Appendix E

Coordination, Device Evaluation, Short Circuit, and Arc Flash Study

for the

Summerland PARC Facility in Summerland, British Columbia

Stantec

One Team.
Infinite Solutions.

Prepared for:

Public Works and Government Services Canada
Pacific Region
800 Burrard Street, 12th floor
Vancouver, B.C.

Prepared by:

Stantec Consulting Limited
1331 Clyde Avenue – Suite 400
Ottawa Ontario, K2C 3G4

August 16, 2013
Issued for Review – Revision 1

TABLE OF CONTENTS

INTRODUCTION

POWER SYSTEMS STUDIES

Stantec Consulting Ltd. is pleased to submit the following Short Circuit, Protective Device Coordination, and Arc Flash Studies for the Summerland Agriculture and Agri-food Canada Research Centre, in Summerland, British Columbia, Canada. These studies have been prepared in accordance with the pertinent standards, including National Electrical Manufacturer's Association (NEMA), Institute of Electrical and Electronic Engineers (IEEE), InterNational Electrical Testing Association (NETA), National Fire Protection Association (NFPA), Canadian Standards Authority (CSA), American National Standards Institute (ANSI), and other related standards.

The Short Circuit Study was performed to calculate the maximum currents that flow in the electrical system under bolted three-phase and single-phase fault conditions. All main system components are included within the model to determine actual system impedances, including any large motors and generators that may contribute to the fault.

The Device Evaluation Study uses the short circuit values calculated in the Short Circuit Study to verify the ability of existing electrical system components to withstand mechanical and thermal stresses caused by the fault condition. It will also verify whether all protective devices can interrupt the maximum fault duties where they are located.

The Coordination Study is performed to determine the protective device settings and fuse size requirements to ensure proper protection and maximum selectivity in the event of a thermal overload or short circuit fault condition.

The Arc Flash Study uses the results of the Short Circuit and Coordination Study, combined with switchgear characteristics, to assess the level of arc flash hazard present at significant busses within the system.

Actual fault levels have been requested from the utility (Fortis BC) and are not available at this time. The study will be updated upon receipt of actual utility fault data.

SCOPE OF STUDIES

The Short-Circuit Study includes all busses from the 8.3kV incoming supply, down to the main low-voltage distribution within the facility shown on the single line.

The Device Evaluation Study includes all protective devices within the scope of the short-circuit study.

The Coordination Study includes the same devices as the Short-Circuit Study, except only the two largest circuit breakers or fuses on each low-voltage distribution panel supplied directly from a main low-voltage switchboard are considered for coordination purposes.

The Arc Flash Hazard Analysis includes the same busses as the Short Circuit Study. All downstream equipment shall be categorized according to CSA Z462 Table 4.

Short-Circuit and Arc-Flash Hazard Calculations are performed for the system in its normal configuration only i.e. with all normally-closed switches closed, and all normally-open switches open. Additional calculations are performed for the system when supplied by emergency generator.

In the emergency short circuit tables the normal distribution is still shown as supplied by normal power, and will therefore have data identical to the normal short circuit tables. Busses fed from emergency will

have data different from what is shown in the normal short circuit tables.

OBJECTIVES

The study was requested by Public Works and Government Services Canada to review the coordination and selectivity of the protective devices within the facilities distribution system, identify any shortcomings in the overcurrent protection including underrated protective devices, and to have arc flash calculations performed in accordance with the CSA standard Z462.

ASSUMPTIONS

1. Short Circuit calculations are performed for a three-phase maximum short circuit fault level of LLL 500MVA, LG 167MVA, X_1/R_1 of 15, and an X_0/R_0 of 15 at 8,300V. These values are typical design values and were used because the actual fault levels at the Summerland PARC are not available at this time. Actual utility fault levels will be confirmed with Fortis BC prior to printing the arc flash labels.
2. The remainder of the data was gathered by site observation by Stantec, supplemented by existing maintenance manuals, shop drawings, and single line drawings as provided by the facility personnel.
3. All cable lengths are estimated based on equipment locations and scaled drawings. The exact routing of cables is not possible to determine due to site conditions.
4. Typical X/R values have been assumed for all transformers.
5. Transformer impedance is determined based on site observation, shop drawings, and transformers with similar kVA ratings.
6. The CT ratios for the ground relays on panel MDC_1's MDC_L feed, 1N panel feed, 2N panel feed, 4N panel feed, and 5N panel feed is assumed to be 1200:5.
7. All pumps below 50hp need not be considered as they will not contribute energy to short circuits as per IEEE standard 1584-2002.

RESULTS AND RECOMMENDATIONS

1. As much infrastructure data as possible was confirmed during site visits and existing documentation such as O&M manuals, shop drawings, test reports, and single line drawings. Recommended Settings are provided to improve coordination with downstream overcurrent devices in the Device Settings Table under Tab D. It is recommended that the study to be updated every 5 years or whenever there are major revisions to the power system.
2. The breakers within the downstream electrical distribution are typically moulded case breakers with thermal magnetic trip units which are not optimal for achieving completely selective coordination. The best possible coordination was achieved with the existing devices. The moulded case breakers trip curves overlap in the short circuit instantaneous region, which cannot be avoided due to the trip unit characteristics, as can be seen in some of the time current curves shown in Appendix C.
3. Within the main 600V panelboard MDC-1, there is no ground fault protection on many of the feeder breakers sized 400A and lower. This can lead to problematic coordination, as shown in TCC G01, as a low level ground fault downstream of the 400A breaker feeding the cooling tower chiller motor, may provide enough fault current to trip the 15kV breaker ground fault relay, but not enough to clear the phase element of the 600V feeder breaker. External ground relay can be installed on the larger feeder breakers (typically those that have an instantaneous curve above 1200A) or those larger feeder breakers can be retrofitted with breakers that have solid state trip units that implement ground fault protection to isolate the ground fault to the individual feeder rather than tripping the main breaker upstream.
4. Under normal power the breakers contained within emergency panel MDC_S could experience fault levels that exceed their interrupting rating. The breakers may need to be replaced subject to confirmation of the fault levels from the utility.
5. The FPE 600V air circuit breaker that feeds the Transfer Switch is using an USD-61 solid state trip unit with LSIG elements. This trip unit is a 1st generation solid state trip unit which uses discrete solid state components and implements peak sensing of current to detect overloads or short circuits. As such, in areas of high harmonics this may result in inaccurate tripping results or nuisance tripping. The characteristics of the solid state electronics also change as the components age resulting in tolerance issues with initial settings and specifications. We would recommend that this trip unit be retrofitted to a new true RMS digital trip unit for this critical load.
6. The existing single line drawings used by the facility personnel are hand marked up hard copies of an original drawing from 1984. AutoCAD drawings are not available. It is recommended that the single line drawings be updated using AutoCAD or equivalent on a regular basis.

APPENDIX A

SHORT CIRCUIT STUDY

The purpose of the Short Circuit Study is to determine the maximum current that will flow in the power system under worst-case three-phase and single line-to-ground fault conditions. Any electrical equipment subjected to these conditions must be rated to safely withstand and/or interrupt these faults. The fault currents calculated in the study are used:

- For selecting interrupting equipment of sufficient short circuit rating.
- To verify the ability of electrical system components to withstand mechanical and thermal stresses caused by the fault condition.
- To determine the time-current coordination of protective relays and fuses. These values are used to show the device "cut off" at the maximum symmetrical fault level of individual bus points

Electrical apparatus manufactured in North America is tested and rated against ANSI, ULC, and NEMA equipment standards, which outline the preferred methods in calculating fault duties for equipment rated to operate at voltage levels:

- Above 1000 volts is considered High and Medium voltage.
- Below 1000 volts is considered Low voltage.

The short circuit calculations depicted in this study were performed using PTW version 7.0, an electrical system modeling software program developed by SKM System Analysis Inc. This software program adheres to the specifications of the American National Standards Institute (ANSI) C37.010, C37.5, and the Institute of Electrical and Electronic Engineers (IEEE) Standard 142.

Short circuit fault contributions include the Utility, large AC motors, and standby generators. DC machines and very small AC motors that do not contribute large fault currents and are excluded from the study. The pre-fault voltage for all calculations is 1.00 Per Unit.

Three types of short-circuits are defined, depending on the time frame of interest taken from the inception of the fault, as:

- First cycle currents
- Interrupting currents
- Time delayed currents

First cycle currents are the initial currents calculated at ½ cycle after fault initiation. First cycle currents relate to the duty devices face when 'closing against' or withstanding short-circuit currents, also called 'close and latch' currents. These currents often contain DC offset, and are calculated on the premise of no ac decrement in the contributing sources. These currents are used to evaluate the combined withstand and interrupting rating of low voltage protective devices, and to evaluate the closing and latching (or momentary) rating of medium and high voltage circuit breakers.

Interrupting currents are the currents calculated from 2–8 cycles after fault initiation, and are seen by typical protective devices when interrupting a fault. These currents are still asymmetrical (i.e. contain DC offset), but consideration to ac decrement is given due to the elapsed time from the fault inception.

Time delayed currents are the short circuit currents that existing beyond 8 cycles and up to 30 cycles from the fault initiation. They are typically represented by purely symmetrical values in that they do not have any dc offset, induction and synchronous motor contributions are neglected, while contributing generators are assumed to have attained transient or higher value reactances.

Short Circuit Report - ANSI Calculations - Medium Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Mom. Fault Amps Based on Sym*1.6	Based on X/R	Interrupting Fault Duty 2 Cycle	3 Cycle	5 Cycle	8 Cycle	Source Z Equivalent R+jX (PU)
8,300 Volt Busses											
BC HYDRO_BUS	3 Phase:	34,780	500.0	15.00	55,648	52,925	46,432	40,241	37,110	35,476	0.009 + j0.137
	SLG:	34,850		15.00	55,760	53,031	46,524	40,321	37,185	35,547	0.040 + j0.597
MAIN_BRKR_PRI_BUS	3 Phase:	14,409	207.2	1.56	23,055	14,661	14,548	14,409	14,409	14,409	0.180 + j0.280
	SLG:	11,626		1.65	18,602	11,884	11,752	11,626	11,626	11,626	0.929 + j1.536
MAIN_TX_PRI_BUS	3 Phase:	14,405	207.1	1.56	23,049	14,657	14,544	14,405	14,405	14,405	0.180 + j0.280
	SLG:	11,620		1.65	18,592	11,878	11,746	11,620	11,620	11,620	0.929 + j1.537

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
600 Volt Busses										
1H_3H_PRI_BUS	3 Phase:	22,119	23.0	1.14	22,208	22,163	4.350	4.350	6.230	0.010 + j0.012
	SLG:	19,334		1.14	19,412	---	---	---	---	0.010 + j0.011
1J_2J_PRI_BUS	3 Phase:	10,413	10.8	.59	10,413	10,413	9.241	9.241	14.769	0.029 + j0.017
	SLG:	8,686		0.63	8,687	---	---	---	---	0.028 + j0.018
1K_2K_PRI_BUS	3 Phase:	11,092	11.5	.62	11,092	11,092	8.675	8.675	13.800	0.027 + j0.016
	SLG:	9,271		0.65	9,272	---	---	---	---	0.026 + j0.017
1N_PRI_BUS	3 Phase:	13,320	13.8	1.22	13,398	13,359	7.224	7.224	12.601	0.016 + j0.020
	SLG:	10,690		1.37	10,797	---	---	---	---	0.016 + j0.022
1Q_PRI_BUS	3 Phase:	1,512	1.6	.10	1,512	1,512	63.621	63.621	100.979	0.228 + j0.023
	SLG:	1,265		0.11	1,265	---	---	---	---	0.227 + j0.026
1R_PRI_BUS	3 Phase:	4,993	5.2	.20	4,993	4,993	19.274	19.274	30.176	0.068 + j0.013
	SLG:	4,201		0.20	4,201	---	---	---	---	0.067 + j0.013
1S_TX_PRI_BUS	3 Phase:	26,995	28.1	1.47	27,371	27,183	3.565	3.565	4.758	0.007 + j0.011
	SLG:	24,286		1.45	24,599	---	---	---	---	0.007 + j0.010
1T_PRI_BUS	3 Phase:	2,537	2.6	.13	2,537	2,537	37.925	37.925	59.979	0.135 + j0.018
	SLG:	2,125		0.14	2,125	---	---	---	---	0.135 + j0.019
1U_PRI_BUS	3 Phase:	9,774	10.2	.57	9,774	9,774	9.845	9.845	15.801	0.031 + j0.018
	SLG:	8,139		0.61	8,139	---	---	---	---	0.030 + j0.019
2H_3H_PRI_BUS	3 Phase:	21,657	22.5	1.11	21,732	21,694	4.443	4.443	6.399	0.011 + j0.012
	SLG:	18,885		1.11	18,951	---	---	---	---	0.010 + j0.011
2N_PRI_BUS	3 Phase:	13,183	13.7	1.22	13,258	13,221	7.299	7.299	12.752	0.017 + j0.020
	SLG:	10,572		1.36	10,676	---	---	---	---	0.016 + j0.022
3N_PRI_BUS	3 Phase:	9,929	10.3	.76	9,932	9,931	9.691	9.691	16.330	0.028 + j0.021
	SLG:	8,096		0.85	8,101	---	---	---	---	0.027 + j0.023
3S_TX_PRI_BUS	3 Phase:	5,863	6.1	.40	5,863	5,863	16.412	16.412	26.619	0.055 + j0.022
	SLG:	4,861		0.45	4,861	---	---	---	---	0.054 + j0.024
4H_5H_PRI_BUS	3 Phase:	22,597	23.5	1.17	22,703	22,650	4.258	4.258	6.063	0.010 + j0.012
	SLG:	19,800		1.17	19,893	---	---	---	---	0.009 + j0.011

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
4N_PRI_BUS	3 Phase:	15,459	16.1	1.34	15,599	15,529	6.224	6.224	10.573	0.013 + j0.018
	SLG:	12,555		1.47	12,728	---	---	---	---	0.013 + j0.019
4S_TX_PRI_BUS	3 Phase:	2,864	3.0	.17	2,864	2,864	33.602	33.602	53.395	0.119 + j0.020
	SLG:	2,394		0.18	2,394	---	---	---	---	0.119 + j0.022
5N_PRI_BUS	3 Phase:	16,110	16.7	1.37	16,275	16,193	5.973	5.973	10.059	0.013 + j0.017
	SLG:	13,133		1.50	13,333	---	---	---	---	0.012 + j0.018
6N_PRI_BUS	3 Phase:	12,791	13.3	.87	12,800	12,795	7.523	7.523	12.375	0.020 + j0.018
	SLG:	10,538		0.95	10,552	---	---	---	---	0.020 + j0.019
ALTERNATOR	3 Phase:	34,426	35.8	3.76	40,394	37,472	2.795	2.795	3.334	0.003 + j0.010
	SLG:	32,355		4.00	38,489	---	---	---	---	0.002 + j0.009
ATS_LOAD_BUS	3 Phase:	35,745	37.1	5.14	45,069	40,549	2.692	2.692	3.128	0.002 + j0.010
	SLG:	33,935		5.93	44,163	---	---	---	---	0.001 + j0.008
ATS_NORMAL_BUS	3 Phase:	35,745	37.1	5.14	45,069	40,549	2.692	2.692	3.128	0.002 + j0.010
	SLG:	33,935		5.93	44,163	---	---	---	---	0.001 + j0.008
CDP-EP Panel	3 Phase:	34,886	36.3	4.57	42,810	38,954	2.758	2.758	3.280	0.002 + j0.010
	SLG:	32,833		5.09	41,302	---	---	---	---	0.002 + j0.009
CH01_BUS	3 Phase:	25,232	26.2	1.50	25,609	25,421	3.814	3.814	5.305	0.008 + j0.011
	SLG:	22,322		1.51	22,665	---	---	---	---	0.007 + j0.011
CH02_BUS	3 Phase:	25,232	26.2	1.50	25,609	25,421	3.814	3.814	5.305	0.008 + j0.011
	SLG:	22,322		1.51	22,665	---	---	---	---	0.007 + j0.011
CT01_STARTER	3 Phase:	33,322	34.6	2.73	36,506	34,933	2.888	2.888	3.475	0.004 + j0.010
	SLG:	31,206		2.74	34,221	---	---	---	---	0.003 + j0.009
CT01B1_BUS	3 Phase:	29,132	30.3	1.58	29,670	29,401	3.303	3.303	4.209	0.006 + j0.010
	SLG:	26,697		1.50	27,102	---	---	---	---	0.006 + j0.009
CT01B2_BUS	3 Phase:	29,132	30.3	1.58	29,670	29,401	3.303	3.303	4.209	0.006 + j0.010
	SLG:	26,697		1.50	27,102	---	---	---	---	0.006 + j0.009
CT01C_STARTER	3 Phase:	27,164	28.2	1.27	27,359	27,261	3.542	3.542	4.603	0.008 + j0.010
	SLG:	24,713		1.18	24,834	---	---	---	---	0.007 + j0.009
H_PANEL	3 Phase:	17,678	18.4	.77	17,683	17,680	5.443	5.443	8.012	0.016 + j0.012
	SLG:	15,275		0.77	15,279	---	---	---	---	0.015 + j0.011

Stantec

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
J_PANEL	3 Phase:	14,174	14.7	.93	14,190	14,182	6.789	6.789	11.024	0.018 + j0.017
	SLG:	11,744		1.00	11,766	---	---	---	---	0.017 + j0.017
K_PANEL	3 Phase:	7,747	8.1	.41	7,747	7,747	12.420	12.420	19.672	0.041 + j0.017
	SLG:	6,487		0.44	6,487	---	---	---	---	0.041 + j0.018
L_PANEL	3 Phase:	6,741	7.0	.38	6,741	6,741	14.274	14.274	22.727	0.048 + j0.018
	SLG:	5,632		0.41	5,632	---	---	---	---	0.047 + j0.019
M_PANEL	3 Phase:	25,850	26.9	1.28	26,043	25,947	3.722	3.722	4.985	0.008 + j0.011
	SLG:	23,226		1.25	23,379	---	---	---	---	0.008 + j0.010
MAIN_TX_SEC_BUS	3 Phase:	38,804	40.3	5.71	50,075	44,630	2.480	2.480	2.147	0.002 + j0.009
	SLG:	40,653		6.66	54,224	---	---	---	---	0.001 + j0.007
MCC_1_PANEL	3 Phase:	26,632	27.7	1.95	27,676	27,156	3.613	3.613	5.036	0.006 + j0.012
	SLG:	23,543		2.01	24,555	---	---	---	---	0.005 + j0.011
MCC_1S	3 Phase:	21,887	22.7	1.16	21,983	21,935	4.396	4.396	6.369	0.010 + j0.012
	SLG:	19,040		1.16	19,126	---	---	---	---	0.010 + j0.011
MCC_E_PANEL	3 Phase:	15,240	15.8	1.08	15,286	15,263	6.314	6.314	10.360	0.015 + j0.017
	SLG:	12,569		1.16	12,625	---	---	---	---	0.015 + j0.017
MCC_ES_BUS	3 Phase:	6,949	7.2	.39	6,949	6,949	13.848	13.848	22.079	0.046 + j0.018
	SLG:	5,802		0.42	5,802	---	---	---	---	0.046 + j0.019
MCC_P1_BUS	3 Phase:	34,426	35.8	3.76	40,396	37,473	2.795	2.795	3.334	0.003 + j0.010
	SLG:	32,355		4.00	38,490	---	---	---	---	0.002 + j0.009
MCC_P2_BUS	3 Phase:	34,562	35.9	3.98	41,072	37,890	2.784	2.784	3.319	0.003 + j0.010
	SLG:	32,491		4.27	39,244	---	---	---	---	0.002 + j0.009
MCC_W_PANEL	3 Phase:	15,240	15.8	1.08	15,286	15,263	6.314	6.314	10.360	0.015 + j0.017
	SLG:	12,569		1.16	12,625	---	---	---	---	0.015 + j0.017
MDC S	3 Phase:	35,399	36.8	4.94	44,213	39,935	2.718	2.718	3.192	0.002 + j0.010
	SLG:	33,473		5.60	43,015	---	---	---	---	0.002 + j0.008
MDC_1	3 Phase:	36,806	38.3	5.95	47,921	42,558	2.614	2.614	2.939	0.002 + j0.009
	SLG:	35,374		7.32	48,085	---	---	---	---	0.001 + j0.008
MDC_A_PRI_BUS	3 Phase:	27,454	28.5	1.61	28,008	27,732	3.505	3.505	4.662	0.007 + j0.011
	SLG:	24,733		1.60	25,221	---	---	---	---	0.006 + j0.010

