IDEA Project No. 24549

KN229976-ARC FLASH STUDY

FF04

Fort Frontenac

Department of National Defence

Issued Date: 2025-03-14

INTEGRATED DESIGN
ENGINEERING + ARCHITECTURE

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RECORD OF REVISIONS			
REVISION	**DATE**	**BY**	**COMMENTS**
0	2025-01-10	Nicholas Frayn, P.Eng	Draft for client review
1	2025-03-14	Nicholas Frayn, P.Eng	Final Report



Disclaimer:

The arc flash values in this report have been determined through analysis conducted by IDEA Inc., following industry-recognized standards and utilizing tools that follow these standards. Improper maintenance of the electrical equipment listed within, age and condition of the equipment, modifications to the equipment, system modifications, and protective device settings could render the results of this study invalid. The results of this study assume that the equipment is operating properly as per the manufacturers' specifications. The data collected was provided by 3rd parties involved in the project, obtained onsite from the existing equipment, and when not available derived through recognized industry standards. This report is only to be used by the qualified personnel it was intended for in which IDEA Inc. has sent the original copy to, and IDEA Inc. assumes no liability or responsibility if the report is distributed or copied without consent from IDEA Inc.

Codes and Standards

- CSA C22.2:21 – Canadian Electrical Code, Part 1 (25th Edition)
- CSA Z462:24 – Workplace Electrical Safety
- IEEE 1584-208 – Guide for Performing Arc-Flash Hazard Calculations
- ANSI/IEEE C37.13 – Standard for Low Volage AC Power Breakers Used in Enclosures
- ANSI/IEEE C37.010 Standard Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current

UL 489-9 Standard for Safety for Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures

1. Executive Summary

DCC engaged IDEA Inc to perform an analysis of the existing electrical distribution system at building FF04 located at Fort Frontenac in Kingston Ontario.

The analysis intends to address the following items:

a) Perform a Short Circuit and Coordination study on both the medium voltage and low voltage systems for the building with short circuit results to be provided to confirm Short Circuit rating of the existing equipment.
b) Use the above short circuit results to provide a protective device coordination study utilizing individual time current coordination curves to provide recommended circuit breaker device settings and fuse types to limit incident energy and fault current.
c) Provide an Arc Flash Hazard Analysis as per CSA Z462-21 utilizing IEEE Std 1584 for the arc flash calculations to indicate incident energy from the medium voltage equipment down to the low voltage panels within the building. From these results and the coordination study recommended setting Arc Flash labels will be provided by the end of the project.
d) Provide the single line diagrams used to perform above studies.
e) Provide an Infrared Thermographic Scanning Report for all electrical distribution equipment from the service transformer down to all panel boards. The report will identify all equipment found to be anomalous, with current readings for this equipment provided and recommendations for correcting the equipment.
f) Provide Phase Balance Testing of the electrical distribution under normal load conditions. This will be measured at the incoming service to the building, and at each distribution panel, step down transformer, and low voltage panel board, where deemed safe to do so. Voltage drop measurements from the incoming main service down the furthest distribution equipment.

This report provides our findings associated with the existing equipment and lists the associated recommended work to be performed to bring the existing equipment up to code, reduce fault levels and incident energy to make the equipment safer to work on.

Multiple site visits were conducted by IDEA Inc., Eaton and Drycore Electric as part of the scope of work to investigate the existing electrical distribution system at building FF04 at Fort Frontenac. The equipment was opened and tested to document the equipment ratings, condition, wire sizes and types, perform voltage and current readings, take pictures and perform a thermographic scan while under load. This information was used to produce an updated single line diagram, and was entered into the Power System Software ETAP to perform the Short Circuit, Coordination, and Arc Flash Studies.

During the site visit, due to the condition and lack of maintenance reports on the 4160V equipment, it was deemed unsafe to open this equipment while energized to perform an inspection and analysis. With approval from DND and Kingston Utilities, the equipment was deenergized to perform the investigation.

The information for the electrical equipment used within the report by IDEA Inc. was provided by Drycore Electric and Kingston Utilities.

1.1. Study Introduction

The short circuit study is used to determine whether the SCCR (Short Circuit Current Rating) of the existing equipment is able to withstand the available fault current associated with the incoming service and down stream equipment.

