2.0s	13.11	5.26	0.00	0.00	2.000	0.000	PNL	25	136.37	18.00	33.15	Category 4 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0114	0.240	MaxTripTime @2.0s	3.55	2.17	0.00	0.00	2.000	0.000	PNL	25	76.01	18.00	12.71	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
BUS-0115	0.208	MaxTripTime @2.0s	26.01	8.51	0.00	0.00	2.000	0.000	PNL	25	187.22	18.00	55.77	Category Dangerous! - No FR Category Found
BUS-0116	0.480	MaxTripTime @2.0s	14.27	8.88	0.00	0.00	2.000	0.000	PNL	25	192.56	18.00	58.41	Category Dangerous! - No FR Category Found
BUS-0118	0.208	MaxTripTime @2.0s	28.94	9.17	0.00	0.00	2.000	0.000	PNL	25	196.70	18.00	60.48	Category Dangerous! - No FR Category Found

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
BUS-0119	0.480	MaxTripTime @2.0s	40.06	21.46	0.00	0.00	2.000	0.000	PNL	25	344.25	18.00	151.53	Category Dangerous! - No FR Category Found
BUS-0120	0.480	MaxTripTime @2.0s	13.88	8.68	0.00	0.00	2.000	0.000	PNL	25	189.60	18.00	56.94	Category Dangerous! - No FR Category Found
Lower Substation	4.160	MaxTripTime @2.0s	5.37	5.27	0.00	0.00	2.000	0.000	SWG	104	364.13	36.00	11.36	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
Lower Substation0	4.160	MaxTripTime @2.0s	5.48	5.37	0.00	0.00	2.000	0.000	SWG	104	372.08	36.00	11.60	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
Middle Substation	12.470	MaxTripTime @2.0s	4.40	4.33	0.00	0.00	2.000	0.000	SWG	153	332.77	36.00	10.40	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
PG&E	70.000	MaxTripTime @2.0s	3.80	3.80	0.00	0.00	2.000	0.000	AIR	153	594.16	18.00	1,302.09	Category Dangerous! - NO SAFE PPE EXISTS
S001-14-A	12.470	MaxTripTime @2.0s	4.36	4.30	0.00	0.00	2.000	0.000	SWG	153	329.91	36.00	10.32	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S002-14-A	12.470	MaxTripTime @2.0s	4.19	4.13	0.00	0.00	2.000	0.000	SWG	153	315.67	36.00	9.88	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S006-14-A	12.470	MaxTripTime @2.0s	4.34	4.27	0.00	0.00	2.000	0.000	SWG	153	327.98	36.00	10.26	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S008-15-A	12.470	MaxTripTime @2.0s	4.31	4.24	0.00	0.00	2.000	0.000	SWG	153	325.22	36.00	10.17	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S009-13-A	12.470	MaxTripTime @2.0s	4.30	4.23	0.00	0.00	2.000	0.000	SWG	153	324.47	36.00	10.15	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S011-13-A	12.470	MaxTripTime @2.0s	4.26	4.20	0.00	0.00	2.000	0.000	SWG	153	321.41	36.00	10.06	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
S013-14-A	12.470	MaxTripTime @2.0s	4.24	4.18	0.00	0.00	2.000	0.000	SWG	153	320.11	36.00	10.02	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S014-14-A	12.470	MaxTripTime @2.0s	4.14	4.08	0.00	0.00	2.000	0.000	SWG	153	311.81	36.00	9.76	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S018-15-A	12.470	MaxTripTime @2.0s	4.32	4.25	0.00	0.00	2.000	0.000	SWG	153	326.31	36.00	10.21	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S019-15-A	12.470	MaxTripTime @2.0s	4.25	4.18	0.00	0.00	2.000	0.000	SWG	153	320.49	36.00	10.03	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S021-15-A	12.470	MaxTripTime @2.0s	4.14	4.08	0.00	0.00	2.000	0.000	SWG	153	311.85	36.00	9.77	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S022-14-A	12.470	MaxTripTime @2.0s	4.35	4.28	0.00	0.00	2.000	0.000	SWG	153	328.96	36.00	10.29	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S027-13-B	12.470	MaxTripTime @2.0s	4.16	4.10	0.00	0.00	2.000	0.000	SWG	153	313.48	36.00	9.82	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S027-15-A	12.470	MaxTripTime @2.0s	4.20	4.14	0.00	0.00	2.000	0.000	SWG	153	316.60	36.00	9.91	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S033-13-A	12.470	MaxTripTime @2.0s	4.38	4.31	0.00	0.00	2.000	0.000	SWG	153	330.99	36.00	10.35	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S034-14-A	12.470	MaxTripTime @2.0s	4.22	4.16	0.00	0.00	2.000	0.000	SWG	153	318.03	36.00	9.95	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S035-14-A	12.470	MaxTripTime @2.0s	4.24	4.17	0.00	0.00	2.000	0.000	SWG	153	319.31	36.00	9.99	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S038-15-A	12.470	MaxTripTime @2.0s	4.32	4.26	0.00	0.00	2.000	0.000	SWG	153	326.69	36.00	10.22	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