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
MDC_B_PRI_BUS	3 Phase:	14,068	14.6	.51	14,068	14,068	6.840	6.840	10.180	0.022 + j0.011
	SLG:	12,101		0.48	12,101	---	---	---	---	0.021 + j0.010
MDC_C_PRI_BUS	3 Phase:	19,124	19.9	.76	19,129	19,126	5.032	5.032	7.073	0.014 + j0.011
	SLG:	16,847		0.74	16,851	---	---	---	---	0.014 + j0.010
MDC_D_PRI_BUS	3 Phase:	30,930	32.1	2.55	33,455	32,205	3.111	3.111	3.974	0.004 + j0.010
	SLG:	28,316		2.63	30,800	---	---	---	---	0.004 + j0.010
MDC_E_PRI_BUS	3 Phase:	31,097	32.3	2.59	33,731	32,427	3.094	3.094	3.939	0.004 + j0.010
	SLG:	28,506		2.67	31,103	---	---	---	---	0.004 + j0.009
MDC_F_PRI_BUS	3 Phase:	29,789	31.0	2.31	31,680	30,742	3.230	3.230	4.218	0.005 + j0.011
	SLG:	27,035		2.36	28,867	---	---	---	---	0.004 + j0.010
MDC_G_PRI_BUS	3 Phase:	29,789	31.0	2.31	31,680	30,742	3.230	3.230	4.218	0.005 + j0.011
	SLG:	27,035		2.36	28,867	---	---	---	---	0.004 + j0.010
MDC_L_PRI_BUS	3 Phase:	17,078	17.7	1.43	17,288	17,183	5.634	5.634	9.367	0.012 + j0.017
	SLG:	14,003		1.56	14,249	---	---	---	---	0.011 + j0.017
MDC_M_PRI_BUS	3 Phase:	29,789	31.0	2.31	31,680	30,742	3.230	3.230	4.218	0.005 + j0.011
	SLG:	27,035		2.36	28,867	---	---	---	---	0.004 + j0.010
P_PANEL	3 Phase:	8,171	8.5	.47	8,171	8,171	11.777	11.777	18.833	0.038 + j0.018
	SLG:	6,814		0.51	6,814	---	---	---	---	0.038 + j0.019
P1_VAC1_BUS	3 Phase:	33,381	34.7	3.05	37,390	35,415	2.883	2.883	3.497	0.003 + j0.010
	SLG:	31,168		3.13	35,096	---	---	---	---	0.003 + j0.009
P1_VAC2_BUS	3 Phase:	33,381	34.7	3.05	37,390	35,415	2.883	2.883	3.497	0.003 + j0.010
	SLG:	31,168		3.13	35,096	---	---	---	---	0.003 + j0.009
P2_COMPRESSOR1_BUS	3 Phase:	33,537	34.9	3.19	37,928	35,767	2.869	2.869	3.478	0.003 + j0.010
	SLG:	31,326		3.29	35,663	---	---	---	---	0.003 + j0.009
P2_COMPRESSOR2_BUS	3 Phase:	33,537	34.9	3.19	37,928	35,767	2.869	2.869	3.478	0.003 + j0.010
	SLG:	31,326		3.29	35,663	---	---	---	---	0.003 + j0.009
Q_PANEL	3 Phase:	6,885	7.2	.43	6,885	6,885	13.975	13.975	22.505	0.046 + j0.020
	SLG:	5,725		0.47	5,725	---	---	---	---	0.046 + j0.021
R_PANEL	3 Phase:	18,018	18.7	.84	18,029	18,023	5.341	5.341	7.918	0.015 + j0.012
	SLG:	15,521		0.85	15,530	---	---	---	---	0.014 + j0.012

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
S_PANEL	3 Phase:	30,193	31.4	2.30	32,098	31,153	3.187	3.187	4.135	0.005 + j0.011
	SLG:	27,472		2.33	29,275	---	---	---	---	0.004 + j0.010
SA_PANEL	3 Phase:	28,899	30.0	1.73	29,657	29,279	3.330	3.330	4.326	0.006 + j0.010
	SLG:	26,277		1.71	26,933	---	---	---	---	0.006 + j0.009
T_PANEL	3 Phase:	5,362	5.6	.34	5,362	5,362	17.945	17.945	28.761	0.061 + j0.021
	SLG:	4,468		0.37	4,468	---	---	---	---	0.061 + j0.023
T2S_BUS	3 Phase:	3,200	3.3	.19	3,200	3,200	30.073	30.073	47.771	0.106 + j0.021
	SLG:	2,676		0.21	2,676	---	---	---	---	0.105 + j0.022
TP_PRI_BUS	3 Phase:	6,741	7.0	.38	6,741	6,741	14.274	14.274	22.727	0.048 + j0.018
	SLG:	5,632		0.41	5,632	---	---	---	---	0.047 + j0.019
208 Volt Busses										
1B_PANEL	3 Phase:	1,518	.5	1.20	1,526	1,522	182.882	182.882	233.923	0.051 + j0.061
	SLG:	1,389		1.18	1,395	---	---	---	---	0.387 + j0.458
1C_PANEL	3 Phase:	1,596	.6	.67	1,596	1,596	173.910	173.910	247.915	0.063 + j0.042
	SLG:	1,398		0.65	1,398	---	---	---	---	0.500 + j0.323
1D_PANEL	3 Phase:	2,076	.7	.61	2,076	2,076	133.702	133.702	198.146	0.049 + j0.030
	SLG:	1,789		0.59	1,789	---	---	---	---	0.400 + j0.237
1F_PANEL	3 Phase:	2,789	1.0	.81	2,790	2,790	99.527	99.527	138.890	0.034 + j0.027
	SLG:	2,465		0.76	2,466	---	---	---	---	0.268 + j0.205
1G_PANEL	3 Phase:	4,043	1.5	1.37	4,083	4,063	68.658	68.658	82.770	0.018 + j0.024
	SLG:	3,787		1.27	3,814	---	---	---	---	0.136 + j0.173
1H_3H_SEC_BUS	3 Phase:	6,113	2.2	2.95	6,801	6,462	45.405	45.405	41.422	0.006 + j0.019
	SLG:	6,298		3.08	7,069	---	---	---	---	0.041 + j0.126
1H_PANEL	3 Phase:	5,608	2.0	2.35	5,981	5,796	49.497	49.497	50.074	0.008 + j0.020
	SLG:	5,586		2.36	5,963	---	---	---	---	0.058 + j0.137
1J_2J_SEC_BUS	3 Phase:	6,017	2.2	2.22	6,362	6,191	46.128	46.128	38.933	0.008 + j0.018
	SLG:	6,360		2.48	6,848	---	---	---	---	0.049 + j0.121
1J_PANEL & 2J_PANEL	3 Phase:	5,493	2.0	1.87	5,682	5,588	50.533	50.533	47.601	0.010 + j0.019
	SLG:	5,606		2.01	5,846	---	---	---	---	0.066 + j0.133

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
1K_2K_SEC_BUS	3 Phase:	5,419	2.0	2.37	5,787	5,604	51.224	51.224	44.444	0.009 + j0.020
	SLG:	5,677		2.61	6,167	---	---	---	---	0.052 + j0.137
1K_PANEL & 2K_PANEL	3 Phase:	5,158	1.9	2.13	5,421	5,290	53.818	53.818	49.615	0.010 + j0.021
	SLG:	5,300		2.29	5,629	---	---	---	---	0.063 + j0.144
1L_PANEL	3 Phase:	7,034	2.5	2.51	7,587	7,313	39.460	39.460	37.377	0.006 + j0.016
	SLG:	7,160		2.53	7,735	---	---	---	---	0.043 + j0.108
1M_PANEL	3 Phase:	5,253	1.9	2.85	5,805	5,533	52.837	52.837	52.980	0.008 + j0.022
	SLG:	5,249		2.80	5,780	---	---	---	---	0.053 + j0.149
1N_PANEL	3 Phase:	6,222	2.2	2.50	6,708	6,467	44.612	44.612	42.107	0.007 + j0.018
	SLG:	6,342		2.60	6,884	---	---	---	---	0.047 + j0.123
1N_SEC_BUS	3 Phase:	6,759	2.4	2.97	7,528	7,149	41.067	41.067	34.400	0.006 + j0.017
	SLG:	7,150		3.19	8,088	---	---	---	---	0.035 + j0.111
1P_PANEL & 2P_PANEL & 3P_PANEL	3 Phase:	3,225	1.2	1.98	3,359	3,292	86.060	86.060	80.472	0.017 + j0.033
	SLG:	3,302		2.19	3,483	---	---	---	---	0.105 + j0.229
1Q_PANEL	3 Phase:	960	.3	1.47	973	967	289.077	289.077	260.673	0.070 + j0.103
	SLG:	996		1.65	1,017	---	---	---	---	0.434 + j0.715
1Q_SEC_BUS	3 Phase:	998	.4	1.60	1,017	1,008	278.158	278.158	244.333	0.064 + j0.102
	SLG:	1,045		1.85	1,079	---	---	---	---	0.379 + j0.701
1R_PANEL & 2R_PANEL	3 Phase:	1,069	.4	2.09	1,120	1,094	259.756	259.756	253.387	0.049 + j0.101
	SLG:	1,078		2.17	1,136	---	---	---	---	0.323 + j0.702
1R_SEC_BUS	3 Phase:	1,092	.4	2.26	1,158	1,125	254.211	254.211	243.667	0.045 + j0.101
	SLG:	1,108		2.39	1,185	---	---	---	---	0.290 + j0.694
1S_PANEL	3 Phase:	3,549	1.3	2.83	3,917	3,735	78.202	78.202	77.382	0.011 + j0.032
	SLG:	3,562		2.85	3,936	---	---	---	---	0.077 + j0.221
1S_TX_SEC_BUS	3 Phase:	3,648	1.3	3.02	4,077	3,866	76.087	76.087	72.667	0.010 + j0.031
	SLG:	3,704		3.06	4,152	---	---	---	---	0.070 + j0.214
1T_PANEL	3 Phase:	1,030	.4	1.80	1,061	1,046	269.375	269.375	253.387	0.057 + j0.102
	SLG:	1,053		1.95	1,094	---	---	---	---	0.361 + j0.704
1T_SEC_BUS	3 Phase:	1,054	.4	1.92	1,093	1,074	263.363	263.363	243.667	0.053 + j0.101
	SLG:	1,083		2.13	1,138	---	---	---	---	0.327 + j0.696

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
1U_PANEL	3 Phase:	5,800	2.1	2.05	6,063	5,933	47.854	47.854	41.496	0.009 + j0.019
	SLG:	6,080		2.26	6,447	---	---	---	---	0.055 + j0.125
1U_SEC_BUS	3 Phase:	5,965	2.1	2.16	6,282	6,125	46.532	46.532	38.933	0.008 + j0.018
	SLG:	6,323		2.43	6,783	---	---	---	---	0.050 + j0.122
2B_PANEL	3 Phase:	1,177	.4	.77	1,177	1,177	235.867	235.867	322.652	0.081 + j0.062
	SLG:	1,049		0.74	1,049	---	---	---	---	0.639 + j0.471
2C_PANEL	3 Phase:	1,779	.6	.78	1,780	1,780	156.003	156.003	218.809	0.053 + j0.042
	SLG:	1,569		0.77	1,569	---	---	---	---	0.421 + j0.323
2D_PANEL	3 Phase:	2,035	.7	.60	2,035	2,035	136.379	136.379	202.698	0.051 + j0.030
	SLG:	1,752		0.58	1,752	---	---	---	---	0.410 + j0.240
2E_PANEL	3 Phase:	2,331	.8	.67	2,331	2,331	119.100	119.100	173.215	0.043 + j0.029
	SLG:	2,024		0.65	2,025	---	---	---	---	0.345 + j0.224
2F_PANEL	3 Phase:	3,535	1.3	1.28	3,561	3,548	78.532	78.532	103.378	0.021 + j0.027
	SLG:	3,198		1.24	3,218	---	---	---	---	0.164 + j0.203
2H_3H_SEC_BUS	3 Phase:	5,336	1.9	3.12	6,007	5,677	52.014	52.014	48.000	0.007 + j0.021
	SLG:	5,478		3.26	6,223	---	---	---	---	0.045 + j0.145
2L_PANEL	3 Phase:	7,089	2.6	2.65	7,721	7,408	39.156	39.156	36.888	0.006 + j0.016
	SLG:	7,229		2.70	7,904	---	---	---	---	0.040 + j0.108
2N_PANEL	3 Phase:	6,687	2.4	2.42	7,171	6,931	41.507	41.507	38.921	0.007 + j0.017
	SLG:	6,831		2.53	7,376	---	---	---	---	0.045 + j0.113
2N_SEC_BUS	3 Phase:	7,316	2.6	2.89	8,108	7,717	37.940	37.940	31.200	0.005 + j0.016
	SLG:	7,782		3.13	8,767	---	---	---	---	0.033 + j0.102
2S_PANEL	3 Phase:	1,395	.5	1.34	1,408	1,401	198.965	198.965	192.859	0.052 + j0.069
	SLG:	1,410		1.36	1,423	---	---	---	---	0.350 + j0.476
3A_PANEL	3 Phase:	2,314	.8	.75	2,314	2,314	119.971	119.971	182.857	0.041 + j0.031
	SLG:	1,970		0.77	1,970	---	---	---	---	0.334 + j0.259
3B_PANEL	3 Phase:	1,164	.4	.76	1,164	1,164	238.422	238.422	327.098	0.082 + j0.062
	SLG:	1,036		0.73	1,036	---	---	---	---	0.649 + j0.473
3C_PANEL	3 Phase:	1,549	.6	.65	1,549	1,549	179.187	179.187	256.947	0.065 + j0.042
	SLG:	1,353		0.63	1,354	---	---	---	---	0.520 + j0.328

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
3D_PANEL	3 Phase:	2,863	1.0	1.01	2,868	2,865	96.966	96.966	138.310	0.029 + j0.030
	SLG:	2,506		1.00	2,511	---	---	---	---	0.235 + j0.235
3E_PANEL	3 Phase:	2,584	.9	.79	2,584	2,584	107.439	107.439	154.237	0.036 + j0.029
	SLG:	2,256		0.77	2,257	---	---	---	---	0.293 + j0.225
3F_PANEL	3 Phase:	2,951	1.1	.91	2,954	2,952	94.068	94.068	130.164	0.030 + j0.027
	SLG:	2,617		0.87	2,619	---	---	---	---	0.240 + j0.209
3G_PANEL	3 Phase:	4,724	1.7	2.31	5,025	4,876	58.757	58.757	64.390	0.010 + j0.023
	SLG:	4,578		2.24	4,847	---	---	---	---	0.074 + j0.166
3H_PANEL & 2H_PANEL	3 Phase:	5,000	1.8	2.70	5,465	5,235	55.510	55.510	55.732	0.008 + j0.023
	SLG:	4,994		2.75	5,479	---	---	---	---	0.057 + j0.157
3L_PANEL	3 Phase:	7,102	2.6	2.68	7,754	7,432	39.084	39.084	36.774	0.006 + j0.016
	SLG:	7,245		2.75	7,947	---	---	---	---	0.039 + j0.108
3M_PANEL	3 Phase:	5,287	1.9	3.01	5,909	5,603	52.497	52.497	52.392	0.007 + j0.022
	SLG:	5,291		2.99	5,904	---	---	---	---	0.050 + j0.149
3N_PANEL	3 Phase:	4,652	1.7	2.27	4,936	4,795	59.671	59.671	55.732	0.010 + j0.024
	SLG:	4,760		2.44	5,108	---	---	---	---	0.066 + j0.162
3N_SEC_BUS	3 Phase:	4,954	1.8	2.53	5,351	5,155	56.028	56.028	48.000	0.009 + j0.023
	SLG:	5,209		2.78	5,726	---	---	---	---	0.054 + j0.150
3S_PANEL	3 Phase:	4,623	1.7	1.64	4,723	4,673	60.042	60.042	52.227	0.014 + j0.022
	SLG:	4,852		1.88	5,022	---	---	---	---	0.080 + j0.152
3S_TX_SEC_BUS	3 Phase:	4,945	1.8	1.76	5,081	5,013	56.133	56.133	44.444	0.012 + j0.021
	SLG:	5,343		2.06	5,589	---	---	---	---	0.068 + j0.140
4A_PANEL	3 Phase:	1,429	.5	.42	1,429	1,429	194.283	194.283	301.100	0.077 + j0.033
	SLG:	1,207		0.43	1,207	---	---	---	---	0.633 + j0.275
4B_PANEL	3 Phase:	1,148	.4	.75	1,148	1,148	241.840	241.840	333.035	0.084 + j0.063
	SLG:	1,020		0.72	1,020	---	---	---	---	0.663 + j0.477
4C_PANEL	3 Phase:	1,523	.5	.64	1,523	1,523	182.277	182.277	262.225	0.066 + j0.042
	SLG:	1,329		0.62	1,329	---	---	---	---	0.532 + j0.331
4D_PANEL	3 Phase:	2,548	.9	.83	2,550	2,549	108.929	108.929	158.192	0.036 + j0.030
	SLG:	2,214		0.82	2,216	---	---	---	---	0.291 + j0.238

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
4E_PANEL	3 Phase:	2,224	.8	.65	2,224	2,224	124.811	124.811	183.013	0.045 + j0.029
	SLG:	1,925		0.62	1,925	---	---	---	---	0.367 + j0.229
4F_PANEL	3 Phase:	2,889	1.0	.89	2,892	2,891	96.069	96.069	133.750	0.031 + j0.028
	SLG:	2,556		0.85	2,558	---	---	---	---	0.248 + j0.211
4G_PANEL	3 Phase:	4,441	1.6	1.75	4,561	4,502	62.497	62.497	71.163	0.013 + j0.023
	SLG:	4,248		1.64	4,340	---	---	---	---	0.102 + j0.168
4H_5H_SEC_BUS	3 Phase:	10,260	3.7	2.73	11,243	10,757	27.054	27.054	23.111	0.004 + j0.011
	SLG:	10,788		2.91	11,965	---	---	---	---	0.025 + j0.073
4H_PANEL & 5H_PANEL	3 Phase:	8,709	3.1	1.85	8,998	8,854	31.871	31.871	32.927	0.007 + j0.012
	SLG:	8,614		1.84	8,895	---	---	---	---	0.046 + j0.085
4L_PANEL	3 Phase:	7,034	2.5	2.51	7,587	7,313	39.460	39.460	37.377	0.006 + j0.016
	SLG:	7,160		2.53	7,735	---	---	---	---	0.043 + j0.108
4M_PANEL	3 Phase:	5,254	1.9	2.85	5,806	5,533	52.833	52.833	52.971	0.008 + j0.022
	SLG:	5,249		2.80	5,781	---	---	---	---	0.053 + j0.149
4N_PANEL	3 Phase:	7,043	2.5	2.50	7,592	7,320	39.413	39.413	37.771	0.006 + j0.016
	SLG:	7,143		2.57	7,740	---	---	---	---	0.042 + j0.109
4N_SECI_BUS	3 Phase:	7,737	2.8	3.04	8,663	8,207	35.876	35.876	30.045	0.005 + j0.015
	SLG:	8,184		3.26	9,297	---	---	---	---	0.030 + j0.097
4S_PANEL	3 Phase:	1,958	.7	1.34	1,976	1,967	141.736	141.736	127.931	0.037 + j0.049
	SLG:	2,029		1.48	2,057	---	---	---	---	0.230 + j0.340
4S_TX_SEC_BUS	3 Phase:	2,126	.8	1.60	2,167	2,146	130.566	130.566	111.111	0.030 + j0.048
	SLG:	2,249		1.87	2,325	---	---	---	---	0.175 + j0.326
5A_PANEL	3 Phase:	1,405	.5	.42	1,405	1,405	197.541	197.541	306.497	0.079 + j0.033
	SLG:	1,187		0.43	1,187	---	---	---	---	0.644 + j0.278
5B_PANEL	3 Phase:	1,136	.4	.74	1,136	1,136	244.411	244.411	337.494	0.085 + j0.063
	SLG:	1,008		0.71	1,008	---	---	---	---	0.673 + j0.479
5C_PANEL	3 Phase:	1,501	.5	.63	1,501	1,501	184.932	184.932	266.754	0.068 + j0.043
	SLG:	1,308		0.61	1,308	---	---	---	---	0.542 + j0.333
5D_PANEL	3 Phase:	2,779	1.0	.98	2,784	2,782	99.869	99.869	143.663	0.031 + j0.030
	SLG:	2,425		0.97	2,429	---	---	---	---	0.246 + j0.239

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
5E_PANEL	3 Phase:	3,316	1.2	1.30	3,342	3,329	83.709	83.709	115.159	0.022 + j0.029
	SLG:	2,947		1.28	2,969	---	---	---	---	0.174 + j0.223
5F_PANEL	3 Phase:	3,355	1.2	1.20	3,373	3,364	82.739	82.739	111.406	0.023 + j0.028
	SLG:	3,008		1.17	3,022	---	---	---	---	0.180 + j0.210
5G_PANEL	3 Phase:	3,795	1.4	1.28	3,823	3,809	73.141	73.141	91.720	0.020 + j0.025
	SLG:	3,501		1.20	3,520	---	---	---	---	0.152 + j0.183
5M_PANEL	3 Phase:	5,281	1.9	2.98	5,889	5,589	52.559	52.559	52.498	0.007 + j0.022
	SLG:	5,283		2.96	5,880	---	---	---	---	0.051 + j0.149
5N_PANEL	3 Phase:	6,882	2.5	2.55	7,445	7,166	40.336	40.336	38.921	0.006 + j0.016
	SLG:	6,963		2.62	7,569	---	---	---	---	0.043 + j0.112
5N_SEC_BUS	3 Phase:	7,540	2.7	3.11	8,480	8,017	36.815	36.815	31.200	0.005 + j0.015
	SLG:	7,946		3.31	9,059	---	---	---	---	0.030 + j0.100
6A_PANEL	3 Phase:	1,386	.5	.41	1,386	1,386	200.335	200.335	311.125	0.080 + j0.033
	SLG:	1,170		0.43	1,170	---	---	---	---	0.654 + j0.280
6B_PANEL	3 Phase:	1,126	.4	.73	1,126	1,126	246.559	246.559	341.214	0.086 + j0.063
	SLG:	998		0.71	998	---	---	---	---	0.681 + j0.481
6C_PANEL	3 Phase:	1,476	.5	.62	1,476	1,476	188.037	188.037	272.043	0.069 + j0.043
	SLG:	1,285		0.61	1,285	---	---	---	---	0.554 + j0.336
6D_PANEL	3 Phase:	260	.1	.09	260	260	1066.338	1066.338	Infinite	0.460 + j0.041
	SLG:	218		0.09	218	---	---	---	---	3.803 + j0.352
6E_PANEL	3 Phase:	3,276	1.2	1.29	3,300	3,288	84.739	84.739	117.166	0.023 + j0.029
	SLG:	2,905		1.27	2,926	---	---	---	---	0.177 + j0.225
6F_PANEL	3 Phase:	2,754	1.0	.85	2,756	2,755	100.785	100.785	142.154	0.033 + j0.028
	SLG:	2,423		0.81	2,424	---	---	---	---	0.266 + j0.217
6G_PANEL	3 Phase:	4,160	1.5	1.66	4,253	4,207	66.718	66.718	80.281	0.015 + j0.025
	SLG:	3,898		1.58	3,971	---	---	---	---	0.114 + j0.181
6M_PANEL	3 Phase:	5,281	1.9	2.98	5,889	5,589	52.559	52.559	52.498	0.007 + j0.022
	SLG:	5,283		2.96	5,880	---	---	---	---	0.051 + j0.149
6N_PANEL	3 Phase:	4,784	1.7	2.44	5,135	4,961	58.022	58.022	55.732	0.010 + j0.023
	SLG:	4,849		2.57	5,251	---	---	---	---	0.062 + j0.160