The protective device coordination study analyzes the existing protective device settings and ratings under fault and normal operating conditions. This includes relay/breaker ratings and trip settings, and fuse ratings. The coordination study is used to ensure that during a fault or overload condition, the immediate upstream protective device associated with the equipment clears the anomaly opposed to a device further upstream. This limits the fault clearing time (FCT) and thus the associated incident energy.

The Arc Flash Incident Energy Report is produced based on CSA Z462:24 standard to study the incident energy available at the equipment and determine the Arc Flash Boundary. Per section 4.3.5.1 of CSA Z462:24, 'an arc flash risk assessment shall be performed to identify arc flash hazards, estimate the likelihood of occurrence of injury or damage to health and the potential of severity of injury or damage to health, and determine if additional protective measures are required, including the use of PPE'.

Once the arc flash assessment is performed, this information is used to determine the arc flash boundary and recommended PPE. The incident energy analysis method used in this report is the IEEE 1584 calculation method. With the incident energy and arc flash boundary determined, Table 2 of CSA Z462:24 provides the PPE requirements at that level of incident energy. The PPE, incident energy and boundary information is applied to an Arc Flash label specifically designed for each unique piece of equipment.

The Infrared Thermographic Scanning is performed to observe any temperature anomalies that occur within existing electrical equipment. These anomalies can occur due to many various reasons, including but not limited to:

- Loose connections or lugs
- Overloaded circuits
- Broken or malfunctioning equipment

An infrared thermal scan is a useful and less-invasive test to help keep electrical equipment in good working condition and should be performed at least once every 12 months for adequate maintenance of the equipment.

Phase balance and voltage drop readings are performed to make sure the electrical system is properly balanced, and the system isn't operating above or below nominal operating voltages regulated in Canada. Current readings are taken at the main service, and the down stream equipment while under load to observe the amperage readings on each phase. Voltage readings are taken at the incoming service transformer and then at each down stream piece of equipment such as panel or MCC to determine the voltage drop of the system.

Visual inspection to the interior and exterior of the existing equipment is performed to ensure that the equipment is free from any deterioration, damage, or corrosion. The installation is inspected to ensure the equipment meets or exceeds the current Canadian Electrical Code.

1.2. Recommendations

Recommendations obtained from the **Short Circuit Study**:

CDP-1A failed. The recommendation is to either replace to main breaker to a model that can be series rated with the branch breaker or replace the branch breakers with breakers rated above 10kA.

Fuses F_TRN-4 and F_TRN4a fail as they represent the Bay-O-Net fuses which are not designed to protect against the short circuit current.

Further detail of the above recommendations can be found in section 2.6.

Recommendations obtained from the **Protective Device Coordination Study**:

Revise the instantaneous trip setting of breaker CB_CDP-1A in DP-PRN-4a from 5 to 10.

Revise the main breaker of CDP-1A from MH model to MGL model to series rate the panel to accommodate the short circuit rating.

Further detail of the above recommendations can be found in section 3.6.

Recommendations obtained from the **Arc Flash Incident Energy Report**:

Revise the style of main breaker in CDP-1A from MH to MGL to reduce the incident energy from Level B (15.966 cal/cm2) to Level A (0.488 cal/cm2.

Install an LSI main breaker in DP-PRN-4A to reduce Arc Flash incident energy below 20 cal/cm2.

Further detail of the above recommendations can be found in section 4.6.

Recommendations obtained from the **Infrared Thermographic Scan**:

No recommendations from this section.

Further detail of the above recommendations can be found in Appendix B.

Recommendations obtained from the **Phase Balance and Voltage Drop Readings**:

No recommendations from this section.

Further detail of the above recommendations can be found in section 6.

Recommendations obtained from the **Visual and Mechanical Inspection**:

Panel CDP-1A:

1. Install grounded conductor from building service to main distribution panel in accordance with CEC section 10.

Panel BP-A:

1. Provide knockout covers.
2. Perform panel cleaning.

Panel BP-B:

1. Provide new neutral lug for the panel.
2. Install additional conduits or upsize the conduit to suit the cables installed in the existing conduit.