S042-15-A	12.470	MaxTripTime @2.0s	4.28	4.22	0.00	0.00	2.000	0.000	SWG	153	323.38	36.00	10.12	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S043-14-A	12.470	MaxTripTime @2.0s	4.22	4.15	0.00	0.00	2.000	0.000	SWG	153	317.96	36.00	9.95	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S045-14-A	12.470	MaxTripTime @2.0s	4.31	4.25	0.00	0.00	2.000	0.000	SWG	153	325.76	36.00	10.19	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S047-14-A	12.470	MaxTripTime @2.0s	4.36	4.29	0.00	0.00	2.000	0.000	SWG	153	329.78	36.00	10.31	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S052-15-A	12.470	MaxTripTime @2.0s	4.32	4.25	0.00	0.00	2.000	0.000	SWG	153	325.96	36.00	10.20	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S058-15-A	12.470	MaxTripTime @2.0s	4.34	4.28	0.00	0.00	2.000	0.000	SWG	153	328.29	36.00	10.27	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S061-14-A	12.470	MaxTripTime @2.0s	4.12	4.06	0.00	0.00	2.000	0.000	SWG	153	309.87	36.00	9.71	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S101-43-A	4.160	MaxTripTime @2.0s	5.35	5.25	0.00	0.00	2.000	0.000	SWG	104	362.82	36.00	11.32	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S106-45-A	4.160	MaxTripTime @2.0s	5.17	5.07	0.00	0.00	2.000	0.000	SWG	104	349.26	36.00	10.90	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S108-44-A	4.160	MaxTripTime @2.0s	5.07	4.97	0.00	0.00	2.000	0.000	SWG	104	341.83	36.00	10.68	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S110-44-A	4.160	MaxTripTime @2.0s	5.14	5.04	0.00	0.00	2.000	0.000	SWG	104	346.94	36.00	10.83	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S112-44-A	4.160	MaxTripTime @2.0s	5.25	5.15	0.00	0.00	2.000	0.000	SWG	104	355.41	36.00	11.09	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit

Bus Name	Bus kV	Protective Device Name	Bus Bolted Fault (kA)	Bus Arcing Fault (kA)	Prot Bolted Fault (kA)	Prot Arcing Fault (kA)	Trip/ Delay Time (sec.)	Breaker Opening Time (sec.)	Equip Type	Gap (mm)	ArcFlash Boundary (in)	Working Distance (in)	Incident Energy (cal/cm2)	Required Protective FR Clothing Category
S113-44-A	4.160	MaxTripTime @2.0s	5.25	5.15	0.00	0.00	2.000	0.000	SWG	104	355.11	36.00	11.08	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S124-15-A	12.470	MaxTripTime @2.0s	4.13	4.07	0.00	0.00	2.000	0.000	SWG	153	310.75	36.00	9.73	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S150-13-A	12.470	MaxTripTime @2.0s	4.32	4.26	0.00	0.00	2.000	0.000	SWG	153	326.50	36.00	10.21	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S160-13-A	12.470	MaxTripTime @2.0s	4.34	4.27	0.00	0.00	2.000	0.000	SWG	153	327.86	36.00	10.25	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S171-16-A	12.470	MaxTripTime @2.0s	4.35	4.28	0.00	0.00	2.000	0.000	SWG	153	328.66	36.00	10.28	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S171-16-B	12.470	MaxTripTime @2.0s	4.29	4.23	0.00	0.00	2.000	0.000	SWG	153	324.17	36.00	10.14	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S171-16-C	12.470	MaxTripTime @2.0s	4.34	4.28	0.00	0.00	2.000	0.000	SWG	153	328.35	36.00	10.27	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
S201-13-A	12.470	MaxTripTime @2.0s	4.23	4.17	0.00	0.00	2.000	0.000	SWG	153	319.16	36.00	9.99	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit
Upper Substation	12.470	MaxTripTime @2.0s	4.40	4.33	0.00	0.00	2.000	0.000	SWG	153	332.77	36.00	10.40	Category 3 - Arc-rated FR Shirt & Pants & Arc Flash Suit