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
6N_SEC_BUS	3 Phase:	5,099	1.8	2.76	5,596	5,350	54.441	54.441	48.000	0.008 + j0.022
	SLG:	5,311		2.97	5,917	---	---	---	---	0.050 + j0.149
MDC_A	3 Phase:	5,879	2.1	2.69	6,420	6,152	47.216	47.216	46.600	0.007 + j0.019
	SLG:	5,904		2.68	6,445	---	---	---	---	0.049 + j0.132
MDC_A_SEC_BUS	3 Phase:	6,194	2.2	3.15	6,987	6,597	44.811	44.811	41.422	0.006 + j0.018
	SLG:	6,355		3.22	7,204	---	---	---	---	0.039 + j0.125
MDC_B	3 Phase:	2,187	.8	2.36	2,335	2,261	126.940	126.940	125.158	0.021 + j0.051
	SLG:	2,197		2.42	2,354	---	---	---	---	0.145 + j0.350
MDC_B_SEC_BUS	3 Phase:	2,245	.8	2.57	2,432	2,339	123.664	123.664	118.666	0.019 + j0.050
	SLG:	2,276		2.67	2,483	---	---	---	---	0.128 + j0.343
MDC_C	3 Phase:	3,514	1.3	2.63	3,824	3,671	78.984	78.984	77.382	0.012 + j0.032
	SLG:	3,539		2.72	3,873	---	---	---	---	0.081 + j0.221
MDC_C_SEC_BUS	3 Phase:	3,613	1.3	2.79	3,974	3,795	76.835	76.835	72.667	0.011 + j0.031
	SLG:	3,680		2.90	4,079	---	---	---	---	0.074 + j0.214
MDC_D	3 Phase:	5,222	1.9	3.14	5,887	5,560	53.154	53.154	52.661	0.007 + j0.022
	SLG:	5,238		3.13	5,898	---	---	---	---	0.048 + j0.151
MDC_D_SEC_BUS	3 Phase:	5,432	2.0	3.50	6,271	5,859	51.095	51.095	48.000	0.006 + j0.021
	SLG:	5,544		3.53	6,411	---	---	---	---	0.041 + j0.144
MDC_E	3 Phase:	5,224	1.9	3.15	5,890	5,562	53.139	53.139	52.661	0.007 + j0.022
	SLG:	5,239		3.13	5,900	---	---	---	---	0.048 + j0.151
MDC_E_SEC_BUS	3 Phase:	5,434	2.0	3.51	6,274	5,862	51.080	51.080	48.000	0.006 + j0.021
	SLG:	5,546		3.53	6,413	---	---	---	---	0.041 + j0.144
MDC_F	3 Phase:	5,211	1.9	3.12	5,865	5,543	53.264	53.264	52.661	0.007 + j0.022
	SLG:	5,231		3.11	5,884	---	---	---	---	0.049 + j0.152
MDC_F_SEC_BUS	3 Phase:	5,421	2.0	3.47	6,245	5,841	51.201	51.201	48.000	0.006 + j0.021
	SLG:	5,537		3.51	6,393	---	---	---	---	0.041 + j0.145
MDC_G	3 Phase:	5,211	1.9	3.12	5,865	5,543	53.264	53.264	52.661	0.007 + j0.022
	SLG:	5,231		3.11	5,884	---	---	---	---	0.049 + j0.152
MDC_G_SEC_BUS	3 Phase:	5,421	2.0	3.47	6,245	5,841	51.201	51.201	48.000	0.006 + j0.021
	SLG:	5,537		3.51	6,393	---	---	---	---	0.041 + j0.145

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
MDC_L	3 Phase:	7,184	2.6	2.78	7,899	7,546	38.636	38.636	35.842	0.006 + j0.016
	SLG:	7,363		2.87	8,146	---	---	---	---	0.037 + j0.107
MDC_L_SEC_BUS	3 Phase:	7,599	2.7	3.17	8,583	8,099	36.528	36.528	31.200	0.005 + j0.015
	SLG:	7,990		3.36	9,139	---	---	---	---	0.030 + j0.100
MDC_M	3 Phase:	5,331	1.9	3.11	5,996	5,669	52.064	52.064	51.462	0.007 + j0.021
	SLG:	5,352		3.10	6,016	---	---	---	---	0.048 + j0.148
MDC_M_SEC_BUS	3 Phase:	5,551	2.0	3.47	6,394	5,980	50.001	50.001	46.800	0.006 + j0.021
	SLG:	5,672		3.50	6,549	---	---	---	---	0.040 + j0.141
T2S_SEC_BUS	3 Phase:	1,568	.6	1.92	1,627	1,598	176.980	176.980	160.001	0.035 + j0.068
	SLG:	1,624		2.16	1,710	---	---	---	---	0.215 + j0.465
TP_SEC_BUS	3 Phase:	3,373	1.2	2.11	3,540	3,457	82.294	82.294	72.667	0.015 + j0.032
	SLG:	3,517		2.36	3,753	---	---	---	---	0.093 + j0.218

Short Circuit Report - ANSI Calculations - Medium Voltage Busses
Maximum Fault Duty - Emergency Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Mom. Fault Amps Based on Sym*1.6	Based on X/R	Interrupting Fault Duty 2 Cycle	3 Cycle	5 Cycle	8 Cycle	Source Z Equivalent R+jX (PU)
8,300 Volt Busses											
BC HYDRO_BUS	3 Phase:	34,780	500.0	15.00	55,648	52,925	46,432	40,241	37,110	35,476	0.009 + j0.137
	SLG:	34,850		15.00	55,760	53,031	46,524	40,321	37,185	35,547	0.040 + j0.597
MAIN_BRKR_PRI_BUS	3 Phase:	14,409	207.2	1.56	23,055	14,661	14,548	14,409	14,409	14,409	0.180 + j0.280
	SLG:	11,626		1.65	18,602	11,884	11,752	11,626	11,626	11,626	0.929 + j1.536
MAIN_TX_PRI_BUS	3 Phase:	14,405	207.1	1.56	23,049	14,657	14,544	14,405	14,405	14,405	0.180 + j0.280
	SLG:	11,620		1.65	18,592	11,878	11,746	11,620	11,620	11,620	0.929 + j1.537

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
600 Volt Busses										
1H_3H_PRI_BUS	3 Phase:	21,600	22.4	1.17	21,699	21,649	4.455	4.455	6.230	0.010 + j0.012
	SLG:	19,067		1.16	19,150	---	---	---	---	0.010 + j0.011
1J_2J_PRI_BUS	3 Phase:	10,321	10.7	.60	10,321	10,321	9.323	9.323	14.769	0.029 + j0.017
	SLG:	8,642		0.64	8,643	---	---	---	---	0.028 + j0.018
1K_2K_PRI_BUS	3 Phase:	10,986	11.4	.63	10,986	10,986	8.759	8.759	13.800	0.027 + j0.017
	SLG:	9,221		0.66	9,221	---	---	---	---	0.026 + j0.017
1N_PRI_BUS	3 Phase:	13,127	13.6	1.24	13,209	13,168	7.330	7.330	12.601	0.017 + j0.021
	SLG:	10,604		1.38	10,714	---	---	---	---	0.016 + j0.022
1Q_PRI_BUS	3 Phase:	1,512	1.6	.10	1,512	1,512	63.660	63.660	100.979	0.228 + j0.024
	SLG:	1,265		0.11	1,265	---	---	---	---	0.227 + j0.026
1R_PRI_BUS	3 Phase:	4,980	5.2	.20	4,980	4,980	19.323	19.323	30.176	0.068 + j0.014
	SLG:	4,194		0.20	4,194	---	---	---	---	0.067 + j0.014
1S_TX_PRI_BUS	3 Phase:	9,102	9.5	4.91	11,355	10,261	10.572	10.572	13.319	0.008 + j0.037
	SLG:	8,377		4.59	10,290	---	---	---	---	0.007 + j0.034
1T_PRI_BUS	3 Phase:	2,534	2.6	.13	2,534	2,534	37.967	37.967	59.979	0.135 + j0.018
	SLG:	2,124		0.14	2,124	---	---	---	---	0.135 + j0.019
1U_PRI_BUS	3 Phase:	9,694	10.1	.58	9,694	9,694	9.926	9.926	15.801	0.031 + j0.018
	SLG:	8,101		0.62	8,101	---	---	---	---	0.030 + j0.019
2H_3H_PRI_BUS	3 Phase:	21,163	22.0	1.14	21,246	21,204	4.547	4.547	6.399	0.011 + j0.012
	SLG:	18,633		1.13	18,703	---	---	---	---	0.010 + j0.012
2N_PRI_BUS	3 Phase:	12,994	13.5	1.23	13,074	13,034	7.405	7.405	12.752	0.017 + j0.021
	SLG:	10,489		1.37	10,595	---	---	---	---	0.016 + j0.022
3N_PRI_BUS	3 Phase:	9,837	10.2	.77	9,839	9,838	9.782	9.782	16.330	0.028 + j0.022
	SLG:	8,053		0.85	8,059	---	---	---	---	0.027 + j0.023
3S_TX_PRI_BUS	3 Phase:	4,700	4.9	.89	4,704	4,702	20.472	20.472	32.037	0.055 + j0.049
	SLG:	3,955		0.88	3,959	---	---	---	---	0.055 + j0.048
4H_5H_PRI_BUS	3 Phase:	22,052	22.9	1.20	22,169	22,110	4.364	4.364	6.063	0.010 + j0.012
	SLG:	19,519		1.19	19,617	---	---	---	---	0.010 + j0.011

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
4N_PRI_BUS	3 Phase:	15,195	15.8	1.35	15,341	15,268	6.333	6.333	10.573	0.014 + j0.018
	SLG:	12,435		1.48	12,612	---	---	---	---	0.013 + j0.019
4S_TX_PRI_BUS	3 Phase:	2,695	2.8	.39	2,695	2,695	35.705	35.705	56.245	0.120 + j0.047
	SLG:	2,261		0.38	2,261	---	---	---	---	0.119 + j0.046
5N_PRI_BUS	3 Phase:	15,822	16.4	1.39	15,995	15,908	6.082	6.082	10.059	0.013 + j0.018
	SLG:	13,002		1.51	13,206	---	---	---	---	0.012 + j0.019
6N_PRI_BUS	3 Phase:	12,629	13.1	.89	12,640	12,634	7.619	7.619	12.375	0.021 + j0.018
	SLG:	10,463		0.95	10,477	---	---	---	---	0.020 + j0.019
ALTERNATOR	3 Phase:	9,488	9.9	12.26	14,067	11,900	10.141	10.141	12.372	0.003 + j0.036
	SLG:	8,840		11.86	13,046	---	---	---	---	0.003 + j0.033
ATS_EMERG_BUS	3 Phase:	9,547	9.9	16.12	14,649	12,246	10.079	10.079	12.197	0.002 + j0.036
	SLG:	8,922		16.17	13,694	---	---	---	---	0.002 + j0.032
ATS_LOAD_BUS	3 Phase:	9,547	9.9	16.12	14,649	12,246	10.079	10.079	12.197	0.002 + j0.036
	SLG:	8,922		16.17	13,694	---	---	---	---	0.002 + j0.032
ATS_NORMAL_BUS	3 Phase:	34,165	35.5	4.93	42,665	38,539	2.817	2.817	3.128	0.002 + j0.010
	SLG:	32,972		5.73	42,580	---	---	---	---	0.002 + j0.009
CDP-EP Panel	3 Phase:	9,500	9.9	14.47	14,393	12,084	10.129	10.129	12.341	0.003 + j0.036
	SLG:	8,855		14.29	13,396	---	---	---	---	0.002 + j0.033
CH01_BUS	3 Phase:	24,521	25.5	1.53	24,919	24,720	3.924	3.924	5.305	0.008 + j0.012
	SLG:	21,946		1.53	22,301	---	---	---	---	0.007 + j0.011
CH02_BUS	3 Phase:	24,521	25.5	1.53	24,919	24,720	3.924	3.924	5.305	0.008 + j0.012
	SLG:	21,946		1.53	22,301	---	---	---	---	0.007 + j0.011
CT01_STARTER	3 Phase:	9,457	9.8	9.22	13,413	11,528	10.175	10.175	12.435	0.004 + j0.036
	SLG:	8,805		8.71	12,366	---	---	---	---	0.004 + j0.033
CT01B1_BUS	3 Phase:	9,301	9.7	5.48	11,896	10,641	10.346	10.346	12.806	0.007 + j0.037
	SLG:	8,619		5.03	10,814	---	---	---	---	0.007 + j0.033
CT01B2_BUS	3 Phase:	9,301	9.7	5.48	11,896	10,641	10.346	10.346	12.806	0.007 + j0.037
	SLG:	8,619		5.03	10,814	---	---	---	---	0.007 + j0.033
CT01C_STARTER	3 Phase:	9,248	9.6	4.51	11,317	10,310	10.404	10.404	12.907	0.008 + j0.037
	SLG:	8,565		4.08	10,237	---	---	---	---	0.008 + j0.033

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
GEN_BUS	3 Phase:	9,593	10.0	18.28	14,918	12,416	10.031	10.031	12.015	0.002 + j0.036
	SLG:	8,999		18.89	14,041	---	---	---	---	0.002 + j0.032
H_PANEL	3 Phase:	17,383	18.1	.79	17,390	17,387	5.535	5.535	8.012	0.016 + j0.012
	SLG:	15,128		0.78	15,133	---	---	---	---	0.015 + j0.012
J_PANEL	3 Phase:	13,971	14.5	.95	13,990	13,980	6.887	6.887	11.024	0.018 + j0.017
	SLG:	11,648		1.01	11,671	---	---	---	---	0.017 + j0.018
K_PANEL	3 Phase:	7,704	8.0	.42	7,704	7,704	12.490	12.490	19.672	0.041 + j0.017
	SLG:	6,466		0.44	6,466	---	---	---	---	0.041 + j0.018
L_PANEL	3 Phase:	6,710	7.0	.39	6,710	6,710	14.341	14.341	22.727	0.048 + j0.019
	SLG:	5,617		0.41	5,617	---	---	---	---	0.047 + j0.020
M_PANEL	3 Phase:	25,125	26.1	1.32	25,336	25,230	3.830	3.830	4.985	0.008 + j0.011
	SLG:	22,834		1.27	22,996	---	---	---	---	0.008 + j0.010
MAIN_TX_SEC_BUS	3 Phase:	37,227	38.7	5.54	47,727	42,649	2.585	2.585	2.147	0.002 + j0.009
	SLG:	39,487		6.47	52,353	---	---	---	---	0.001 + j0.007
MCC_1_PANEL	3 Phase:	25,814	26.8	1.98	26,877	26,348	3.728	3.728	5.036	0.006 + j0.012
	SLG:	23,111		2.03	24,132	---	---	---	---	0.006 + j0.011
MCC_1S	3 Phase:	8,634	9.0	3.60	10,031	9,346	11.145	11.145	14.622	0.011 + j0.039
	SLG:	7,822		3.38	8,961	---	---	---	---	0.010 + j0.035
MCC_E_PANEL	3 Phase:	7,504	7.8	2.74	8,226	7,869	12.823	12.823	18.502	0.016 + j0.043
	SLG:	6,539		2.66	7,127	---	---	---	---	0.016 + j0.041
MCC_ES_BUS	3 Phase:	5,340	5.5	.96	5,348	5,344	18.018	18.018	27.418	0.047 + j0.045
	SLG:	4,550		0.93	4,555	---	---	---	---	0.046 + j0.043
MCC_P1_BUS	3 Phase:	9,488	9.9	12.26	14,067	11,900	10.141	10.141	12.372	0.003 + j0.036
	SLG:	8,840		11.86	13,046	---	---	---	---	0.003 + j0.033
MCC_P2_BUS	3 Phase:	9,493	9.9	12.86	14,167	11,957	10.136	10.136	12.364	0.003 + j0.036
	SLG:	8,845		12.50	13,148	---	---	---	---	0.003 + j0.033
MCC_W_PANEL	3 Phase:	7,504	7.8	2.74	8,226	7,869	12.823	12.823	18.502	0.016 + j0.043
	SLG:	6,539		2.66	7,127	---	---	---	---	0.016 + j0.041
MDC S	3 Phase:	9,531	9.9	15.53	14,563	12,192	10.096	10.096	12.259	0.002 + j0.036
	SLG:	8,896		15.44	13,583	---	---	---	---	0.002 + j0.032

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
MDC_1	3 Phase:	35,224	36.6	5.78	45,581	40,579	2.732	2.732	2.939	0.002 + j0.010
	SLG:	34,387		7.11	46,478	---	---	---	---	0.001 + j0.008
MDC_A_PRI_BUS	3 Phase:	26,605	27.6	1.65	27,185	26,896	3.617	3.617	4.662	0.007 + j0.011
	SLG:	24,268		1.63	24,771	---	---	---	---	0.006 + j0.010
MDC_B_PRI_BUS	3 Phase:	13,912	14.5	.52	13,912	13,912	6.917	6.917	10.180	0.022 + j0.012
	SLG:	12,026		0.49	12,026	---	---	---	---	0.022 + j0.011
MDC_C_PRI_BUS	3 Phase:	18,781	19.5	.78	18,788	18,784	5.123	5.123	7.073	0.015 + j0.011
	SLG:	16,671		0.76	16,675	---	---	---	---	0.014 + j0.010
MDC_D_PRI_BUS	3 Phase:	29,813	31.0	2.58	32,310	31,074	3.228	3.228	3.974	0.004 + j0.011
	SLG:	27,682		2.64	30,145	---	---	---	---	0.004 + j0.010
MDC_E_PRI_BUS	3 Phase:	29,967	31.1	2.62	32,568	31,281	3.211	3.211	3.939	0.004 + j0.011
	SLG:	27,863		2.69	30,435	---	---	---	---	0.004 + j0.010
MDC_F_PRI_BUS	3 Phase:	28,756	29.9	2.34	30,647	29,709	3.346	3.346	4.218	0.005 + j0.011
	SLG:	26,459		2.38	28,288	---	---	---	---	0.004 + j0.010
MDC_G_PRI_BUS	3 Phase:	28,756	29.9	2.34	30,647	29,709	3.346	3.346	4.218	0.005 + j0.011
	SLG:	26,459		2.38	28,288	---	---	---	---	0.004 + j0.010
MDC_L_PRI_BUS	3 Phase:	16,752	17.4	1.45	16,971	16,862	5.744	5.744	9.367	0.012 + j0.017
	SLG:	13,853		1.57	14,104	---	---	---	---	0.011 + j0.018
MDC_M_PRI_BUS	3 Phase:	28,756	29.9	2.34	30,647	29,709	3.346	3.346	4.218	0.005 + j0.011
	SLG:	26,459		2.38	28,288	---	---	---	---	0.004 + j0.010
P_PANEL	3 Phase:	8,120	8.4	.48	8,120	8,120	11.851	11.851	18.833	0.038 + j0.018
	SLG:	6,790		0.51	6,790	---	---	---	---	0.038 + j0.019
P1_VAC1_BUS	3 Phase:	9,441	9.8	10.11	13,596	11,621	10.192	10.192	12.492	0.004 + j0.037
	SLG:	8,781		9.63	12,546	---	---	---	---	0.003 + j0.033
P1_VAC2_BUS	3 Phase:	9,441	9.8	10.11	13,596	11,621	10.192	10.192	12.492	0.004 + j0.037
	SLG:	8,781		9.63	12,546	---	---	---	---	0.003 + j0.033
P2_COMPRESSOR1_BUS	3 Phase:	9,447	9.8	10.53	13,693	11,677	10.186	10.186	12.483	0.004 + j0.036
	SLG:	8,787		10.05	12,643	---	---	---	---	0.003 + j0.033
P2_COMPRESSOR2_BUS	3 Phase:	9,447	9.8	10.53	13,693	11,677	10.186	10.186	12.483	0.004 + j0.036
	SLG:	8,787		10.05	12,643	---	---	---	---	0.003 + j0.033

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
Q_PANEL	3 Phase:	6,851	7.1	.44	6,851	6,851	14.046	14.046	22.505	0.046 + j0.020
	SLG:	5,709		0.48	5,709	---	---	---	---	0.046 + j0.022
R_PANEL	3 Phase:	17,702	18.4	.87	17,715	17,708	5.436	5.436	7.918	0.015 + j0.013
	SLG:	15,364		0.86	15,374	---	---	---	---	0.014 + j0.012
S_PANEL	3 Phase:	9,231	9.6	7.49	12,605	10,988	10.425	10.425	13.033	0.005 + j0.037
	SLG:	8,520		7.11	11,516	---	---	---	---	0.005 + j0.034
SA_PANEL	3 Phase:	9,212	9.6	5.81	11,934	10,620	10.445	10.445	13.042	0.006 + j0.037
	SLG:	8,508		5.45	10,865	---	---	---	---	0.006 + j0.033
T_PANEL	3 Phase:	5,343	5.6	.35	5,343	5,343	18.008	18.008	28.761	0.061 + j0.021
	SLG:	4,459		0.38	4,459	---	---	---	---	0.061 + j0.023
T2S_BUS	3 Phase:	2,967	3.1	.44	2,967	2,967	32.430	32.430	50.969	0.107 + j0.047
	SLG:	2,492		0.44	2,492	---	---	---	---	0.106 + j0.046
TP_PRI_BUS	3 Phase:	6,710	7.0	.39	6,710	6,710	14.341	14.341	22.727	0.048 + j0.019
	SLG:	5,617		0.41	5,617	---	---	---	---	0.047 + j0.020
208 Volt Busses										
1B_PANEL	3 Phase:	1,517	.5	1.20	1,525	1,521	182.987	182.987	233.923	0.051 + j0.061
	SLG:	1,388		1.18	1,395	---	---	---	---	0.387 + j0.458
1C_PANEL	3 Phase:	1,595	.6	.67	1,595	1,595	173.996	173.996	247.915	0.063 + j0.042
	SLG:	1,398		0.65	1,398	---	---	---	---	0.500 + j0.323
1D_PANEL	3 Phase:	2,075	.7	.61	2,075	2,075	133.785	133.785	198.146	0.049 + j0.030
	SLG:	1,788		0.59	1,788	---	---	---	---	0.400 + j0.238
1F_PANEL	3 Phase:	2,786	1.0	.81	2,787	2,787	99.620	99.620	138.890	0.034 + j0.027
	SLG:	2,464		0.77	2,465	---	---	---	---	0.268 + j0.205
1G_PANEL	3 Phase:	4,036	1.5	1.37	4,077	4,057	68.767	68.767	82.770	0.018 + j0.024
	SLG:	3,784		1.27	3,811	---	---	---	---	0.136 + j0.173
1H_3H_SEC_BUS	3 Phase:	6,097	2.2	2.95	6,784	6,446	45.522	45.522	41.422	0.006 + j0.019
	SLG:	6,287		3.08	7,057	---	---	---	---	0.041 + j0.126
1H_PANEL	3 Phase:	5,595	2.0	2.35	5,968	5,783	49.613	49.613	50.074	0.008 + j0.020
	SLG:	5,578		2.36	5,954	---	---	---	---	0.058 + j0.137