3. Perform panel clean
4. Provide strapping to support the armoured cable leaving the panel.

Panel BP-C:

1. Extend wiring of circuit 37.

Panel BP-D:

1. Provide new screws in panel cover.
2. Perform panel cleaning.

Panel BP-E:

1. Trim feeder cables to reduce amount of exposed wire.
2. Cap conduit.

Panel BP-F:

1. Provide knockout covers.

Panel BP-G:

1. Provide strapping to support raceways.
2. Remove owner equipment in front of panel.

Panel BP-H:

1. Provide knockout covers.
2. Cap conduit.

Panel BP-I:

1. Perform panel clean.

Panel BP-J:

1. Perform panel clean.

Panel P-F:

1. Main breaker needs to be replaced with 200A breaker.

General Building:

1. Print and Frame Single Line Diagram as required by CEC.

Exterior Transformer TRN-4:

1. Tag transformer to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the Transformer.
2. Provide new door gasket.

Exterior Panel Feeding FF04 DP-PRN-4:

1. Tag panel to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the panel.
2. Provide new door gasket.
3. Replace panel.

Exterior Transformer TRN-4a:

1. Tag transformer to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the transformer.

Exterior Panel Feeding FF04 DP-PRN-4a:

1. Tag panel to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the panel. Consider purchasing new enclosure if rust worsens.
2. Apply penetrox to cable terminations.
3. Install lamacoid with panel information.
4. Replace panel.

Further detail of the above recommendations can be found in section 7.

2. Short Circuit Study

The importance of the short circuit study is to determine whether the existing equipment can withstand the available fault current of the distribution system. If the equipment is underrated, significant damage to the equipment and personnel working near the equipment can occur due to mechanical and electrical forces created during the fault. The Short Circuit Study was performed using the ETAP Power System Software.

2.1. Methodology

Utilizing ETAP, the short circuit coordination study is performed using the ANSI C37 calculation method. From the data obtained within the field from the existing equipment, and fault levels provided by the Local Utilities Company, the single line diagram for the building is created within the software, and the software simulates three phase bolted faults and line to ground bolted faults at every bus included within the system. Critical information needed for the study includes cable impedance and lengths, and transformer X/R ratios to determine how the fault propagates through the system. The equipment analyzes both symmetrical and asymmetrical fault current contributions at each bus. The results are compared to the rating of the equipment to determine if any marginal or critical failures can occur from a fault.

2.2. Information Provided

The field information for the existing equipment was obtained by the electrical contracting company Drycore Electric.

The Hydro Fault information was provided by Kingston Utilities.

2.3. Assumptions

Where device information was not obtainable due to damaged name plates or lack there of, design values and standard values are used and listed within.

2.4. Input Information

The following reports are exported from ETAP to list the input information used within the study:

Cables:

ID	kV	Cond./ Phase	Cond./ Cable	Size AWG/mm²	Z				Length m	Conductor
					Z Ohms / Unit Length	R Ohms / Unit Length	X Ohms / Unit Length	L H / Unit Length		
CBLE_AC	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	10	CU
CBLE_ACCR	0.6	1	1/C	8	0.7827	0.78	0.065	0.0001724	30	CU
CBLE_ACU#C-4	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	30	CU
CBLE_ASU#1	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	30	CU
CBLE_ASU#2	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	10	CU
CBLE_ASU#3	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	30	CU
CBLE_ASU#4	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	30	CU
CBLE_DUMB-WAITER	0.6	1	1/C	6	0.49416	0.49	0.064	0.0001698	10	CU
CBL_AC	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	200	CU
CBL_ACCR	0.6	1	1/C	6	0.49416	0.49	0.064	0.0001698	175	CU
CBL_ACU#C-4	0.6	1	1/C	8	0.7827	0.78	0.065	0.0001724	175	CU
CBL_ASU#1	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	20	CU
CBL_ASU#2	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	200	CU
CBL_ASU#3	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	200	CU
CBL_ASU#4	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	20	CU
CBL_BP-A	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	40	CU
CBL_BP-B	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	80	CU
CBL_BP-C	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	110	CU
CBL_BP-D	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	90	CU
CBL_BP-E	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	125	CU
CBL_BP-F	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	135	CU
CBL_BP-G	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	115	CU
CBL_BP-H	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	110	CU
CBL_BP-I	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	145	CU
CBL_BP-J	0.6	1	1/C	3	0.25687	0.25	0.059	0.0001565	155	CU
CBL_CDP-1A	0.6	2	1/C	350	0.05517	0.038	0.04	0.0001061	50	CU
CBL_DUMB WAITER	0.6	1	1/C	12	2.00116	2	0.068	0.0001804	175	CU
CBL_P2-TRN4	5	1	1/C	1/0	0.13777	0.1281	0.0507	0.0001345	250	CU
CBL_PANEL-F	0.6	1	1/C	4/0	0.07433	0.062	0.041	0.0001088	50	CU
CBL_TRN4-TRN4a	5	1	1/C	1/0	0.13777	0.1281	0.0507	0.0001345	20	CU