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
1J_2J_SEC_BUS	3 Phase:	6,002	2.2	2.22	6,347	6,176	46.244	46.244	38.933	0.008 + j0.018
	SLG:	6,349		2.48	6,836	---	---	---	---	0.049 + j0.122
1J_PANEL & 2J_PANEL	3 Phase:	5,481	2.0	1.88	5,670	5,576	50.647	50.647	47.601	0.010 + j0.019
	SLG:	5,597		2.01	5,837	---	---	---	---	0.066 + j0.133
1K_2K_SEC_BUS	3 Phase:	5,407	1.9	2.37	5,774	5,592	51.340	51.340	44.444	0.009 + j0.020
	SLG:	5,668		2.61	6,158	---	---	---	---	0.053 + j0.137
1K_PANEL & 2K_PANEL	3 Phase:	5,147	1.9	2.13	5,410	5,279	53.933	53.933	49.615	0.010 + j0.021
	SLG:	5,292		2.29	5,621	---	---	---	---	0.063 + j0.144
1L_PANEL	3 Phase:	7,014	2.5	2.51	7,566	7,293	39.577	39.577	37.377	0.006 + j0.016
	SLG:	7,146		2.53	7,720	---	---	---	---	0.043 + j0.108
1M_PANEL	3 Phase:	5,242	1.9	2.85	5,792	5,521	52.954	52.954	52.980	0.008 + j0.022
	SLG:	5,241		2.80	5,772	---	---	---	---	0.053 + j0.150
1N_PANEL	3 Phase:	6,206	2.2	2.50	6,691	6,451	44.729	44.729	42.107	0.007 + j0.018
	SLG:	6,330		2.60	6,872	---	---	---	---	0.047 + j0.123
1N_SEC_BUS	3 Phase:	6,740	2.4	2.97	7,507	7,129	41.184	41.184	34.400	0.006 + j0.017
	SLG:	7,135		3.19	8,072	---	---	---	---	0.035 + j0.111
1P_PANEL & 2P_PANEL & 3P_PANEL	3 Phase:	3,221	1.2	1.99	3,354	3,288	86.175	86.175	80.472	0.017 + j0.033
	SLG:	3,299		2.19	3,480	---	---	---	---	0.105 + j0.230
1Q_PANEL	3 Phase:	960	.3	1.47	973	966	289.187	289.187	260.673	0.070 + j0.103
	SLG:	995		1.65	1,017	---	---	---	---	0.434 + j0.715
1Q_SEC_BUS	3 Phase:	997	.4	1.60	1,017	1,007	278.270	278.270	244.333	0.064 + j0.102
	SLG:	1,044		1.85	1,079	---	---	---	---	0.379 + j0.701
1R_PANEL & 2R_PANEL	3 Phase:	1,068	.4	2.09	1,120	1,094	259.871	259.871	253.387	0.049 + j0.101
	SLG:	1,077		2.17	1,135	---	---	---	---	0.323 + j0.702
1R_SEC_BUS	3 Phase:	1,091	.4	2.26	1,157	1,125	254.327	254.327	243.667	0.045 + j0.101
	SLG:	1,107		2.40	1,185	---	---	---	---	0.290 + j0.694
1S_PANEL	3 Phase:	3,255	1.2	3.10	3,660	3,461	85.263	85.263	77.382	0.011 + j0.035
	SLG:	3,359		3.04	3,759	---	---	---	---	0.078 + j0.235
1S_TX_SEC_BUS	3 Phase:	3,337	1.2	3.31	3,804	3,574	83.190	83.190	72.667	0.010 + j0.034
	SLG:	3,484		3.26	3,959	---	---	---	---	0.070 + j0.229

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
1T_PANEL	3 Phase:	1,030	.4	1.80	1,061	1,045	269.489	269.489	253.387	0.057 + j0.102
	SLG:	1,052		1.95	1,094	---	---	---	---	0.361 + j0.704
1T_SEC_BUS	3 Phase:	1,053	.4	1.92	1,093	1,073	263.477	263.477	243.667	0.053 + j0.101
	SLG:	1,082		2.13	1,138	---	---	---	---	0.327 + j0.696
1U_PANEL	3 Phase:	5,787	2.1	2.05	6,050	5,919	47.969	47.969	41.496	0.009 + j0.019
	SLG:	6,069		2.26	6,437	---	---	---	---	0.055 + j0.126
1U_SEC_BUS	3 Phase:	5,950	2.1	2.16	6,267	6,110	46.647	46.647	38.933	0.008 + j0.018
	SLG:	6,312		2.43	6,772	---	---	---	---	0.050 + j0.122
2B_PANEL	3 Phase:	1,176	.4	.77	1,177	1,177	235.958	235.958	322.652	0.081 + j0.062
	SLG:	1,048		0.74	1,049	---	---	---	---	0.639 + j0.471
2C_PANEL	3 Phase:	1,778	.6	.79	1,779	1,779	156.095	156.095	218.809	0.053 + j0.042
	SLG:	1,568		0.77	1,569	---	---	---	---	0.421 + j0.323
2D_PANEL	3 Phase:	2,034	.7	.60	2,034	2,034	136.462	136.462	202.698	0.051 + j0.030
	SLG:	1,751		0.58	1,751	---	---	---	---	0.411 + j0.240
2E_PANEL	3 Phase:	2,329	.8	.68	2,329	2,329	119.187	119.187	173.215	0.043 + j0.029
	SLG:	2,024		0.65	2,024	---	---	---	---	0.345 + j0.224
2F_PANEL	3 Phase:	3,530	1.3	1.29	3,556	3,543	78.639	78.639	103.378	0.021 + j0.027
	SLG:	3,195		1.24	3,216	---	---	---	---	0.164 + j0.203
2H_3H_SEC_BUS	3 Phase:	5,324	1.9	3.12	5,994	5,664	52.131	52.131	48.000	0.007 + j0.021
	SLG:	5,470		3.26	6,213	---	---	---	---	0.045 + j0.146
2L_PANEL	3 Phase:	7,068	2.5	2.65	7,699	7,387	39.273	39.273	36.888	0.006 + j0.016
	SLG:	7,214		2.70	7,889	---	---	---	---	0.040 + j0.108
2N_PANEL	3 Phase:	6,669	2.4	2.43	7,152	6,912	41.623	41.623	38.921	0.007 + j0.017
	SLG:	6,818		2.53	7,363	---	---	---	---	0.045 + j0.114
2N_SEC_BUS	3 Phase:	7,294	2.6	2.90	8,084	7,694	38.057	38.057	31.200	0.005 + j0.016
	SLG:	7,765		3.13	8,748	---	---	---	---	0.033 + j0.102
2S_PANEL	3 Phase:	1,354	.5	1.40	1,369	1,361	205.019	205.019	192.859	0.052 + j0.072
	SLG:	1,381		1.40	1,397	---	---	---	---	0.350 + j0.491
3A_PANEL	3 Phase:	2,312	.8	.75	2,312	2,312	120.062	120.062	182.857	0.041 + j0.031
	SLG:	1,969		0.78	1,970	---	---	---	---	0.334 + j0.259

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
3B_PANEL	3 Phase:	1,164	.4	.76	1,164	1,164	238.514	238.514	327.098	0.082 + j0.062
	SLG:	1,036		0.73	1,036	---	---	---	---	0.650 + j0.474
3C_PANEL	3 Phase:	1,548	.6	.65	1,548	1,548	179.272	179.272	256.947	0.065 + j0.042
	SLG:	1,353		0.63	1,353	---	---	---	---	0.521 + j0.328
3D_PANEL	3 Phase:	2,860	1.0	1.01	2,865	2,862	97.067	97.067	138.310	0.030 + j0.030
	SLG:	2,505		1.00	2,510	---	---	---	---	0.235 + j0.235
3E_PANEL	3 Phase:	2,581	.9	.79	2,582	2,582	107.532	107.532	154.237	0.036 + j0.029
	SLG:	2,255		0.77	2,256	---	---	---	---	0.293 + j0.225
3F_PANEL	3 Phase:	2,948	1.1	.91	2,951	2,949	94.166	94.166	130.164	0.030 + j0.027
	SLG:	2,616		0.87	2,617	---	---	---	---	0.240 + j0.209
3G_PANEL	3 Phase:	4,715	1.7	2.31	5,016	4,867	58.873	58.873	64.390	0.010 + j0.023
	SLG:	4,573		2.24	4,842	---	---	---	---	0.074 + j0.166
3H_PANEL & 2H_PANEL	3 Phase:	4,990	1.8	2.70	5,454	5,224	55.627	55.627	55.732	0.008 + j0.023
	SLG:	4,987		2.75	5,471	---	---	---	---	0.057 + j0.157
3L_PANEL	3 Phase:	7,081	2.6	2.68	7,732	7,410	39.201	39.201	36.774	0.006 + j0.016
	SLG:	7,230		2.75	7,932	---	---	---	---	0.039 + j0.108
3M_PANEL	3 Phase:	5,276	1.9	3.02	5,896	5,590	52.614	52.614	52.392	0.007 + j0.022
	SLG:	5,283		2.99	5,895	---	---	---	---	0.050 + j0.150
3N_PANEL	3 Phase:	4,643	1.7	2.27	4,927	4,786	59.787	59.787	55.732	0.010 + j0.024
	SLG:	4,753		2.44	5,101	---	---	---	---	0.067 + j0.162
3N_SEC_BUS	3 Phase:	4,944	1.8	2.53	5,341	5,144	56.145	56.145	48.000	0.009 + j0.023
	SLG:	5,201		2.78	5,718	---	---	---	---	0.054 + j0.151
3S_PANEL	3 Phase:	4,171	1.5	1.87	4,315	4,243	66.542	66.542	52.227	0.014 + j0.025
	SLG:	4,502		2.06	4,712	---	---	---	---	0.081 + j0.166
3S_TX_SEC_BUS	3 Phase:	4,425	1.6	2.02	4,616	4,521	62.735	62.735	44.444	0.012 + j0.024
	SLG:	4,915		2.27	5,214	---	---	---	---	0.068 + j0.155
4A_PANEL	3 Phase:	1,428	.5	.42	1,428	1,428	194.353	194.353	301.100	0.077 + j0.033
	SLG:	1,207		0.43	1,207	---	---	---	---	0.633 + j0.275
4B_PANEL	3 Phase:	1,147	.4	.75	1,148	1,147	241.931	241.931	333.035	0.084 + j0.063
	SLG:	1,020		0.72	1,020	---	---	---	---	0.663 + j0.477

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
4C_PANEL	3 Phase:	1,522	.5	.64	1,522	1,522	182.362	182.362	262.225	0.066 + j0.042
	SLG:	1,328		0.62	1,328	---	---	---	---	0.532 + j0.331
4D_PANEL	3 Phase:	2,546	.9	.84	2,547	2,547	109.024	109.024	158.192	0.036 + j0.030
	SLG:	2,213		0.82	2,214	---	---	---	---	0.291 + j0.239
4E_PANEL	3 Phase:	2,222	.8	.65	2,223	2,222	124.896	124.896	183.013	0.045 + j0.029
	SLG:	1,924		0.63	1,924	---	---	---	---	0.367 + j0.229
4F_PANEL	3 Phase:	2,886	1.0	.89	2,889	2,888	96.166	96.166	133.750	0.031 + j0.028
	SLG:	2,555		0.85	2,556	---	---	---	---	0.248 + j0.212
4G_PANEL	3 Phase:	4,433	1.6	1.75	4,554	4,494	62.610	62.610	71.163	0.013 + j0.024
	SLG:	4,243		1.65	4,335	---	---	---	---	0.102 + j0.168
4H_5H_SEC_BUS	3 Phase:	10,216	3.7	2.74	11,197	10,712	27.171	27.171	23.111	0.004 + j0.011
	SLG:	10,756		2.91	11,930	---	---	---	---	0.025 + j0.073
4H_PANEL & 5H_PANEL	3 Phase:	8,678	3.1	1.86	8,967	8,823	31.985	31.985	32.927	0.007 + j0.012
	SLG:	8,594		1.85	8,875	---	---	---	---	0.046 + j0.085
4L_PANEL	3 Phase:	7,014	2.5	2.51	7,566	7,293	39.577	39.577	37.377	0.006 + j0.016
	SLG:	7,146		2.53	7,720	---	---	---	---	0.043 + j0.108
4M_PANEL	3 Phase:	5,242	1.9	2.85	5,793	5,521	52.950	52.950	52.971	0.008 + j0.022
	SLG:	5,242		2.81	5,773	---	---	---	---	0.053 + j0.150
4N_PANEL	3 Phase:	7,022	2.5	2.50	7,570	7,299	39.529	39.529	37.771	0.006 + j0.016
	SLG:	7,128		2.58	7,725	---	---	---	---	0.042 + j0.109
4N_SECI_BUS	3 Phase:	7,712	2.8	3.04	8,636	8,180	35.993	35.993	30.045	0.005 + j0.015
	SLG:	8,165		3.26	9,276	---	---	---	---	0.030 + j0.097
4S_PANEL	3 Phase:	1,878	.7	1.43	1,901	1,889	147.812	147.812	127.931	0.037 + j0.052
	SLG:	1,969		1.54	2,002	---	---	---	---	0.230 + j0.355
4S_TX_SEC_BUS	3 Phase:	2,027	.7	1.70	2,076	2,052	136.964	136.964	111.111	0.030 + j0.051
	SLG:	2,172		1.95	2,256	---	---	---	---	0.175 + j0.341
5A_PANEL	3 Phase:	1,405	.5	.42	1,405	1,405	197.610	197.610	306.497	0.079 + j0.033
	SLG:	1,187		0.43	1,187	---	---	---	---	0.644 + j0.278
5B_PANEL	3 Phase:	1,135	.4	.74	1,135	1,135	244.502	244.502	337.494	0.085 + j0.063
	SLG:	1,008		0.71	1,008	---	---	---	---	0.673 + j0.479

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
5C_PANEL	3 Phase:	1,500	.5	.63	1,500	1,500	185.017	185.017	266.754	0.068 + j0.043
	SLG:	1,308		0.62	1,308	---	---	---	---	0.542 + j0.334
5D_PANEL	3 Phase:	2,777	1.0	.98	2,781	2,779	99.968	99.968	143.663	0.031 + j0.030
	SLG:	2,424		0.97	2,427	---	---	---	---	0.246 + j0.240
5E_PANEL	3 Phase:	3,312	1.2	1.30	3,338	3,325	83.817	83.817	115.159	0.022 + j0.029
	SLG:	2,945		1.29	2,967	---	---	---	---	0.174 + j0.223
5F_PANEL	3 Phase:	3,351	1.2	1.20	3,369	3,360	82.844	82.844	111.406	0.023 + j0.028
	SLG:	3,006		1.17	3,019	---	---	---	---	0.180 + j0.210
5G_PANEL	3 Phase:	3,789	1.4	1.28	3,817	3,803	73.248	73.248	91.720	0.020 + j0.025
	SLG:	3,498		1.20	3,517	---	---	---	---	0.152 + j0.183
5M_PANEL	3 Phase:	5,269	1.9	2.98	5,876	5,577	52.676	52.676	52.498	0.007 + j0.022
	SLG:	5,275		2.96	5,871	---	---	---	---	0.051 + j0.150
5N_PANEL	3 Phase:	6,862	2.5	2.55	7,425	7,146	40.453	40.453	38.921	0.006 + j0.016
	SLG:	6,950		2.62	7,556	---	---	---	---	0.043 + j0.112
5N_SEC_BUS	3 Phase:	7,516	2.7	3.11	8,454	7,992	36.933	36.933	31.200	0.005 + j0.015
	SLG:	7,929		3.31	9,039	---	---	---	---	0.030 + j0.101
6A_PANEL	3 Phase:	1,385	.5	.42	1,385	1,385	200.404	200.404	311.125	0.080 + j0.033
	SLG:	1,170		0.43	1,170	---	---	---	---	0.654 + j0.280
6B_PANEL	3 Phase:	1,125	.4	.73	1,126	1,125	246.649	246.649	341.214	0.086 + j0.063
	SLG:	998		0.71	998	---	---	---	---	0.681 + j0.481
6C_PANEL	3 Phase:	1,475	.5	.62	1,476	1,476	188.121	188.121	272.043	0.069 + j0.043
	SLG:	1,285		0.61	1,285	---	---	---	---	0.554 + j0.337
6D_PANEL	3 Phase:	260	.1	.09	260	260	1066.376	1066.376	Infinite	0.460 + j0.041
	SLG:	218		0.09	218	---	---	---	---	3.803 + j0.352
6E_PANEL	3 Phase:	3,271	1.2	1.29	3,296	3,284	84.846	84.846	117.166	0.023 + j0.029
	SLG:	2,903		1.27	2,924	---	---	---	---	0.177 + j0.225
6F_PANEL	3 Phase:	2,752	1.0	.85	2,753	2,752	100.880	100.880	142.154	0.033 + j0.028
	SLG:	2,422		0.82	2,423	---	---	---	---	0.267 + j0.217
6G_PANEL	3 Phase:	4,153	1.5	1.66	4,246	4,200	66.830	66.830	80.281	0.015 + j0.025
	SLG:	3,894		1.58	3,967	---	---	---	---	0.114 + j0.181

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Stantec

Government of Canada

Bus Name		Sym. Fault Amps Amps	Sym. Fault Amps MVA	Sym. Fault Amps X/R	Asym. Fault Amps Maximum RMS Amps	Asym. Fault Amps Average RMS Amps	Source Impedance PU Seq. Z1	Source Impedance PU Seq. Z2	Source Impedance PU Seq. Z0	Source Impedance Equivalent R+jX (PU)
6M_PANEL	3 Phase:	5,269	1.9	2.98	5,876	5,577	52.676	52.676	52.498	0.007 + j0.022
	SLG:	5,275		2.96	5,871	---	---	---	---	0.051 + j0.150
6N_PANEL	3 Phase:	4,774	1.7	2.44	5,126	4,952	58.139	58.139	55.732	0.010 + j0.023
	SLG:	4,843		2.57	5,244	---	---	---	---	0.062 + j0.160
6N_SEC_BUS	3 Phase:	5,088	1.8	2.76	5,585	5,339	54.558	54.558	48.000	0.008 + j0.022
	SLG:	5,303		2.97	5,909	---	---	---	---	0.050 + j0.149
MDC_A	3 Phase:	5,864	2.1	2.69	6,405	6,138	47.333	47.333	46.600	0.007 + j0.019
	SLG:	5,895		2.68	6,435	---	---	---	---	0.049 + j0.132
MDC_A_SEC_BUS	3 Phase:	6,178	2.2	3.15	6,969	6,580	44.928	44.928	41.422	0.006 + j0.019
	SLG:	6,343		3.23	7,191	---	---	---	---	0.039 + j0.125
MDC_B	3 Phase:	2,185	.8	2.37	2,333	2,259	127.056	127.056	125.158	0.021 + j0.051
	SLG:	2,196		2.42	2,353	---	---	---	---	0.145 + j0.350
MDC_B_SEC_BUS	3 Phase:	2,242	.8	2.57	2,430	2,337	123.781	123.781	118.666	0.019 + j0.050
	SLG:	2,274		2.67	2,481	---	---	---	---	0.128 + j0.343
MDC_C	3 Phase:	3,509	1.3	2.64	3,819	3,666	79.101	79.101	77.382	0.012 + j0.032
	SLG:	3,535		2.72	3,869	---	---	---	---	0.081 + j0.221
MDC_C_SEC_BUS	3 Phase:	3,607	1.3	2.79	3,968	3,790	76.952	76.952	72.667	0.011 + j0.031
	SLG:	3,676		2.90	4,075	---	---	---	---	0.074 + j0.214
MDC_D	3 Phase:	5,211	1.9	3.14	5,874	5,548	53.272	53.272	52.661	0.007 + j0.022
	SLG:	5,230		3.13	5,890	---	---	---	---	0.049 + j0.152
MDC_D_SEC_BUS	3 Phase:	5,420	2.0	3.50	6,256	5,846	51.213	51.213	48.000	0.006 + j0.021
	SLG:	5,536		3.53	6,401	---	---	---	---	0.041 + j0.145
MDC_E	3 Phase:	5,212	1.9	3.15	5,877	5,550	53.256	53.256	52.661	0.007 + j0.022
	SLG:	5,232		3.13	5,892	---	---	---	---	0.048 + j0.152
MDC_E_SEC_BUS	3 Phase:	5,422	2.0	3.51	6,260	5,849	51.198	51.198	48.000	0.006 + j0.021
	SLG:	5,537		3.53	6,403	---	---	---	---	0.041 + j0.145
MDC_F	3 Phase:	5,200	1.9	3.12	5,853	5,531	53.381	53.381	52.661	0.007 + j0.022
	SLG:	5,223		3.11	5,875	---	---	---	---	0.049 + j0.152
MDC_F_SEC_BUS	3 Phase:	5,409	1.9	3.47	6,231	5,827	51.319	51.319	48.000	0.006 + j0.021
	SLG:	5,528		3.51	6,383	---	---	---	---	0.041 + j0.145

Short Circuit Report - ANSI Calculations - Low Voltage Busses
Maximum Fault Duty - Emergency Power

Government of Canada

Bus Name		Sym. Fault Amps Amps	MVA	X/R	Asym. Fault Amps Maximum RMS Amps	Average RMS Amps	Source Impedance PU Seq. Z1	PU Seq. Z2	PU Seq. Z0	Equivalent R+jX (PU)
MDC_G	3 Phase:	5,200	1.9	3.12	5,853	5,531	53.381	53.381	52.661	0.007 + j0.022
	SLG:	5,223		3.11	5,875	---	---	---	---	0.049 + j0.152
MDC_G_SEC_BUS	3 Phase:	5,409	1.9	3.47	6,231	5,827	51.319	51.319	48.000	0.006 + j0.021
	SLG:	5,528		3.51	6,383	---	---	---	---	0.041 + j0.145
MDC_L	3 Phase:	7,163	2.6	2.78	7,877	7,524	38.753	38.753	35.842	0.006 + j0.016
	SLG:	7,347		2.87	8,129	---	---	---	---	0.037 + j0.107
MDC_L_SEC_BUS	3 Phase:	7,575	2.7	3.17	8,556	8,073	36.645	36.645	31.200	0.005 + j0.015
	SLG:	7,972		3.36	9,118	---	---	---	---	0.030 + j0.100
MDC_M	3 Phase:	5,319	1.9	3.11	5,983	5,656	52.182	52.182	51.462	0.007 + j0.021
	SLG:	5,344		3.10	6,007	---	---	---	---	0.048 + j0.148
MDC_M_SEC_BUS	3 Phase:	5,538	2.0	3.47	6,379	5,966	50.119	50.119	46.800	0.006 + j0.021
	SLG:	5,663		3.50	6,538	---	---	---	---	0.040 + j0.141
T2S_SEC_BUS	3 Phase:	1,511	.5	2.01	1,577	1,544	183.642	183.642	160.001	0.035 + j0.071
	SLG:	1,582		2.23	1,673	---	---	---	---	0.216 + j0.480
TP_SEC_BUS	3 Phase:	3,368	1.2	2.11	3,535	3,452	82.409	82.409	72.667	0.015 + j0.032
	SLG:	3,513		2.36	3,750	---	---	---	---	0.093 + j0.218

APPENDIX B

DEVICE EVALUATION STUDY

The purpose of a Device Evaluation Study is to ensure that the equipment in an electrical system exhibits the characteristics necessary for safe and effective operation under the worst-case fault conditions. Each component must be able to withstand the thermal and mechanical stresses arising from the flow of maximum fault current through it, and additionally, each protective device must be able to interrupt the maximum potential fault current at its present location. Equipment ratings, in conjunction with Short Circuit Study results, are used to assess the suitability of each component in the system.