Buses/ Panels/ Switch Gear:

ID	Nominal kV	Type	Bracing Symm. kA	Bracing Asymm. kA	Bracing Peak kA
BP-A	0.24	Panelboard	10	10	
BP-B	0.24	Panelboard	10	10	
BP-C	0.24	Panelboard	10	10	
BP-D	0.24	Panelboard	10	10	
BP-E	0.24	Panelboard	10	10	
BP-F	0.24	Panelboard	10	10	
BP-G	0.24	Panelboard	10	10	
BP-H	0.24	Panelboard	10	10	
BP-I	0.24	Panelboard	10	10	
BP-J	0.24	Panelboard	10	10	
BUS_HV-SG	4.16	Switchgear		26	43.88
BUS_TRN-4	4.16	Cable Bus		22	37.13
BUS_TRN-4a	4.16	Cable Bus		22	37.13
CDP-1A	0.208	Panelboard	10	10	
DP-PRN-4	0.6	Panelboard	14	17.5	
DP-PRN-4a	0.208	Panelboard	65	65	
PANEL-F	0.6	Panelboard	14	14	

Circuit Breakers

ID	kV	Type	Bus	Rated Int. Adj. kA	Rated Int. kA
CB_AC	0.6	Molded Case	PANEL-F	14	14
CB_ACCR	0.6	Molded Case	PANEL-F	14	14
CB_ACU#C-4	0.6	Molded Case	PANEL-F	14	14
CB_ASU#1	0.6	Molded Case	PANEL-F	14	14
CB_ASU#2	0.6	Molded Case	PANEL-F	14	14
CB_ASU#3	0.6	Molded Case	PANEL-F	14	14
CB_ASU#4	0.6	Molded Case	PANEL-F	14	14
CB_BP-A	0.208	Molded Case	CDP-1A	10	10
CB_BP-B	0.208	Molded Case	CDP-1A	10	10
CB_BP-C	0.208	Molded Case	CDP-1A	10	10
CB_BP-D	0.208	Molded Case	CDP-1A	10	10
CB_BP-E	0.208	Molded Case	CDP-1A	10	10
CB_BP-F	0.208	Molded Case	CDP-1A	10	10
CB_BP-G	0.208	Molded Case	CDP-1A	10	10
CB_BP-H	0.208	Molded Case	CDP-1A	10	10
CB_BP-I	0.208	Molded Case	CDP-1A	10	10
CB_BP-J	0.208	Molded Case	CDP-1A	10	10
CB_CDP-1A	0.208	Molded Case	DP-PRN-4a	65	65
CB_DUMB WAITER	0.6	Molded Case	PANEL-F	14	14
CB_FF04	0.6	Molded Case	DP-PRN-4	14	14
MCB_CDP-1A	0.208	Molded Case	CDP-1A	65	65
MCB_PANEL-F	0.6	Molded Case	PANEL-F	25	25

Fuses:

ID	kV	Type	Bus	Rated Int. Adj. kA	Rated Int. kA
F_HV-SG	4.16	Fuse	BUS_HV-SG	26	26
F_P2	4.16	Fuse	BUS_HV-SG	26	26
F_TRN-4	4.16	Fuse	BUS_TRN-4	3.5	3.5
F_TRN-4a	4.16	Fuse	BUS_TRN-4a	3.5	3.5