Non-protective devices must be able to, without malfunctioning and overheating, carry the worst-case fault current for a number of cycles prior to interruption by the appropriate overcurrent device. The short-circuit ratings of devices are not defined in the same manner, and consequently, devices of different types are evaluated differently. However, the basic requirement is that the short-circuit rating of each component is in excess of the maximum fault current that may flow through it, as revealed by the Short Circuit Study.

It must also be verified that the protective devices under study are of sufficiently high rating to function as required when subjected to the worst-case First Cycle Currents and Interrupting Currents determined through the Short Circuit Study.

Low voltage circuit breakers and fuses are evaluated according to their ability to interrupt the maximum current that may occur within the first ½ cycle of the fault condition. Medium and high voltage circuit breakers are evaluated according to their ability to close and latch during the first ½ cycle of the worst-case fault condition as well as their ability to interrupt the maximum fault current that may be present in cycles 2 through 8. Protective devices that fail to adhere to the following criteria are over-dutied and should be replaced:

- A low voltage breaker or fuse must have an interrupting rating that exceeds the First Cycle Current
- A medium/high voltage breaker must have a closing and latching rating (also referred to as momentary rating or asymmetrical rating) that exceeds the First Cycle Current.
- A medium or high voltage breaker must have an interrupting rating that exceeds its calculated interrupting duty. The interrupting duty of each breaker is determined by the cycle in which the breaker is expected to interrupt the fault, the maximum current flow expected during that cycle, and the basis on which the breaker is rated (i.e. whether the breaker is rated in terms of symmetrical or total fault current.)

The devices within the scope of this study were evaluated in accordance with American National Standards Institute (ANSI) C37.010, C37.5 and the Institute of Electrical and Electronic Engineers (IEEE) Standard 1015, using PTW-Equipment Evaluation version 7.0, an electrical system modeling software program developed by SKM System Analysis Inc.

Device Evaluation Report - ANSI Calculations - Medium Voltage Devices
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name / Device Name	Bus Voltage / Dev. Voltage	Interrupting Evaluation: Max. S.C. Amps / Dev. Int. Duty	Interrupting Evaluation: Sys. X/R Ratio / Test X/R	Interrupting Evaluation: Sym. Rating	Momentary Evaluation: Max. Mom Amps / Dev. Mom. Duty	Momentary Evaluation: Dev C/L Rating	Momentary Evaluation: Series Rating	Momentary Evaluation: Dev. Pass/Fail
8,300 Volt Busses								
MAIN_BRKR_PRI_BUS	**8,300**	**14,409**	**1.6**		**14,661**			
MAIN_BRKR (FPE RM17.5-75)	18,000	14,409	15.0	32,500	14,661	74,000		Pass
MAIN_ISOLATION_SWITCH (FPE IS)	15,000	14,409	15.0	40,000	14,661	62,000		Pass

Stantec

Device Evaluation Report - ANSI Calculations - Low Voltage Devices
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Government of Canada

Bus Name / Device Name	Bus Voltage / Device Voltage	Bus Max S.C. Amps / Device Fault Duty	System X/R Ratio / Device Test X/R	Device Sym. Rating	Series Rating	Device Pass/Fail
600 Volt Busses						
MDC S	**600**	**35,399**	**4.9**			
30 (FPE 250)	600	35,457	4.9	18,000		Fail
31 (FPE 250)	600	35,457	4.9	18,000		Fail
80 (FPE 250)	600	35,457	4.9	18,000		Fail
81 (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
82 (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
83 (FPE 250)	600	35,457	4.9	18,000		Fail
84 (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
85 (FPE 250)	600	35,457	4.9	18,000		Fail
86 (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
87 (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
88 (FPE CE-E)	600	35,457	4.9	18,000		Fail
89 (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
90 (GE THED)	600	39,443	3.2	18,000		Fail
91 (GE THED)	600	39,443	3.2	18,000		Fail
CDP-EP BKRK (SQUARE D JL)	600	35,457	4.9	50,000		Pass
Cooling Tower #2 BRKR (FPE 250)	600	35,457	4.9	18,000		Fail
MCC_M BRKR (GE TFJ)	600	39,443	3.2	18,000		Fail
MCC-ES BRKR (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
MDC_D (52-27) (FPE 250)	600	35,457	4.9	18,000		Fail
Panel 3S XMER BRKR (Federal Pioneer CHED)	600	39,443	3.2	18,000		Fail
MDC_1	**600**	**36,806**	**5.9**			
20 (GE TB1)	600	38,324	4.9	200,000		Pass
21 (GE TB4)	600	38,324	4.9	200,000		Pass
22 (GE TB1)	600	38,324	4.9	200,000		Pass
23 (GE TB1)	600	38,324	4.9	200,000		Pass
24 (GE TB1)	600	38,324	4.9	200,000		Pass
25 (General Electric TB4)	600	38,324	4.9	200,000		Pass
26 (General Electric TB4)	600	38,324	4.9	200,000		Pass
27 (General Electric TB4)	600	38,324	4.9	200,000		Pass
28 (GE TB1)	600	38,324	4.9	200,000		Pass
29 (GE TB4)	600	38,324	4.9	200,000		Pass
32 (General Electric TB4)	600	38,324	4.9	200,000		Pass

Device Evaluation Report - ANSI Calculations - Low Voltage Devices
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name / Device Name	Bus Voltage / Device Voltage	Bus Max S.C. Amps / Device Fault Duty	System X/R Ratio / Device Test X/R	Device Sym. Rating	Series Rating	Device Pass/Fail
33 (General Electric TB4)	600	38,324	4.9	200,000		Pass
40 (General Electric TB4)	600	38,324	4.9	200,000		Pass
41 (GE TB1)	600	38,324	4.9	200,000		Pass
42 (GE TB1)	600	38,324	4.9	200,000		Pass
43 (General Electric TB4)	600	38,324	4.9	200,000		Pass
44 (General Electric TB4)	600	38,324	4.9	200,000		Pass
45 (GE TB4)	600	38,324	4.9	200,000		Pass
46 (General Electric TB4)	600	38,324	4.9	200,000		Pass
47 (General Electric TB4)	600	38,324	4.9	200,000		Pass
48 (General Electric TB4)	600	38,324	4.9	200,000		Pass
49 (General Electric TB4)	600	38,324	4.9	200,000		Pass
50 (General Electric TB4)	600	38,324	4.9	200,000		Pass
51 (GE TB4)	600	38,324	4.9	200,000		Pass
52 (General Electric TB4)	600	38,324	4.9	200,000		Pass
53 (General Electric TB4)	600	38,324	4.9	200,000		Pass
54 (General Electric TB4)	600	38,324	4.9	200,000		Pass
55 (General Electric TB4)	600	38,324	4.9	200,000		Pass
56 (General Electric TB4)	600	38,324	4.9	200,000		Pass
57 (GE TB4)	600	38,324	4.9	200,000		Pass
58 (GE TB1)	600	38,324	4.9	200,000		Pass
59 (GE TB1)	600	38,324	4.9	200,000		Pass
60 (GE TB1)	600	38,324	4.9	200,000		Pass
61 (GE TB1)	600	38,324	4.9	200,000		Pass
62 (General Electric TB4)	600	38,324	4.9	200,000		Pass
63 (FPE 50H-3)	635	36,806	6.6	50,000		Pass
63 FUSE (FEDERAL PACIFIC LCL-1200)	600	38,324	4.9	200,000		Pass
64 (GE TB4)	600	38,324	4.9	200,000		Pass
65 (General Electric TB4)	600	38,324	4.9	200,000		Pass
208 Volt Busses						
MDC_A	**208**	**5,904**	**2.7**			
3A_BRKR (GE TJD)	240	5,904	4.9	22,000		Pass
4A_BRKR (GE TEB)	240	6,631	1.8	10,000		Pass
5A_BRKR (GE TEB)	240	6,631	1.8	10,000		Pass
6A_BRKR (GE TEB)	240	6,631	1.8	10,000		Pass

Device Evaluation Report - ANSI Calculations - Low Voltage Devices
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name / Device Name	Bus Voltage / Device Voltage	Bus Max S.C. Amps / Device Fault Duty	System X/R Ratio / Device Test X/R	Device Sym. Rating	Series Rating	Device Pass/Fail
MDC_B	**208**	**2,197**	**2.4**			
1B_BRKR (GE TEB)	240	2,397	1.8	10,000		Pass
2B_BRKR (GE TEB)	240	2,397	1.8	10,000		Pass
3B_BRKR (GE TEB)	240	2,397	1.8	10,000		Pass
4B_BRKR (GE TEB)	240	2,397	1.8	10,000		Pass
5B_BRKR (GE TEB)	240	2,397	1.8	10,000		Pass
6B_BRKR (GE TEB)	240	2,397	1.8	10,000		Pass
MDC_C	**208**	**3,539**	**2.7**			
1C_BRKR (GE TEB)	240	3,989	1.8	10,000		Pass
2C_BRKR (FPE CQD)	240	3,989	1.8	10,000		Pass
3C_BRKR (GE TEB)	240	3,989	1.8	10,000		Pass
4C_BRKR (GE TEB)	240	3,989	1.8	10,000		Pass
5C_BRKR (GE TEB)	240	3,989	1.8	10,000		Pass
6C_BRKR (GE TEB)	240	3,989	1.8	10,000		Pass
MDC_D	**208**	**5,238**	**3.1**			
1D_BRKR (GE TEB)	240	6,136	1.8	10,000		Pass
2D_BRKR (GE TEB)	240	6,136	1.8	10,000		Pass
3D_BRKR (FPE CQD)	240	6,136	1.8	10,000		Pass
4D_BRKR (FPE CQD)	240	6,136	1.8	10,000		Pass
5D_BRKR (FPE CQD)	240	6,136	1.8	10,000		Pass
6D_BRKR (GE TEB)	240	6,136	1.8	10,000		Pass
MDC_E	**208**	**5,239**	**3.1**			
2E_BRKR (GE TEB)	240	6,139	1.8	10,000		Pass
3E_BRKR (FPE CQD)	240	6,139	1.8	10,000		Pass
4E_BRKR (GE TEB)	240	6,139	1.8	10,000		Pass
5E_BRKR (FPE CQD)	240	6,139	1.8	10,000		Pass
6E_BRKR (FPE CQD)	240	6,139	1.8	10,000		Pass
MDC_F	**208**	**5,231**	**3.1**			
1F_BRKR (GE TEB)	240	6,119	1.8	10,000		Pass
2F_BRKR (FPE CQD)	240	6,119	1.8	10,000		Pass
3F_BRKR (FPE CQD)	240	6,119	1.8	10,000		Pass
4F_BRKR (FPE CQD)	240	6,119	1.8	10,000		Pass
5F_BRKR (FPE CQD)	240	6,119	1.8	10,000		Pass

Device Evaluation Report - ANSI Calculations - Low Voltage Devices
Maximum Fault Duty - 500MVA (3 Phase) - Normal Power

Stantec

Government of Canada

Bus Name / Device Name	Bus Voltage / Device Voltage	Bus Max S.C. Amps / Device Fault Duty	System X/R Ratio / Device Test X/R	Device Sym. Rating	Series Rating	Device Pass/Fail
6F_BRKR (FPE CQD)	240	6,119	1.8	10,000		Pass
MDC_G	**208**	**5,231**	**3.1**			
1G_BRKR (GE TEB)	240	6,119	1.8	10,000		Pass
3G_BRKR (GE TEB)	240	6,119	1.8	10,000		Pass
4G_BRKR (FPE CQD)	240	6,119	1.8	10,000		Pass
5G_BRKR (FPE CQD)	240	6,119	1.8	10,000		Pass
6G_BRKR (GE TJD)	240	5,231	4.9	22,000		Pass
MDC_L	**208**	**7,363**	**2.9**			
1L_BRKR (Federal Pioneer CED6)	240	7,363	3.2	18,000		Pass
2L_BRKR (Federal Pioneer CJJ)	240	7,363	4.9	42,000		Pass
3L_BRKR (FPE CQD)	240	8,427	1.8	10,000		Pass
4L_BRKR (Federal Pioneer CED6)	240	7,363	3.2	18,000		Pass
MDC_M	**208**	**5,352**	**3.1**			
1M_BRKR (FPE CQD)	240	6,255	1.8	10,000		Pass
3M_BRKR (Federal Pioneer CED6)	240	5,352	3.2	18,000		Pass
4M_BRKR (Federal Pioneer CJJ)	240	5,352	4.9	42,000		Pass
5M_BRKR (Federal Pioneer CED6)	240	5,352	3.2	18,000		Pass
6M_BRKR (FPE CQD)	240	6,255	1.8	10,000		Pass

APPENDIX C

COORDINATION STUDY

A Coordination Study involves the selection of the proper overcurrent protective devices including circuit breakers trip units, overcurrent relays, and fuses. It additionally involves the specification of the appropriate settings, if any, for each selected protective device. The goal is to select and configure devices in the manner most effective in minimizing the potential damage to electrical apparatus and the risk of human injury during fault or thermal overloads conditions.

It is also important that devices be coordinated such that the equipment closest to the fault will be selectively isolated with minimal disruption to adjacent portions of the distribution system. In the event of a fault or overload condition, only the fuse or breaker nearest the fault should be configured to trip, thereby de-energizing the smallest portion of the system necessary. Larger upstream breakers should not respond to the abnormality, ensuring that the remaining portions of the system are not unnecessarily disrupted.

Prior to the coordination study the following steps are performed.

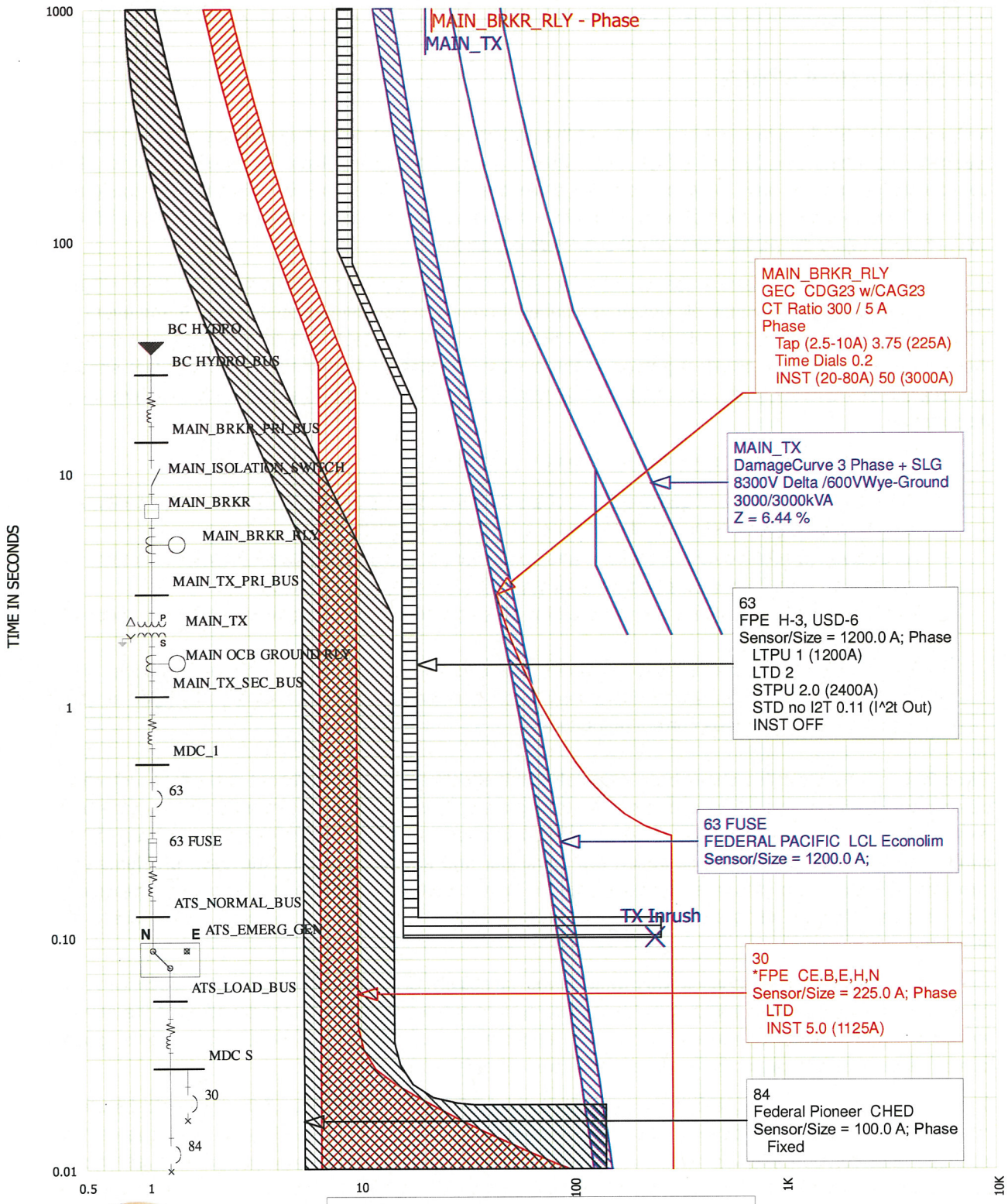
- Electrical system data is gathered, the characteristics of all pertinent electrical components are identified, and the system is modeled using a single line diagram.
- An equivalent circuit model is realized and a short circuit study is conducted in order to determine the maximum fault levels at each relevant bus within the scope of the study.
- Time-current characteristics are obtained for all overcurrent protective devices within the scope of the study.
- The time-current characteristics of system fuses, low voltage breakers, overcurrent relays, and equipment thermal damage curves are computer generated and are graphically displayed on log-log paper as time versus current magnitudes.

Once these preliminary steps have been completed, the effectiveness of the present network of protective devices and their configurations is determined through examination of the generated graphs. Improperly protected electrical equipment, instances of miscoordination, potential human hazards, and any other shortcomings in the present configuration are identified, and strategies to alleviate such problems are explored. Provided that it is in accordance with the power system requirements, the strategy providing the greatest degree of selectivity without compromising equipment protection and safety is recommended.

Overcurrent device characteristics vary widely and selectivity of these devices is often sacrificed for protection and vice versa depending on the power system requirements. An understanding of the power system's requirements combined with good engineering judgment is essential to ensure good coordination when compromising between these and other factors.

The graphics depicted in this study were generated using PTW-CAPTOR version 7.0, an electrical system modeling software program developed by SKM System Analysis Inc. In developing the protective device settings, consideration is given to both isolation of faults and protection of equipment such as cable, motors, and transformers. Minimum requirements for equipment protection as outlined in the Canadian Electrical Code and publications of the Canadian Standards Association are followed in all cases. The coordination study in this report is based on Standard IEEE-242.

Current in Amps x 138.333 @600 V x 10 @8.3 kV at 8300 volts

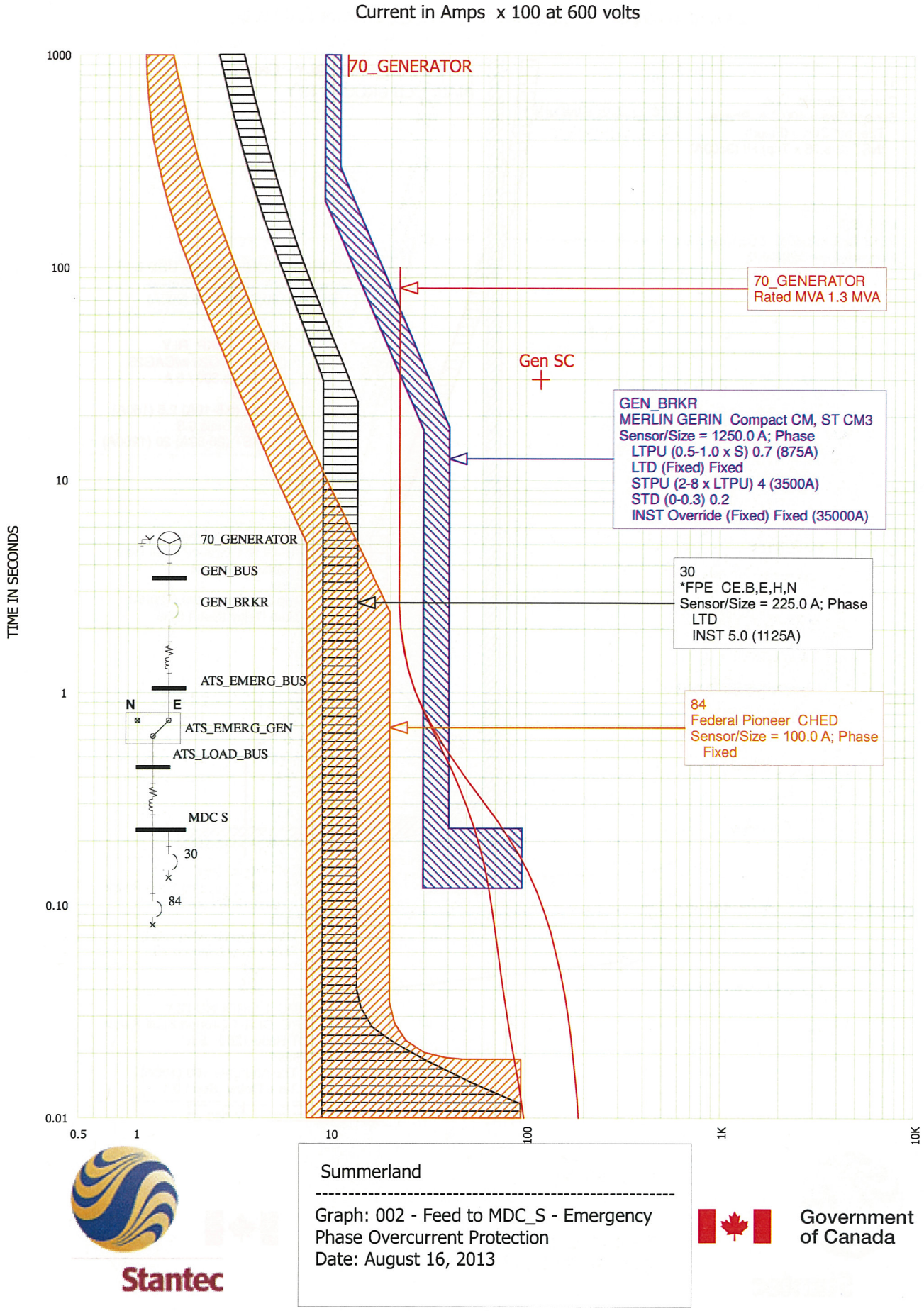


Summerland

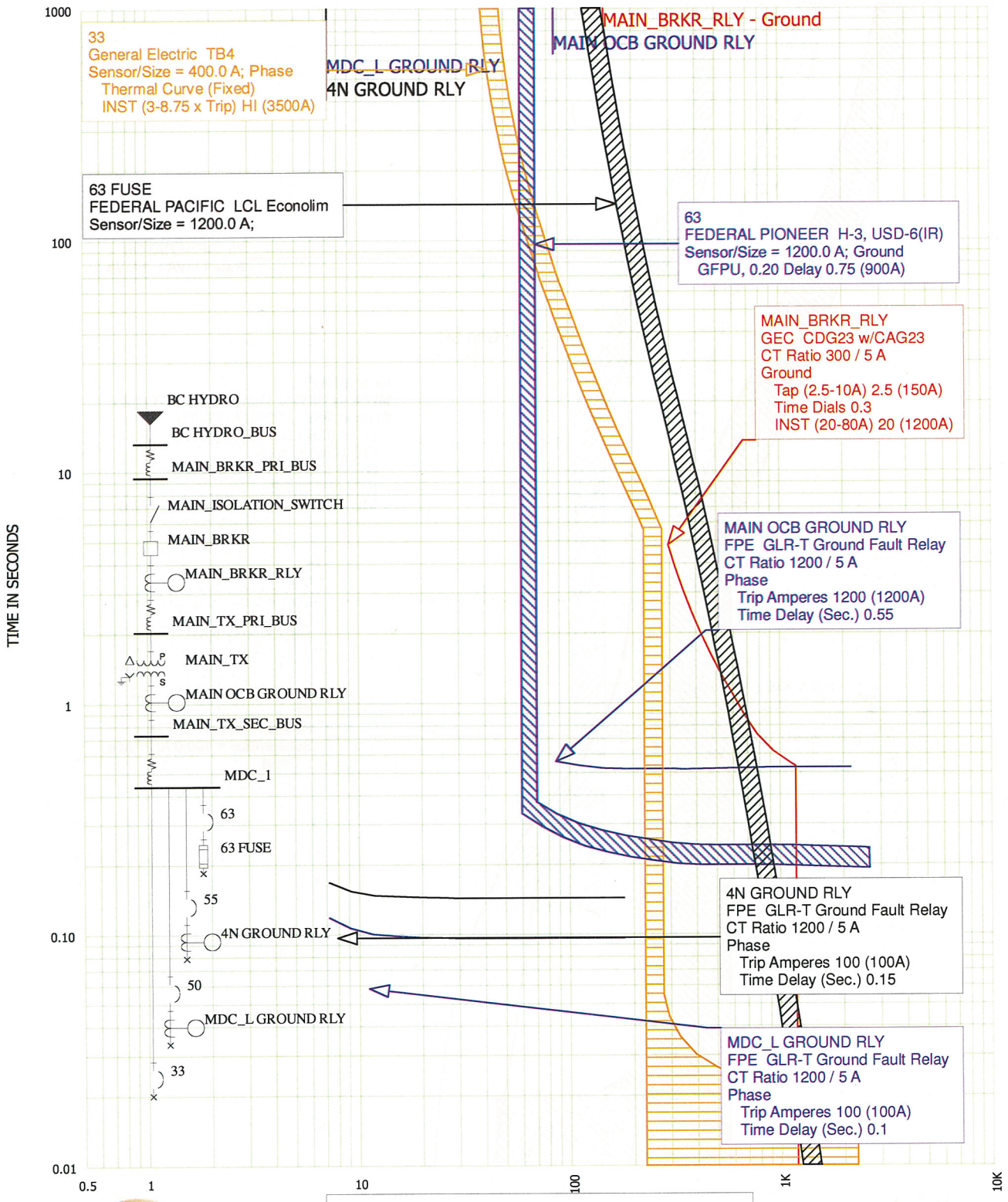
Graph: 001 - Feed to MDC_S - Normal
Phase Overcurrent Protection
Date: August 16, 2013

Stantec

Government of Canada


Current in Amps x 100 at 600 volts
TIME IN SECONDS
1000
100
10
1
0.10
0.01
0.5
1
10
100
1K
10K
70_GENERATOR
70_GENERATOR
Rated MVA 1.3 MVA
Gen SC
GEN_BRKR
MERLIN GERIN Compact CM, ST CM3
Sensor/Size = 1250.0 A; Phase
LTPU (0.5-1.0 x S) 0.7 (875A)
LTD (Fixed) Fixed
STPU (2-8 x LTPU) 4 (3500A)
STD (0-0.3) 0.2
INST Override (Fixed) Fixed (35000A)
30
*FPE CE.B,E,H,N
Sensor/Size = 225.0 A; Phase
LTD
INST 5.0 (1125A)
84
Federal Pioneer CHED
Sensor/Size = 100.0 A; Phase
Fixed
70_GENERATOR
GEN_BUS
GEN_BRKR
ATS_EMERG_BUS
N
E
ATS_EMERG_GEN
ATS_LOAD_BUS
MDC S
30
84
Summerland
Graph: 002 - Feed to MDC_S - Emergency Phase Overcurrent Protection
Date: August 16, 2013
Stantec
Government of Canada

Current in Amps x 13.833 @600 V x 1 @8.3 kV at 8300 volts

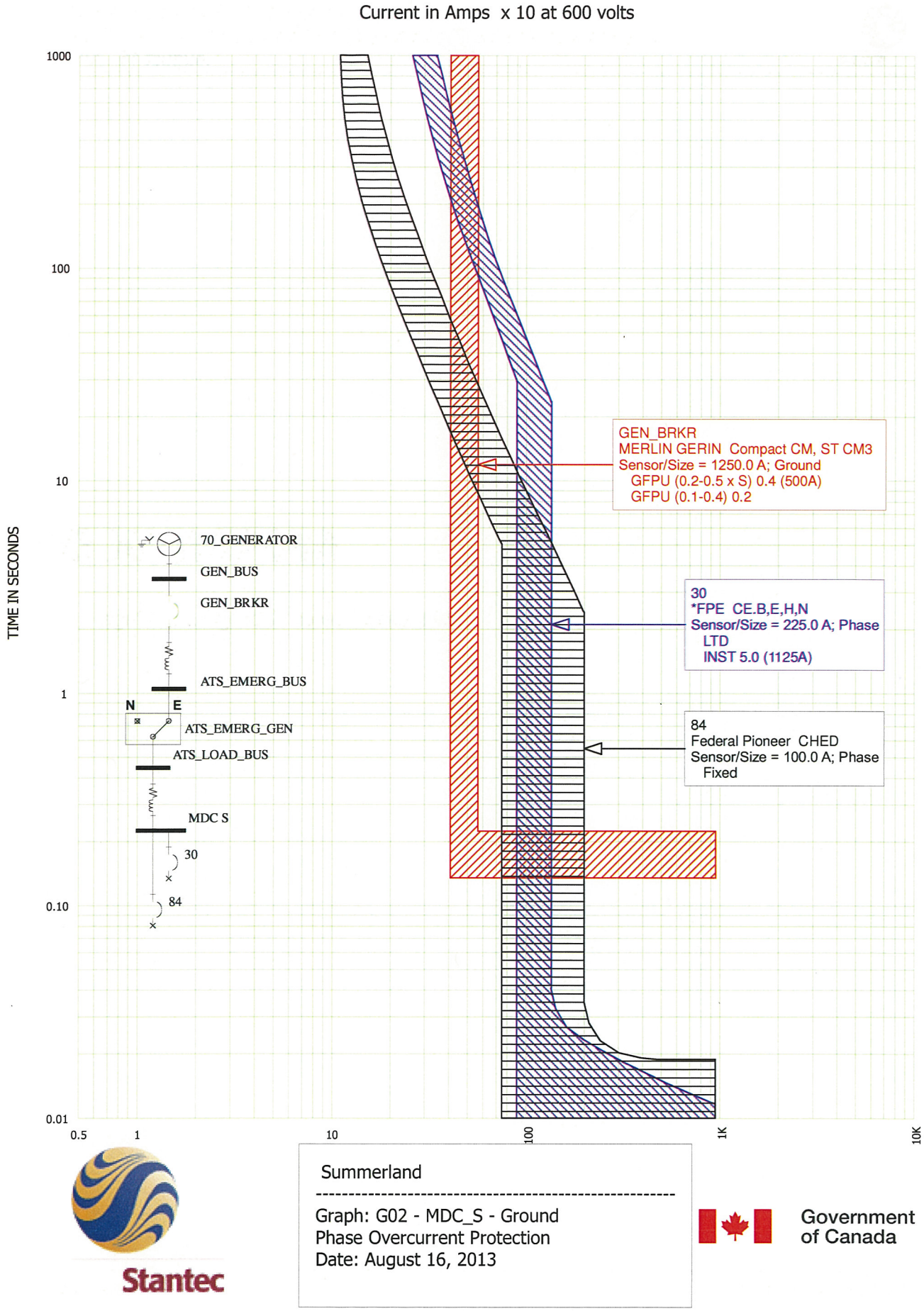


Stantec

Summerland

Graph: G01 - MDC_1 - Ground
Phase Overcurrent Protection
Date: August 16, 2013

Government of Canada



Stantec

Summerland

Graph: G02 - MDC_S - Ground
Phase Overcurrent Protection
Date: August 16, 2013

Government of Canada

APPENDIX D

High Voltage Overcurrent Relays

Description	Graph/Curve	Manufacturer/Model	IEEE Number/Curve	CT Ratio/Sensor	Tap Range/Setting	Time Dial Range/Setting	Inst. Range/Setting
8kV Main Breaker - Phase Relay	001	GEG CDG23		300:5	Tap (2.5-10A) 3.75	Time Dial 0.3	Inst (20-80) 50 (3000A)
Recommended Setting:	001	GEG CDG23		300:5	Tap (2.5-10A) 3.75	Time Dial 0.2	Inst (20-80) 50 (3000A)
8kV Main Breaker - Ground Relay	G01	GEG CDG23		300:5	Tap (2.5-10A) 2.5	Time Dial 0.3	Inst (20-80) 50 (3000A)*
8kV Main TX Secondary - Ground Relay	G01	FPE GLR-T		1200:5*	Trip (1-12)x100 12x	Time Delay (Inst-1.0) 0.55	
Panel MDC_1 Feed to Panel 5N Ground Relay		FPE GLR-T		1200:5*	Trip (1-12)x100 1x	Time Delay (Inst-1.0) 0.1	
Panel MDC_1 Feed to Panel 4N Ground Relay	G01	FPE GLR-T		1200:5*	Trip (1-12)x100 1x	Time Delay (Inst-1.0) 0.15	
Panel MDC_1 Feed to Panel 2N Ground Relay		FPE GLR-T		1200:5*	Trip (1-12)x100 1x	Time Delay (Inst-1.0) 0.1	
Panel MDC_1 Feed to Panel 1N Ground Relay		FPE GLR-T		1200:5*	Trip (1-12)x100 1x	Time Delay (Inst-1.0) 0.1	
Panel MDC_1 Feed to MDC_L Ground Relay	G01	FPE GLR-T		1200:5*	Trip (1-12)x100 1x	Time Delay (Inst-1.0) 0.1	

Transformers

Description	Graph/Curve	Manufacturer/Serial No.	kVA/Class	Voltage Ratio	Configuration	Impedance
Main Transformer	001	FPE	3000kVA ANN 4000kVA ANF	8300V/ 600(347)V	Delta- Wye Solid GND	6.44%

Molded Case Circuit Breakers with Solid State Trip Units

Description	Graph/Curve	Breaker/Trip Unit	Sensor/Plug	Long Delay P.U./Time	Short Delay P.U./Time	Instantaneous P.U.	Ground P.U./Time
Generator Circuit Breaker	002, G02	MG Compact CM1250 ST-CM3	In=1250A	Ir/In 0.7 (875A)	Im/Ir=6(5250A) t=B(0.2)	Fixed at 35kA	Ig/In=0.5 t=0.2
Recommended Settings:	002, G02	MG Compact CM1250 ST-CM3	In=1250A	Ir/In 0.7 (875A)	Im/Ir=4(3500A) t=B(0.2)	Fixed at 35kA	Ig/In=0.5 t=0.2
Panel MDC_1, Feed to Transfer Switch	001 Curve 63	FPE USD	1600AF 1200AT	LTPU=1* LTD=2*	STPU=2.0* STD=0.11*	OFF	GFPU=0.75(900A)* GT=0.2*
Recommended Settings:	001 Curve 63	FPE USD	1600AF 1200AT	LTPU=1 LTD=2	STPU=2.0 STD=0.11	OFF	GFPU=0.75(900A) GT=0.2

Low Voltage Fuses

Description	Graph/Curve	Manufacturer	Type	Fuse Speed	Current Rating	Voltage Rating
Panel MDC_1, Transfer Switch Fuse	001	FPE	LCL-1200	time-delay	1200A	600V

Downstream Panelboards or other Enclosures c/w Significant Circuit Breakers or Fuses

Description/Amps, Volts, Configuration	Graph/Curve	Largest Device/Type	Trip/Instantaneous	2nd Largest Device/Type	Trip/Instantaneous

Downstream Panelboards or other Enclosures c/w Significant Circuit Breakers or Fuses

Description/Amps, Volts, Configuration	*Graph/Curve*	*Largest Device/Type*	*Trip/Instantaneous*	*2nd Largest Device/Type*	*Trip/Instantaneous*
MDC_1 600A, 600V, 3PH-4W	001, G01	GE, TB4 Thermal-Mag	400A HI (3500A)	GE, TB1 Thermal-Mag	100A Fixed
MDC_A 600A, 120(208)V, 3PH-4W		GE, TJD* Thermal-Mag	350A Fixed	GE, TEB Thermal-Mag	100A Fixed
MDC_B 225A, 120(208)V, 3PH-4W		GE, TEB Thermal-Mag	100A Fixed	GE, TEB Thermal-Mag	100A Fixed
MDC_C 400A, 120(208)V, 3PH-4W		FPE, CQD Thermal-Mag	125A Fixed	GE, TEB Thermal-Mag	100A Fixed
MDC_D 600A, 120(208)V, 3PH-4W		FPE, CQD Thermal-Mag	175A Fixed	GE, TEB Thermal-Mag	100A Fixed
MDC_E 600A, 120(208)A, 3PH-4W		FPE, CQD Thermal-Mag	200A Fixed	GE, TEB Thermal-Mag	100A Fixed
MDC_F 600A, 120(208)A, 3PH-4W		FPE, CQD Thermal-Mag	175A Fixed	GE, TEB Thermal-Mag	100A Fixed
MDC_G 600A, 120(208)A, 3PH-4W		GE, TJD* Thermal-Mag	350A Fixed	FPE, CQD Thermal-Mag	200A Fixed
MDC_L 1200A, 120(208)A, 3PH-4W		FPE, CJJ* Thermal-Mag	350A LO (1050A)	FPE, CQD* Thermal-Mag	200A Fixed
MDC_M 600A, 120(208)A, 3PH-4W		FPE, CJJ* Thermal-Mag	250A LO (750A)	FPE, CQD* Thermal-Mag	175A Fixed
MDC_S 1200A, 347(600)V, 3PH-4W	002, 003	FPE, CHFK Thermal-Mag	225A HI (2250A)	GE, THED Thermal-Mag	100A Fixed

Generators

Description	*Graph/Curve*	*Manufacturer/Serial No.*	*kVA/Amperage*	*Voltage/RPM*	*Configuration./Frequency*	*Xd/Xd'/Xd"*
Generator	002	SIMPOWER	1250kVA 1204A	600V 1800rpm	3 Phase 0.8PF	

APPENDIX E

ARC FLASH HAZARD ANALYSIS

An arc fault is initiated by current passing between two conducting metals through ionized gas or vapor caused by a flashover or by breakdown of insulating material. When an arc fault occurs, it produces an explosion with a significant amount of destructive energy. An electrical arc produces temperatures that can exceed 35,000°F, melting and vaporizing copper and other materials. The expansion of copper during vaporization (to 67,000 times its original volume) as well as heating of surrounding air; creates immense sound and pressure waves, intense light, molten metal, as well as shrapnel. All of this occurs in a fraction of a second and will continue until the arc fault is cleared by an overcurrent protective device.

An Arc Flash Hazard Analysis is conducted in order to determine the risk of personal injury present as a result of exposure to incident energy from an electrical arc flash at various points within an electrical system. Once this level of risk is ascertained, measures can be taken to mitigate the risk through the development of strategies with the goal of minimizing burn injuries. Such strategies may include specification of the rating of *Personal Protective Equipment* **(PPE)**, de-energization of equipment prior to performing work, and the application of arc-resistant switchgear. The requirement to apply appropriate warning labels on electrical apparatus identifying arc flash hazards has been incorporated into the Canadian Electrical Code to increase the level of awareness of personnel of the hazard to which they may be exposed while working on or near live electrical equipment:

Canadian Electrical Code, Part I - 2006

2-306 Shock and flash protection (see Appendix B)

(1) Electrical equipment such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centres that are installed in other than dwelling units and are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn persons of potential electric shock and arc flash hazards.

(2) The marking referred to in Subrule (1) shall be located so that it is clearly visible to persons before examination, adjustment, services, or maintenance of the equipment.

The field marking of equipment may be a warning label signifying a shock and arc flash hazard, containing specific information pertaining to the electrical equipment, including the level of hazard present, PPE recommendations, the maximum level of incident energy that could result from an electrical arc event, and the relevant working boundaries. Alternatively, a generic label signifying a shock or arc flash hazard is permitted and an Arc Flash Hazard Report can be consulted to determine the particular information regarding the potential hazard present and other relevant parameters for each piece of electrical equipment within the system. Whether the specific information for electrical equipment is included on a warning label affixed to the equipment or within an Arc Flash Hazard Report, it is determined by performing arc flash hazard calculations in accordance with IEEE-1584-2002 'IEEE Guide for Performing Arc-Flash Hazard Calculations'. CSA Z462-2008 'Workplace Electrical Safety', which is based on the NFPA 70E-2004 'Standard for Electrical Safety in the Workplace', is used to assist in the determination of the severity of potential exposure, the establishment of safe work practices, and selection of appropriate PPE to protect against shock and flash hazards.

This Arc Flash Hazard analysis was performed using PTW version 7.0, developed by SKM System Analysis Inc., incorporating the findings from the short-circuit and protective device evaluation studies. The short circuit study is performed to determine the 3-phase bolted fault current at each point of assessment and the coordination study is used to determine the time required for protective devices to isolate short-circuit/overload conditions. These parameters, in conjunction with switchgear characteristics, are used to calculate the incident energy and establish the flash protection boundary. It should be noted that the models used in this study are based upon measured arc current incident energy

under a specific set of test conditions and on theoretical work, thus the severity of real arc exposures may differ from that indicated due to limitations of the calculation methods currently available.