Switches:

ID	kV	Type	Bus	Rated Mom. Asymm. kA
SW1_TRN-4	4.16	SPST Switch	BUS_TRN-4	22
SW1_TRN-4a	4.16	SPST Switch	BUS_TRN-4a	22
SW2_TRN-4	4.16	SPST Switch	BUS_TRN-4	22
SW_HV-SG	4.16	SPST Switch	BUS_HV-SG	26
SW_P2	4.16	SPST Switch	BUS_HV-SG	26
SW_TRN-4	4.16	SPST Switch	BUS_TRN-4	63
SW_TRN-4a	4.16	SPST Switch	BUS_TRN-4a	63

2.5. Results

The following summary tables are exported from ETAP to evaluate the Fault Current Calculations against the Equipment ratings inputted into the software.

Project:	Arc Flash Study Fort Frontenac	ETAP		Page:	1
Location:	Fort Frontenac, Kingston	24.0.0C		Date:	01-10-2025
Contract:	KN229976			SN:	IDEAINC-01
Engineer:	Nicholas Frayn	Study Case:	SC	Revision:	Base
Filename:	24549 - DCC Arc Flash - FF04			Config.:	Normal

Momentary Duty Summary Report

3-Phase Fault Currents: (Prefault Voltage = 100 % of the Bus Nominal Voltage)

Bus		Device		Momentary Duty					Device Capability		
ID	kV	ID	Type	Symm. kA rms	X/R Ratio	M.F.	Asymm. kA rms	Asymm. kA Peak	Symm. kA rms	Asymm. kA rms	Asymm. kA Peak
BP-A	0.240	BP-A	Panelboard	6.698	1.0	1.002	6.714	9.937	10.000	10.000	
BP-B	0.240	BP-B	Panelboard	4.643	0.7	1.000	4.644	6.646	10.000	10.000	
BP-C	0.240	BP-C	Panelboard	3.735	0.6	1.000	3.736	5.311	10.000	10.000	
BP-D	0.240	BP-D	Panelboard	4.299	0.7	1.000	4.299	6.133	10.000	10.000	
BP-E	0.240	BP-E	Panelboard	3.398	0.6	1.000	3.398	4.823	10.000	10.000	
BP-F	0.240	BP-F	Panelboard	3.203	0.5	1.000	3.203	4.543	10.000	10.000	
BP-G	0.240	BP-G	Panelboard	3.616	0.6	1.000	3.616	5.138	10.000	10.000	
BP-H	0.240	BP-H	Panelboard	3.735	0.6	1.000	3.736	5.311	10.000	10.000	
BP-I	0.240	BP-I	Panelboard	3.029	0.5	1.000	3.029	4.294	10.000	10.000	
BP-J	0.240	BP-J	Panelboard	2.873	0.5	1.000	2.873	4.070	10.000	10.000	
BUS_HV-SG	4.160	BUS_HV-SG	Switchgear	13.259	5.6	1.284	17.021	29.424		26.000	43.880
	4.160	SW_HV-SG	SPST Switch	13.259	5.6	1.284	17.021	29.424		26.000	
	4.160	SW_P2	SPST Switch	13.259	5.6	1.284	17.021	29.424		26.000	
BUS_Kingston Utility	4.160	BUS_Kingston Utility	Bus	13.259	5.6	1.284	17.021	29.424			
	4.160	SW_HV-SG	SPST Switch	13.259	5.6	1.284	17.021	29.424		26.000	
BUS_TRN-4	4.160	BUS_TRN-4	Cable Bus	11.929	3.0	1.115	13.303	22.759		22.000	37.130
	4.160	SW1_TRN-4	SPST Switch	11.929	3.0	1.115	13.303	22.759		22.000	
	4.160	SW2_TRN-4	SPST Switch	11.929	3.0	1.115	13.303	22.759		22.000	
	4.160	SW_TRN-4	SPST Switch	11.929	3.0	1.115	13.303	22.759		63.000	
BUS_TRN-4a	4.160	BUS_TRN-4a	Cable Bus	11.825	2.9	1.107	13.095	22.350		22.000	37.130
	4.160	SW1_TRN-4a	SPST Switch	11.825	2.9	1.107	13.095	22.350		22.000	
	4.160	SW_TRN-4a	SPST Switch	11.825	2.9	1.107	13.095	22.350		63.000	
CDP-1A	0.208	CDP-1A	Panelboard	9.039	2.9	1.109	10.023	17.113	10.000	10.000*	
DP-PRN-4	0.600	DP-PRN-4	Panelboard	4.404	4.5	1.221	5.376	9.312	14.000	17.500	
DP-PRN-4a	0.208	DP-PRN-4a	Panelboard	9.971	3.4	1.148	11.451	19.731	65.000	65.000	
PANEL-F	0.600	PANEL-F	Panelboard	4.267	3.9	1.182	5.046	8.728	14.000	14.000	

- Method: IEEE - X/R is calculated from separate R & X networks.
- Generator protective device duty is calculated based on maximum through fault current. Other protective device duty is calculated based on total fault current.

- The multiplication factors for high voltage circuit-breaker and high voltage bus momentary duty (asymmetrical and crest values) are calculated based on system X/R.

* Indicates a device with momentary duty exceeding the device capability.

Project:	Arc Flash Study Fort Frontenac	**ETAP**		Page:	2
Location:	Fort Frontenac, Kingston	24.0.0C		Date:	01-10-2025
Contract:	KN229976			SN:	IDEAINC-01
Engineer:	Nicholas Frayn	Study Case:	SC	Revision:	Base
Filename:	24549 - DCC Arc Flash - FF04			Config.:	Normal

Interrupting Duty Summary Report

3-Phase Fault Currents: (Prefault Voltage = 100 % of the Bus Nominal Voltage)

Bus		Device			Interrupting Duty				Device Capability				
ID	kV	ID	Type	CPT (Cy)	Symm. kA rms	X/R Ratio	M.F.	Adj. Sym. kA rms	kV	Test PF	Rated Int.	Adjusted Int.	
BP-A	0.240				6.698	1.0							
BP-B	0.240				4.643	0.7							
BP-C	0.240				3.735	0.6							
BP-D	0.240				4.299	0.7							
BP-E	0.240				3.398	0.6							
BP-F	0.240				3.203	0.5							
BP-G	0.240				3.616	0.6							
BP-H	0.240				3.735	0.6							
BP-I	0.240				3.029	0.5							
BP-J	0.240				2.873	0.5							
BUS_HV-SG	4.160	F_HV-SG	Fuse		13.259	5.6	1.000	13.259	4.760	6.65	26.000	26.000	
		F_P2	Fuse		13.259	5.6	1.000	13.259	4.760	6.65	26.000	26.000	
BUS_Kingston Utility	4.160	F_HV-SG	Fuse		13.259	5.6	1.000	13.259	4.760	6.65	26.000	26.000	
BUS_TRN-4	4.160	F_TRN-4	Fuse		11.929	3.0	1.000	11.929	4.160	6.65	3.500	3.500	*
BUS_TRN-4a	4.160	F_TRN-4a	Fuse		11.825	2.9	1.000	11.825	4.160	6.65	3.500	3.500	*
CDP-1A	0.208	MCB_CDP-1A	Molded Case		9.039	2.9	1.000	9.039	0.240	20.00	65.000	65.000	
		CB_BP-A	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-B	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-C	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-D	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-E	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-F	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-G	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-H	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-I	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
		CB_BP-J	Molded Case		9.039	2.9	1.080	9.766	0.240	50.00	10.000	10.000	
DP-PRN-4	0.600	CB_FF04	Molded Case		4.404	4.5	1.080	4.757	0.600	30.00	14.000	14.000	
DP-PRN-4a	0.208	CB_CDP-1A	Molded Case		9.971	3.4	1.000	9.971	0.240	20.00	65.000	65.000	
PANEL-F	0.600	MCB_PANEL-F	Molded Case		4.267	3.9	1.000	4.267	0.600	20.00	25.000	25.000	
		CB_ASU#3	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000	
		CB_ASU#2	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000	
		CB_AC	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000	