CSA Z462 defines a series of boundaries relating to electrical safety when working on energized equipment. Only "qualified" personnel can enter these boundaries and are required to wear the appropriate PPE within these boundaries. The four protection boundaries are shown in Figure 1 below: *Flash Protection Boundary, Limited Approach Boundary, Restricted Approach Boundary,* and the *Prohibited Approach Boundary.*

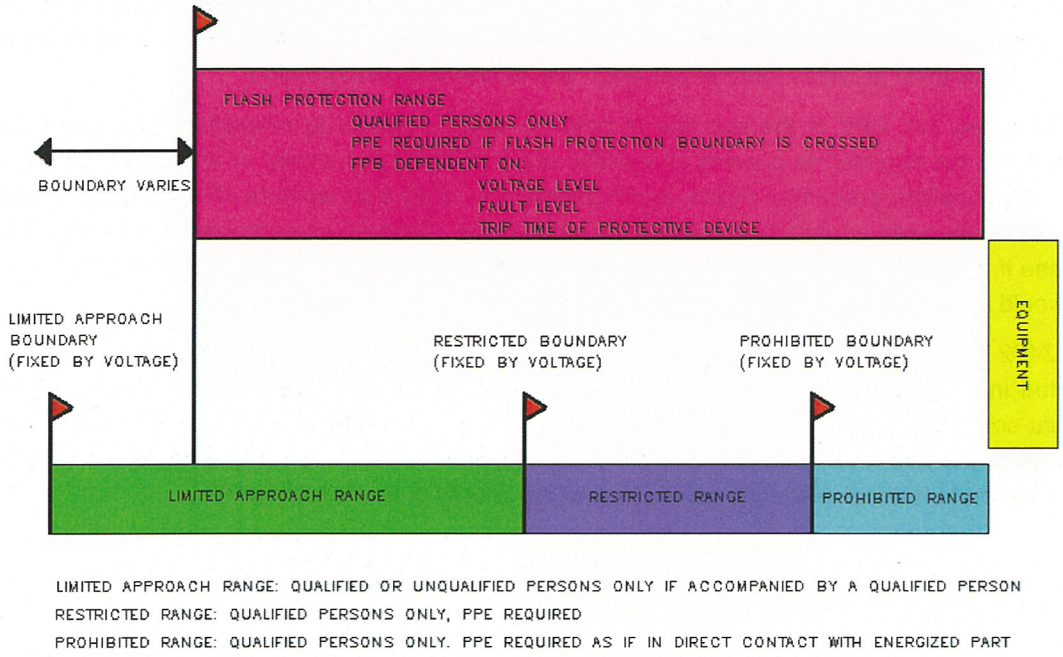


Figure 1: Working Boundaries

The significance of the four boundaries/ranges is as follows. The first three boundaries describe the level of shock hazard and are fixed based only on the operating voltage of the particular piece of electrical equipment. The *Limited Approach Boundary* (**LAB**) is the distance from an exposed energized circuit part at which a shock hazard exists. For that reason, a person is not permitted to cross this boundary and enter the limited approach range for a particular piece of equipment unless he or she is, or is accompanied by, a qualified person.

A qualified person is defined by z462 as one who shall be trained in and knowledgeable about the construction and operation of electrical equipment or a specific work method and trained to recognize and avoid the electrical hazards that might be present with respect to that equipment or work method. Within the *Restricted Boundary* (**RB**), there is an increased risk of shock due to an arc over combined with inadvertent movement of personnel, so only qualified persons are permitted and can only cross the restricted approach boundary with the appropriate PPE.

Work within the *Prohibited Boundary* (**PB**) is considered to be the same as being in direct contact with the energized equipment. Therefore, a person must not cross the prohibited approach boundary unless he or she is protected accordingly.

The final working boundary, the *Flash Protection Boundary* (**FPB**), is defined as the distance from exposed energized parts that a person could receive a second-degree burn should an arc flash occur. This boundary is not determined based on operating voltage but is determined by performing an Arc Flash Hazard Analysis.

CSA Z462 specifies the requirement of PPE for workers within the flash protection boundary. All parts of the body that may be exposed to the arc flash must be covered by the appropriate type and quality of PPE. The entire PPE set may be comprised of FR clothing, helmet or headgear, face shield, safety glasses, gloves, shoes, etc. depending upon the magnitude of the calculated *Incident Energy* **(IE)**. The protective clothing should limit the incident energy reaching the chest/face of the worker to no more than 1.2 cal/cm^2. FR clothing provides thermal insulation and is also self-extinguishing.

It should be noted that PPE is the last line of defence when it comes to protection against arc flash hazards and it is not intended to prevent all injuries, but to mitigate the impact of an arc flash upon the individual. The analysis presented herein is not intended to imply that workers should be permitted to perform work on exposed energized equipment or circuit parts. Working on energized equipment should only be done if de-energizing the equipment is infeasible due to its design or operational limitations, or if doing so would introduce additional or increased hazards.

The CSA Z462 Table 6 (shown below) defines five (5) levels of Hazard/Risk categories for various levels of calculated incident energies at the typical *Working Distance* **(WD)**. Examples of typical protective clothing that cover the torso are also provided in this table. Please note, other PPE required to protect various parts of the body are assumed and are identified within Z462, and include items like hard hat, safety classes, and electrical insulating gloves (if working directly on live equipment).

CSA Z462 TABLE 6 'Protective Clothing Characteristics'

HAZARD/RISK LEVEL	INCIDENT ENERGY	DESCRIPTION OF CLOTHING
0	N/A	Non-melting, flammable materials (e.g. untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight of at least 4.5 oz/yd^2
1	4 cal/cm^2	Arc-rated FR shirt and FR pants or FR coverall
2	8 cal/cm^2	Arc-rated FR shirt and FR pants or FR coverall
3	25 cal/cm^2	Arc-rated FR shirt and FR pants or FR coverall, and arc flash suit selected so that the system arc rating meets the required minimum
4	40 cal/cm^2	Arc-rated FR shirt and FR pants or FR coverall, and arc flash suit selected so that the system arc rating meets the required minimum

The Table 5 from CSA Z462 then lists detailed protective clothing sets and equipment requirements based on each of the hazard/risk classification levels. All parts of the body that may be exposed to the arc flash must be covered by the appropriate type and quality of PPE. The entire PPE set may be comprised of Flame Resistant (**FR**) clothing, helmet or headgear, face shield, safety glasses, gloves, shoes, etc. depending upon the magnitude of the calculated incident energy. The protective clothing should limit the incident energy reaching the chest/face of the worker to 1.2cal/cm^2 or less. FR clothing provides thermal insulation and is also self-extinguishing. When work on or near energized circuit parts is performed within the flash protection boundary, personnel should be equipped with PPE appropriate for the hazard/risk classification of the switchgear. The latest version of the Z462 source document should be referenced to ensure adequate PPE is being used for the various tasks being performed within the facility.

As part of this project, two types of labels are provided for the distribution equipment within this facility. Most downstream distribution equipment within the facility can be covered with the default hazard/risk categories from CSA Z462 Table 4. This table is the simplest method for determining PPE requirements as it provides typical risk categories associated with performing various activities on or near live electrical equipment within the flash protection boundary. These risk categories provided are based on specific fault levels and fault clearing times and, as a result, cannot be applied to all installations of electrical equipment within a distribution system. The guidelines provided in Table 4 are applicable to all devices outside the scope of detailed IEEE 1584 calculations within this study.

All distribution equipment that does not require detailed IEEE 1584 calculations will be labelled with standard CSA Z462 Table 4 labels similar to that of Figure 2. For example, this label is the standard label that will be applied to Panel boards with a voltage rating above 240V and up to 600V. It identifies that operating a switch or circuit breaker with the panel covers off is a Hazard/Risk Level (HRL) 1 operation and does not require Insulating Gloves or Insulating Tools. With this information at hand, facility personnel would use PPE rated for HRL 1 from Table 5 of CSA Z462 for this specific operation. Similarly, standard labels will be generated for other electrical equipment such as Transformers, MCCs, Splitters, Disconnects, etc. that meet the requirements of CSA Z462 Table 4. All the labels will provide specific tasks related to the equipment with a corresponding hazard risk level.

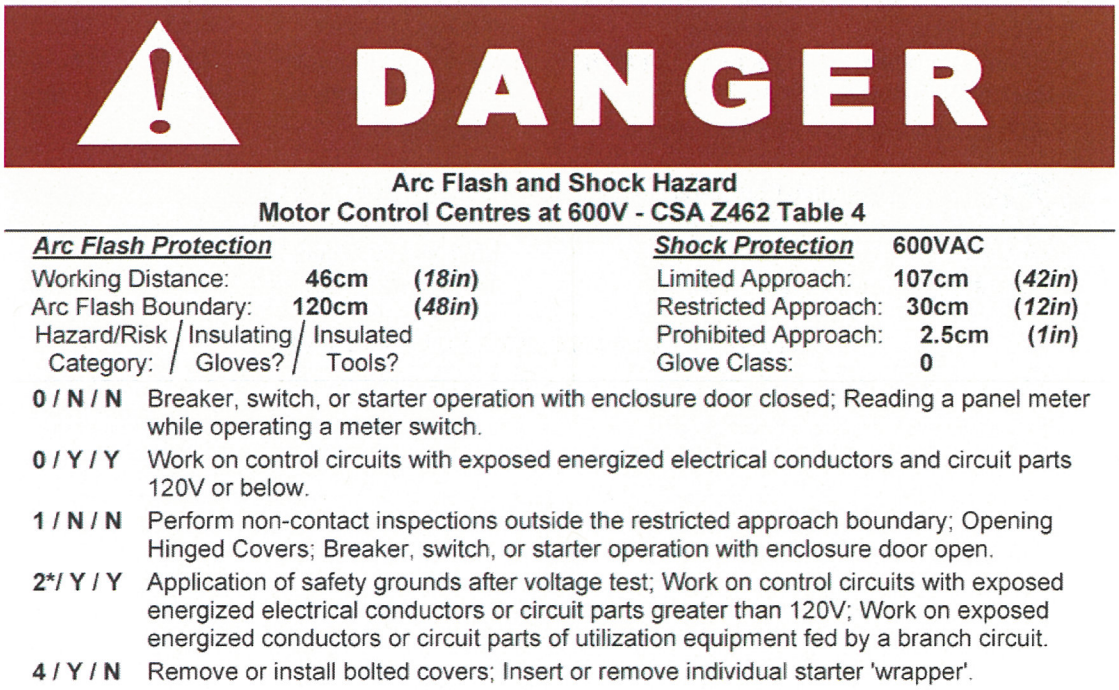


Figure 2: Sample Standard Arc Flash Label

Some switchgear cannot be covered by CSA Z462 Table 4, they are usually the main switchboards and distribution equipment found the furthest upstream in the system closest to the main power source(s), where higher potential fault energies are encountered and intentional clearing delays are often applied to protective devices to aid in protective device coordination. As such, detailed calculations are performed on these areas of the system with the intention of identifying cases where the risk may be significantly

greater than those identified in Table 4. These devices are included within our detailed arc flash table, and will be provided with detailed arc flash labels as per Figure 3. Similar to the labels shown in Figure 2, the labels illustrated by Figure 3 identifies the Hazard/Risk Level and actual Incident Energy present at the specific piece of electrical equipment. However, this HRL does not change regardless of the task being performed at the equipment and thus the appropriate PPE for this HRL is required no matter which tasks are being performed. This HRL is used by the worker to wear appropriate PPE based on Table 5 of the CSA Z462.

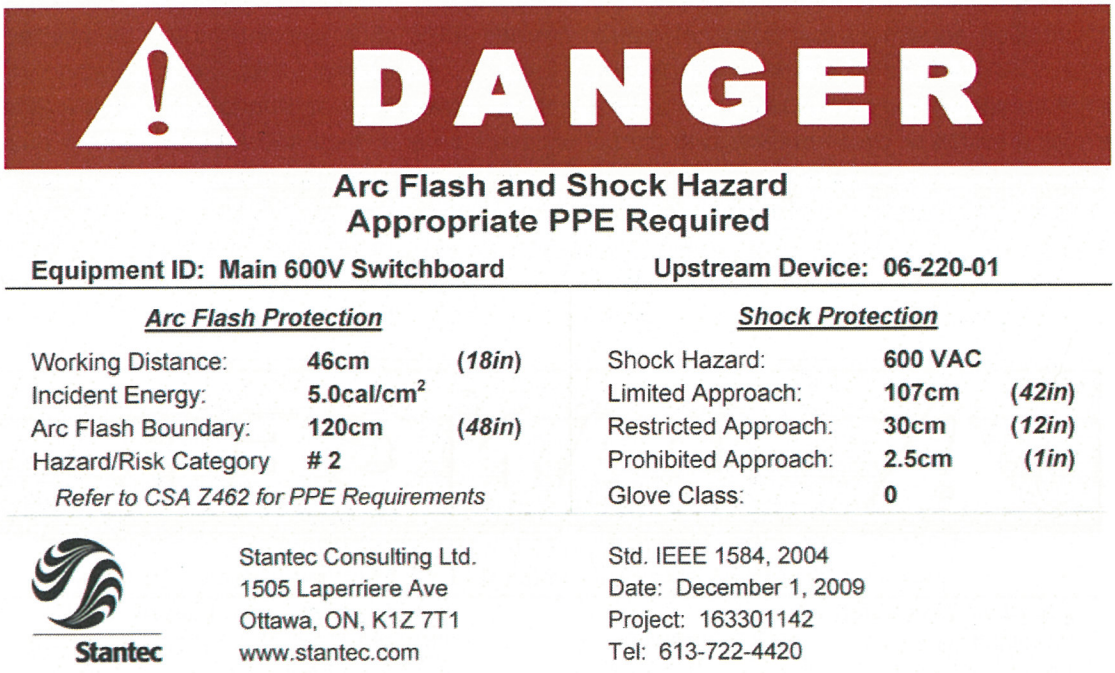


Figure 3: Sample Specific Arc Flash Label

Arc Flash Report - IEEE 1584 Calculations
Maximum Fault Duty - Worst Case

Stantec

Government of Canada

Bus Name	Equipment Type	Upstream Protective Device Clearing Fault	Bolted Fault Current @ Bus	Bolted Fault Current Through Prot.	Arcing Fault Current @ Bus	Arcing Fault Current Through Prot.	Clearing Time (ms)	Arc Flash Hazard Analysis Results FPB (mm)	WD (mm)	IE (ca/cm2)	CSA Z462 PPE Cat.
8,300 Volt Busses											
BC HYDRO_BUS	SWG (153)	MaxTripTime @2.0s	34,780	34,780	33,050	33,050	2,000	80,864.3	914	93.64	Dangerous!
MAIN_BRKR_PRI_BUS	SWG (153)	MaxTripTime @2.0s	14,410	14,410	13,900	13,900	2,000	30,890.3	914	36.71	Level 4
MAIN_TX_PRI_BUS	SWG (153)	MAIN_BRKR_RLY	14,410	14,410	13,890	13,890	100	1,416.0	914	1.83	Level 1
600 Volt Busses											
1H_3H_PRI_BUS	PNL (25)	47	21,600	21,600	15,980	15,980	25	498.5	457	1.38	Level 1
1J_2J_PRI_BUS	PNL (25)	48	10,320	10,320	8,090	8,090	25	318.4	457	.66	Level 0
1K_2K_PRI_BUS	PNL (25)	49	10,990	10,990	8,570	8,570	25	330.7	457	.70	Level 0
1N_PRI_BUS	PNL (25)	52	13,130	13,130	10,100	10,100	10	210.8	457	.34	Level 0
1Q_PRI_BUS	PNL (25)	59	1,510	1,510	1,380	1,380	16	75.6	457	.06	Level 0
1R_PRI_BUS	PNL (25)	60	4,980	4,980	4,130	4,130	16	155.9	457	.20	Level 0
1S_TX_PRI_BUS	PNL (25)	86	25,500	25,500	18,620	18,620	19	464.9	457	1.23	Level 1
1T_PRI_BUS	PNL (25)	61	2,530	2,530	2,220	2,220	16	103.5	457	.10	Level 0
1U_PRI_BUS	PNL (25)	62	9,690	9,690	7,640	7,640	25	306.5	457	.62	Level 0
2H_3H_PRI_BUS	PNL (25)	64	21,160	21,160	15,680	15,680	25	492.3	457	1.35	Level 1
2N_PRI_BUS	PNL (25)	53	12,990	12,990	10,000	10,000	10	209.5	457	.33	Level 0
3N_PRI_BUS	PNL (25)	54	9,840	9,840	7,740	7,740	25	309.3	457	.63	Level 0
3S_TX_PRI_BUS	PNL (25)	87	5,700	5,700	4,680	4,680	20	191.0	457	.29	Level 0
4H_5H_PRI_BUS	PNL (25)	65	22,050	22,050	16,290	16,290	25	504.8	457	1.41	Level 1
4N_PRI_BUS	PNL (25)	55	15,190	15,190	11,560	11,560	10	230.4	457	.39	Level 0
4S_TX_PRI_BUS	PNL (25)	88	2,790	2,790	2,430	2,430	18	119.5	457	.13	Level 0
5N_PRI_BUS	PNL (25)	56	15,820	15,820	11,990	11,990	10	236.1	457	.40	Level 0
6N_PRI_BUS	PNL (25)	57	12,630	12,630	9,740	9,740	25	359.9	457	.81	Level 0
ALTERNATOR	PNL (25)	63 FUSE	32,150	32,200	19,590	19,620	17	454.6	457	1.18	Level 0
ATS_EMERG_BUS	PNL (25)	CDP-EP BKRK	7,780	57,670	6,240	46,230	16	205.1	457	.32	Level 0
ATS_LOAD_BUS	PNL (25)	CDP-EP BKRK	33,390	57,670	23,860	41,220	16	568.2	457	1.71	Level 1

Stantec

Arc Flash Report - IEEE 1584 Calculations
Maximum Fault Duty - Worst Case

Government of Canada

Bus Name	Equipment Type	Upstream Protective Device Clearing Fault	Bolted Fault Current @ Bus	Bolted Fault Current Through Prot.	Arcing Fault Current @ Bus	Arcing Fault Current Through Prot.	Clearing Time (ms)	Arc Flash Hazard Analysis Results FPB (mm)	WD (mm)	IE (ca/cm2)	CSA Z462 PPE Cat.
ATS_NORMAL_BUS	PNL (25)	63 FUSE	34,160	34,160	20,720	20,720	12	384.3	457	.90	Level 0
CDP-EP Panel	PNL (25)	CDP-EP BKRK	33,350	68,590	23,840	49,030	16	496.2	457	1.37	Level 1
CH01_BUS	PNL (25)	32	24,520	24,520	17,960	17,960	25	538.4	457	1.56	Level 1
CH02_BUS	PNL (25)	33	24,520	24,520	17,960	17,960	25	538.4	457	1.56	Level 1
CT01_STARTER	PNL (25)	89	31,160	31,190	19,040	19,060	19	465.7	457	1.23	Level 1
CT01B1_BUS	PNL (25)	91	27,390	27,440	16,900	16,930	19	436.2	457	1.11	Level 0
CT01B2_BUS	PNL (25)	91	27,390	27,440	16,900	16,930	19	436.2	457	1.11	Level 0
CT01C_STARTER	PNL (25)	90	25,610	25,640	15,890	15,910	19	413.3	457	1.01	Level 0
GEN_BUS	PNL (25)	MaxTripTime @2.0s	7,830	3,700	6,270	3,150	2,000	2,817.2	457	23.62	Level 3
H_PANEL	PNL (25)	20	17,380	17,380	13,080	13,080	10	250.0	457	.44	Level 0
J_PANEL	PNL (25)	21	13,970	13,970	10,700	10,700	25	382.7	457	.89	Level 0
K_PANEL	PNL (25)	22	7,700	7,700	6,180	6,180	16	203.2	457	.32	Level 0
L_PANEL	PNL (25)	23	6,710	6,710	5,440	5,440	16	186.8	457	.28	Level 0
M_PANEL	PNL (25)	24	25,120	25,120	18,370	18,370	10	312.6	457	.64	Level 0
MAIN_TX_SEC_BUS	PNL (25)	MAIN_BRKR_RLY	37,230	37,230	26,380	26,380	420	3,871.3	457	39.79	Level 4
MCC_1_PANEL	PNL (25)	29	25,810	25,810	18,830	18,830	25	555.4	457	1.64	Level 1
MCC_1S	PNL (25)	83	20,830	20,830	15,450	15,450	10	279.0	457	.53	Level 0
MCC_E_PANEL	PNL (25)	30	14,620	14,620	11,150	11,150	11	236.6	457	.41	Level 0
MCC_ES_BUS	PNL (25)	82	6,750	6,750	5,470	5,470	19	207.5	457	.33	Level 0
MCC_P1_BUS	PNL (25)	63 FUSE	32,150	32,200	19,590	19,620	17	454.6	457	1.18	Level 0
MCC_P2_BUS	PNL (25)	85	32,270	32,340	23,130	23,170	10	363.9	457	.82	Level 0
MCC_W_PANEL	PNL (25)	31	14,620	14,620	11,150	11,150	14	277.5	457	.53	Level 0
MDC S	PNL (25)	63 FUSE	33,050	33,050	20,090	20,090	15	421.4	457	1.05	Level 0
MDC_1	SWG (32)	MAIN_BRKR_RLY	35,220	35,220	23,440	23,440	449	4,643.0	610	23.78	Level 3
MDC_A_PRI_BUS	PNL (25)	40	26,600	26,600	19,360	19,360	25	565.7	457	1.69	Level 1
MDC_B_PRI_BUS	PNL (25)	41	13,910	13,910	10,650	10,650	10	218.4	457	.36	Level 0

Arc Flash Report - IEEE 1584 Calculations
Maximum Fault Duty - Worst Case

Stantec

Government of Canada

Bus Name	Equipment Type	Upstream Protective Device Clearing Fault	Bolted Fault Current @ Bus	Bolted Fault Current Through Prot.	Arcing Fault Current @ Bus	Arcing Fault Current Through Prot.	Clearing Time (ms)	Arc Flash Hazard Analysis Results FPB (mm)	WD (mm)	IE (ca/cm2)	CSA Z462 PPE Cat.
MDC_C_PRI_BUS	PNL (25)	42	18,780	18,780	14,050	14,050	10	262.0	457	.48	Level 0
MDC_D_PRI_BUS	PNL (25)	43	29,810	29,810	21,500	21,500	25	606.2	457	1.90	Level 1
MDC_E_PRI_BUS	PNL (25)	44	29,970	29,970	21,600	21,600	25	608.1	457	1.91	Level 1
MDC_F_PRI_BUS	PNL (25)	45	28,760	28,760	20,800	20,800	25	593.0	457	1.83	Level 1
MDC_G_PRI_BUS	PNL (25)	46	28,760	28,760	20,800	20,800	25	593.0	457	1.83	Level 1
MDC_L_PRI_BUS	PNL (25)	50	16,750	16,750	12,640	12,640	10	244.4	457	.43	Level 0
MDC_M_PRI_BUS	PNL (25)	51	28,760	28,760	20,800	20,800	25	593.0	457	1.83	Level 1
P_PANEL	PNL (25)	25	8,120	8,120	6,490	6,490	25	275.3	457	.52	Level 0
P1_VAC1_BUS	PNL (25)	84	31,210	31,260	19,060	19,090	19	472.2	457	1.26	Level 1
P1_VAC2_BUS	PNL (25)	84	31,210	31,260	19,060	19,090	19	472.2	457	1.26	Level 1
P2_COMPRESSOR1_BUS	PNL (25)	85	31,340	31,410	22,520	22,560	10	357.5	457	.80	Level 0
P2_COMPRESSOR2_BUS	PNL (25)	85	31,340	31,410	22,520	22,560	10	357.5	457	.80	Level 0
Q_PANEL	PNL (25)	26	6,850	6,850	5,550	5,550	25	248.3	457	.44	Level 0
R_PANEL	PNL (25)	27	17,700	17,700	13,300	13,300	25	441.8	457	1.13	Level 0
S_PANEL	PNL (25)	80	28,370	28,370	20,540	20,540	10	336.5	457	.72	Level 0
SA_PANEL	PNL (25)	63 FUSE	27,220	27,220	19,770	19,770	16	442.6	457	1.13	Level 0
T_PANEL	PNL (25)	28	5,340	5,340	4,410	4,410	16	162.7	457	.22	Level 0
T2S_BUS	PNL (25)	82	2,820	2,820	2,080	2,080	32	152.3	457	.20	Level 0
TP_PRI_BUS	PNL (25)	58	6,710	6,710	5,440	5,440	16	186.8	457	.28	Level 0
208 Volt Busses											
1B_PANEL	PNL (25)	1B_BRKR	1,520	1,520	1,160	1,160	2,000	458.3	457	1.20	Level 0
1C_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,600	67,120	1,200	50,430	573	458.3	457	1.20	Level 0
1D_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,070	67,260	1,440	46,730	573	689.2	457	2.34	Level 1
1F_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,790	67,030	1,770	42,660	573	789.9	457	2.93	Level 1
1G_PANEL	PNL (25)	1G_BRKR	4,040	4,040	1,960	1,960	2,000	1,804.6	457	11.37	Level 3
1H_3H_SEC_BUS	PNL (25)	47	6,100	6,100	3,070	3,070	25	168.3	457	.23	Level 0

Stantec

Arc Flash Report - IEEE 1584 Calculations
Maximum Fault Duty - Worst Case

Government of Canada

Bus Name	Equipment Type	Upstream Protective Device Clearing Fault	Bolted Fault Current @ Bus	Bolted Fault Current Through Prot.	Arcing Fault Current @ Bus	Arcing Fault Current Through Prot.	Clearing Time (ms)	Arc Flash Hazard Analysis Results FPB (mm)	WD (mm)	IE (ca/cm2)	CSA Z462 PPE Cat.
1H_PANEL	PNL (25)	47	5,590	5,590	2,890	2,890	25	162.7	457	.22	Level 0
1J_2J_SEC_BUS	PNL (25)	48	6,000	6,000	3,040	3,040	28	180.8	457	.26	Level 0
1J_PANEL & 2J_PANEL	PNL (25)	48	5,480	5,480	2,850	2,850	30	178.8	457	.26	Level 0
1K_2K_SEC_BUS	PNL (25)	49	5,410	5,410	2,820	2,820	25	160.7	457	.21	Level 0
1K_PANEL & 2K_PANEL	PNL (25)	49	5,150	5,150	2,730	2,730	26	157.9	457	.21	Level 0
1L_PANEL	PNL (25)	1L_BRKR	7,010	7,010	3,390	3,390	20	155.4	457	.20	Level 0
1M_PANEL	PNL (25)	51	5,240	5,240	2,760	2,760	29	170.0	457	.24	Level 0
1N_PANEL	PNL (25)	1N GROUND RLY	6,210	6,210	2,640	2,640	146	446.7	457	1.15	Level 0
1N_SEC_BUS	PNL (25)	1N GROUND RLY	6,740	6,740	2,800	2,800	146	464.1	457	1.22	Level 1
1P_PANEL & 2P_PANEL & 3P_PANEL	PNL (25)	58	3,220	3,220	1,960	1,960	2,000	458.3	457	1.20	Level 0
1Q_PANEL	PNL (25)	59	960	960	840	840	2,000	458.3	457	1.20	Level 0
1Q_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	1,000	66,630	860	57,570	573	458.3	457	1.20	Level 0
1R_PANEL & 2R_PANEL	PNL (25)	60	1,070	1,070	900	900	2,000	458.3	457	1.20	Level 0
1R_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	1,090	66,450	920	55,910	573	458.3	457	1.20	Level 0
1S_PANEL	PNL (25)	86	3,110	3,110	1,920	1,920	2,000	458.3	457	1.20	Level 0
1S_TX_SEC_BUS	PNL (25)	86	3,190	3,190	1,950	1,950	2,000	458.3	457	1.20	Level 0
1T_PANEL	PNL (25)	61	1,030	1,030	880	880	2,000	458.3	457	1.20	Level 0
1T_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	1,050	66,530	900	56,560	573	458.3	457	1.20	Level 0
1U_PANEL	PNL (25)	62	5,790	5,790	2,960	2,960	25	164.7	457	.22	Level 0
1U_SEC_BUS	PNL (25)	62	5,950	5,950	3,020	3,020	25	166.4	457	.23	Level 0
2B_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,180	66,990	970	55,110	573	458.3	457	1.20	Level 0
2C_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,780	67,000	1,290	48,740	573	458.3	457	1.20	Level 0
2D_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,030	67,270	1,420	47,020	573	682.9	457	2.31	Level 1
2E_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,330	67,200	1,560	45,110	573	727.0	457	2.56	Level 1
2F_PANEL	PNL (25)	45	3,530	3,530	1,780	1,780	47	173.3	457	.24	Level 0
2H_3H_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	5,320	64,230	2,790	33,700	573	1,065.8	457	4.79	Level 2

Arc Flash Report - IEEE 1584 Calculations
Maximum Fault Duty - Worst Case

Government of Canada

Bus Name	Equipment Type	Upstream Protective Device Clearing Fault	Bolted Fault Current @ Bus	Bolted Fault Current Through Prot.	Arcing Fault Current @ Bus	Arcing Fault Current Through Prot.	Clearing Time (ms)	Arc Flash Hazard Analysis Results FPB (mm)	WD (mm)	IE (ca/cm2)	CSA Z462 PPE Cat.
2L_PANEL	PNL (25)	2L_BRKR	7,070	7,070	3,410	3,410	25	180.2	457	.26	Level 0
2N_PANEL	PNL (25)	2N GROUND RLY	6,670	6,670	2,780	2,780	146	461.8	457	1.21	Level 1
2N_SEC_BUS	PNL (25)	53	7,290	7,290	2,960	2,960	46	238.5	457	.41	Level 0
2S_PANEL	PNL (25)	82	1,310	1,310	1,040	1,040	2,000	458.3	457	1.20	Level 0
3A_PANEL	PNL (25)	40	2,310	2,310	1,320	1,320	48	144.1	457	.18	Level 0
3B_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,160	66,990	960	55,290	573	458.3	457	1.20	Level 0
3C_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,550	67,130	1,170	50,890	573	458.3	457	1.20	Level 0
3D_PANEL	PNL (25)	3D_BRKR	2,860	2,860	1,810	1,810	2,000	1,712.5	457	10.44	Level 3
3E_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,580	67,040	1,680	43,640	573	762.5	457	2.77	Level 1
3F_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,950	66,860	1,840	41,840	573	810.8	457	3.06	Level 1
3G_PANEL	PNL (25)	3G_BRKR	4,710	4,710	2,180	2,180	28	142.8	457	.18	Level 0
3H_PANEL & 2H_PANEL	PNL (25)	64	4,990	4,990	2,670	2,670	2,000	2,215.6	457	15.93	Level 3
3L_PANEL	PNL (25)	50	7,080	7,080	2,900	2,900	48	242.0	457	.42	Level 0
3M_PANEL	PNL (25)	3M_BRKR	5,280	5,280	2,360	2,360	25	142.2	457	.18	Level 0
3N_PANEL	PNL (25)	54	4,640	4,640	2,540	2,540	2,000	2,142.9	457	15.08	Level 3
3N_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	4,940	64,700	2,650	34,710	573	1,029.9	457	4.53	Level 2
3S_PANEL	PNL (25)	87	3,970	3,970	2,270	2,270	2,000	458.3	457	1.20	Level 0
3S_TX_SEC_BUS	PNL (25)	87	4,200	4,200	2,370	2,370	2,000	458.3	457	1.20	Level 0
4A_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,430	67,360	1,110	52,310	573	458.3	457	1.20	Level 0
4B_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,150	67,000	950	55,530	573	458.3	457	1.20	Level 0
4C_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,520	67,140	1,160	51,150	573	458.3	457	1.20	Level 0
4D_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,550	66,970	1,660	43,780	573	757.6	457	2.74	Level 1
4E_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,220	67,230	1,510	45,770	573	711.5	457	2.47	Level 1
4F_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,890	66,890	1,820	42,130	573	802.9	457	3.01	Level 1
4G_PANEL	PNL (25)	4G_BRKR	4,430	4,430	2,460	2,460	2,000	2,097.6	457	14.56	Level 3
4H_5H_SEC_BUS	PNL (25)	65	10,220	10,220	4,420	4,420	25	213.7	457	.34	Level 0

Arc Flash Report - IEEE 1584 Calculations
Maximum Fault Duty - Worst Case

Stantec

Government of Canada

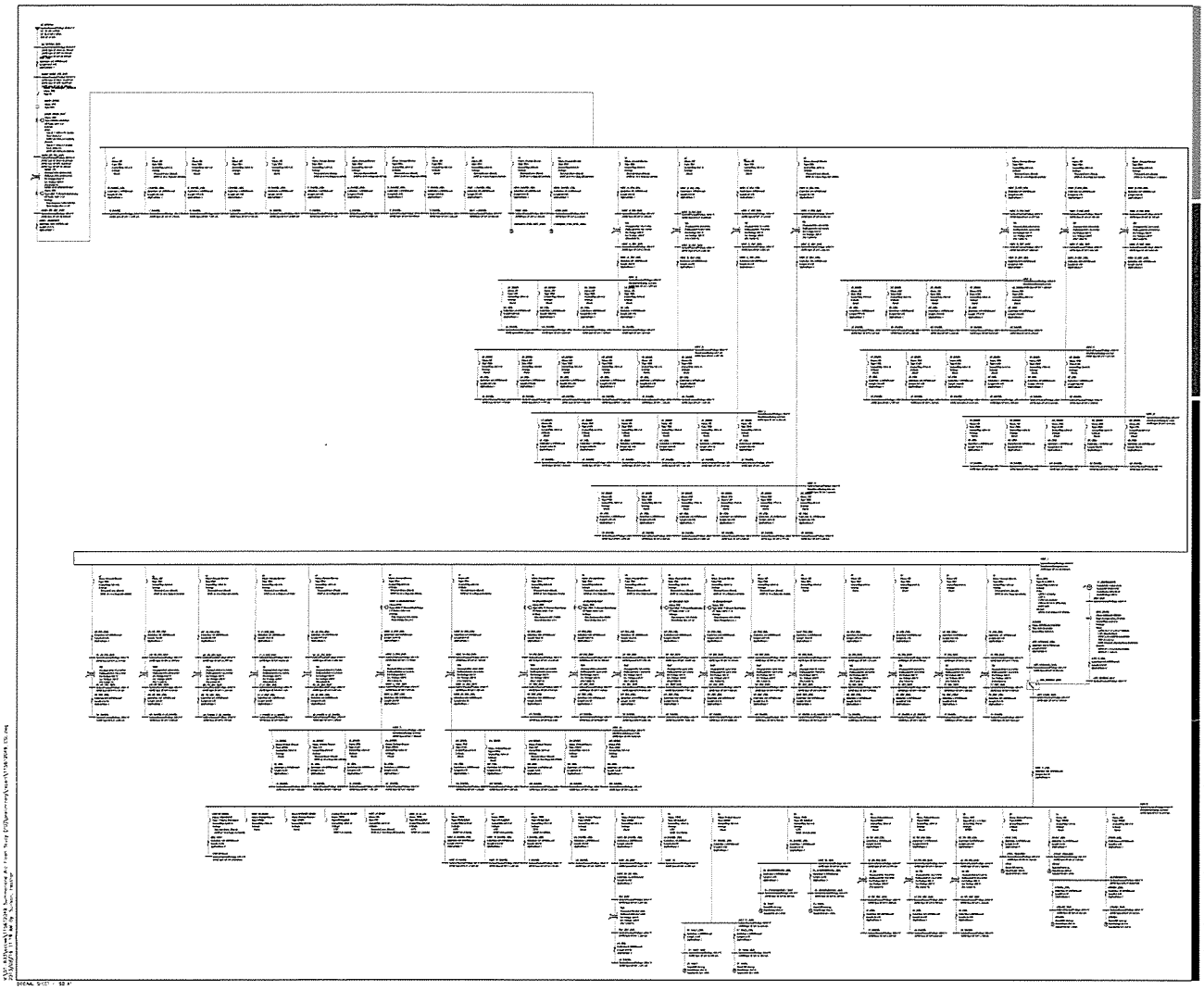
Bus Name	Equipment Type	Upstream Protective Device Clearing Fault	Bolted Fault Current @ Bus	Bolted Fault Current Through Prot.	Arcing Fault Current @ Bus	Arcing Fault Current Through Prot.	Clearing Time (ms)	Arc Flash Hazard Analysis Results FPB (mm)	WD (mm)	IE (ca/cm2)	CSA Z462 PPE Cat.
4H_PANEL & 5H_PANEL	PNL (25)	65	8,680	8,680	3,940	3,940	25	198.1	457	.30	Level 0
4L_PANEL	PNL (25)	4L_BRKR	7,010	7,010	3,390	3,390	20	155.4	457	.20	Level 0
4M_PANEL	PNL (25)	4M_BRKR	5,240	5,240	2,760	2,760	25	156.9	457	.21	Level 0
4N_PANEL	PNL (25)	55	7,020	7,020	2,880	2,880	49	242.9	457	.42	Level 0
4N_SECI_BUS	PNL (25)	55	7,710	7,710	3,080	3,080	42	232.2	457	.39	Level 0
4S_PANEL	PNL (25)	88	1,810	1,810	1,310	1,310	2,000	458.3	457	1.20	Level 0
4S_TX_SEC_BUS	PNL (25)	88	1,960	1,960	1,380	1,380	2,000	458.3	457	1.20	Level 0
5A_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,400	67,360	1,100	52,560	573	458.3	457	1.20	Level 0
5B_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,140	67,010	940	55,710	573	458.3	457	1.20	Level 0
5C_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,500	67,140	1,150	51,380	573	458.3	457	1.20	Level 0
5D_PANEL	PNL (25)	5D_BRKR	2,780	2,780	1,770	1,770	2,000	1,689.4	457	10.21	Level 3
5E_PANEL	PNL (25)	5E_BRKR	3,310	3,310	2,000	2,000	2,000	1,832.8	457	11.67	Level 3
5F_PANEL	PNL (25)	5F_BRKR	3,350	3,350	1,720	1,720	2,000	1,655.7	457	9.87	Level 3
5G_PANEL	PNL (25)	5G_BRKR	3,790	3,790	1,870	1,870	2,000	1,752.7	457	10.84	Level 3
5M_PANEL	PNL (25)	5M_BRKR	5,270	5,270	2,360	2,360	25	142.2	457	.18	Level 0
5N_PANEL	PNL (25)	5N GROUND RLY	6,860	6,860	2,840	2,840	146	467.9	457	1.24	Level 1
5N_SEC_BUS	PNL (25)	56	7,520	7,520	3,030	3,030	44	235.1	457	.40	Level 0
6A_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,390	67,350	1,090	52,780	573	458.3	457	1.20	Level 0
6B_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,130	67,010	940	55,860	573	458.3	457	1.20	Level 0
6C_PANEL	PNL (25)	MAIN OCB GROUND RLY	1,480	67,150	1,130	51,640	573	458.3	457	1.20	Level 0
6D_PANEL	PNL (25)	MAIN OCB GROUND RLY	260	67,080	260	67,080	573	115.2	457	.08	Level 0
6E_PANEL	PNL (25)	6E_BRKR	3,270	3,270	1,980	1,980	2,000	1,822.5	457	11.56	Level 3
6F_PANEL	PNL (25)	MAIN OCB GROUND RLY	2,750	66,960	1,760	42,770	573	785.3	457	2.90	Level 1
6G_PANEL	PNL (25)	6G_BRKR	4,150	4,150	2,350	2,350	2,000	2,035.3	457	13.85	Level 3
6M_PANEL	PNL (25)	51	5,270	5,270	2,770	2,770	28	170.3	457	.24	Level 0
6N_PANEL	PNL (25)	57	4,770	4,770	2,590	2,590	29	165.4	457	.23	Level 0

Arc Flash Report - IEEE 1584 Calculations
Maximum Fault Duty - Worst Case

Government of Canada

Bus Name	Equipment Type	Upstream Protective Device Clearing Fault	Bolted Fault Current @ Bus	Bolted Fault Current Through Prot.	Arcing Fault Current @ Bus	Arcing Fault Current Through Prot.	Clearing Time (ms)	Arc Flash Hazard Analysis Results FPB (mm)	WD (mm)	IE (ca/cm2)	CSA Z462 PPE Cat.
6N_SEC_BUS	PNL (25)	57	5,090	5,090	2,710	2,710	29	168.5	457	.23	Level 0
MDC_A	PNL (25)	40	5,860	5,860	2,990	2,990	25	165.5	457	.23	Level 0
MDC_A_SEC_BUS	PNL (25)	40	6,180	6,180	3,100	3,100	25	169.3	457	.23	Level 0
MDC_B	PNL (25)	41	2,180	2,180	1,490	1,490	2,000	458.3	457	1.20	Level 0
MDC_B_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	2,240	65,870	1,520	44,720	573	458.3	457	1.20	Level 0
MDC_C	PNL (25)	42	3,510	3,510	2,080	2,080	2,000	458.3	457	1.20	Level 0
MDC_C_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	3,610	65,170	2,130	38,410	573	458.3	457	1.20	Level 0
MDC_D	PNL (25)	43	5,210	5,210	2,750	2,750	31	178.3	457	.25	Level 0
MDC_D_SEC_BUS	PNL (25)	43	5,420	5,420	2,830	2,830	30	179.6	457	.26	Level 0
MDC_E	PNL (25)	44	5,210	5,210	2,750	2,750	2,000	2,260.7	457	16.46	Level 3
MDC_E_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	5,420	64,030	2,830	33,420	573	1,074.8	457	4.86	Level 2
MDC_F	PNL (25)	45	5,200	5,200	2,750	2,750	29	169.6	457	.23	Level 0
MDC_F_SEC_BUS	PNL (25)	45	5,410	5,410	2,830	2,830	28	171.6	457	.24	Level 0
MDC_G	PNL (25)	46	5,200	5,200	2,750	2,750	2,000	2,258.2	457	16.43	Level 3
MDC_G_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	5,410	64,050	2,830	33,450	573	1,073.6	457	4.85	Level 2
MDC_L	PNL (25)	50	7,160	7,160	2,920	2,920	47	240.6	457	.42	Level 0
MDC_L_SEC_BUS	PNL (25)	50	7,570	7,570	3,040	3,040	43	234.2	457	.40	Level 0
MDC_M	PNL (25)	51	5,320	5,320	2,790	2,790	28	170.8	457	.24	Level 0
MDC_M_SEC_BUS	PNL (25)	51	5,540	5,540	2,870	2,870	28	172.9	457	.24	Level 0
T2S_SEC_BUS	PNL (25)	82	1,460	1,460	1,130	1,130	2,000	458.3	457	1.20	Level 0
TP_SEC_BUS	PNL (25)	MAIN OCB GROUND RLY	3,370	65,580	2,030	39,450	573	458.3	457	1.20	Level 0

APPENDIX F



Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON Canada
K1Z 7T1
Tel 613 722 4420
Fax 613 722 2799
www.stantec.com

Revision	By	Appd	YY.MM.DD
2 ISSUED FOR FINAL REVIEW	H.S.	P.S.	13.06.18
1 ISSUED FOR REVIEW	H.S.	P.S.	13.03.13
Issued	By	Appd	YY.MM.DD
File name: 115612049_130.dwg	Dsn	Dwd	Dept. YY.MM.DD

Permit-Seal

Client/Project

Summerland PARC Facility

SHORT CIRCUIT DEVICE EVALUATION
COORDINATION & ARC FLASH STUDY

Summerland BC Canada

Title

ELECTRICAL
SINGLE LINE DRAWING

Project No.	Scale	
115612049	N.T.S.	
Drawing No.	Sheet	Revision
F-1	of	0