Project:	Arc Flash Study Fort Frontenac	ETAP		Page:	3
Location:	Fort Frontenac, Kingston	24.0.0C		Date:	01-10-2025
Contract:	KN229976			SN:	IDEAINC-01
Engineer:	Nicholas Frayn	Study Case:	SC	Revision:	Base
Filename:	24549 - DCC Arc Flash - FF04			Config.:	Normal

3-Phase Fault Currents: (Prefault Voltage = 100 % of the Bus Nominal Voltage)

Bus		Device			Interrupting Duty				Device Capability			
ID	kV	ID	Type	CPT (Cy)	Symm. kA rms	X/R Ratio	M.F.	Adj. Sym. kA rms	kV	Test PF	Rated Int.	Adjusted Int.
PANEL-F		CB_DUMB WAITER	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000
		CB_ACU#C-4	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000
		CB_ASU#4	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000
		CB_ASU#1	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000
		CB_ACCR	Molded Case		4.267	3.9	1.046	4.465	0.600	30.00	14.000	14.000

- Method: IEEE - X/R is calculated from separate R & X networks.
- HV CB interrupting capability is adjusted based on bus nominal voltage.
- Short-circuit multiplying factor for LV Molded Case and Insulated Case Circuit Breakers is calculated based on asymmetrical current.
- Generator protective device duty is calculated based on maximum through fault current. Other protective device duty is calculated based on total fault current.

* Indicates a device with interrupting duty exceeding the device capability

** Indicates that the circuit breaker has been flagged as a generator circuit breaker. However, ETAP could not detect a single path, without a transformer, to the specified generator. Therefore, this circuit breaker is treated as a regular circuit breaker in short-circuit calculations.

\+ The prefault voltage exceeds the rated maximum kV limit of the circuit breaker - The rated interrupting kA must be derated.

2.6. Observations and Recommendations

CDP-1A does not have a series rated main circuit breaker installed and therefore the panel takes the rating of the branch circuit breakers installed within. Panel CDP-1A experiences a bolted fault current of 10.023kA which is 0.023kA above the rating of the device. The recommendation is to either replace to main breaker to a model that can be series rated with the branch breaker, or replace the branch breakers with breakers rated above 10kA. By replacing the main breaker from an MH style breaker to an MG style breaker, the main panel can be series rated at 22kA. This also reduces the Arc Flash Level indicated further down in the report.

Fuses for TRN-4 and TRN4a within Site transformers TRN-4 and TRN-4a were not accessible. The style of fuses are Bay-O-Net fuses and current limiting installed within the transformer, and due to the lack of maintenance records on these transformers, Drycore Electric and Kingston Utilities recommended to not remove these fuses due to the high chance of failure upon reinstallation. The recommendation is to replace these fuses. Standard values from manufacturers loaded within the ETAP software were used. The recommendation is to replace these fuses with the size indicated in the report, at the short circuit and continuous amperage rating indicated within the report. Short circuit to be 12kA or greater for current limiting fuses. Continuous rating to be 40A for TRN-4 and 30A for TRN-4a.

3. Protective Device Coordination Study

The protective device coordination study is performed to ensure appropriate protective device ratings and settings are selected to protect the electrical system. The Canadian Electrical Code gives design standards for overcurrent protection ratings such that the equipment won't trip during operation at rated load and will trip at values greater than the continuous amperage rating. Protective device coordination studies are required when considering protecting the system under fault conditions. Coordination studies help with two main concepts:

1. To stop the entire distribution system from shutting down during a down stream fault depending on the location, and
2. To reduce incident energy at the location of the fault by lowering the fault clearing time (FCT)

The above situations are designed by using time-current characteristics plots to ensure that the nearest upstream overcurrent device clears the fault at the specific location it occurs, rather being cleared from a further upstream device that may serve more loads. This can be illustrated by considering a system with a distribution panel (Panel X) that also feeds three downstream panels (Panel A, Panel B and Panel C) . If fault occurred at Panel B, you would want the breaker for Panel B to clear the fault and only energized Panel B. Poor coordination of the system would have the main breaker for Panel X clearing the fault, which would deenergize all three panels. This further away breaker would also give more time for incident energy build, creating a larger arc flash boundary and a dangerous distribution system.

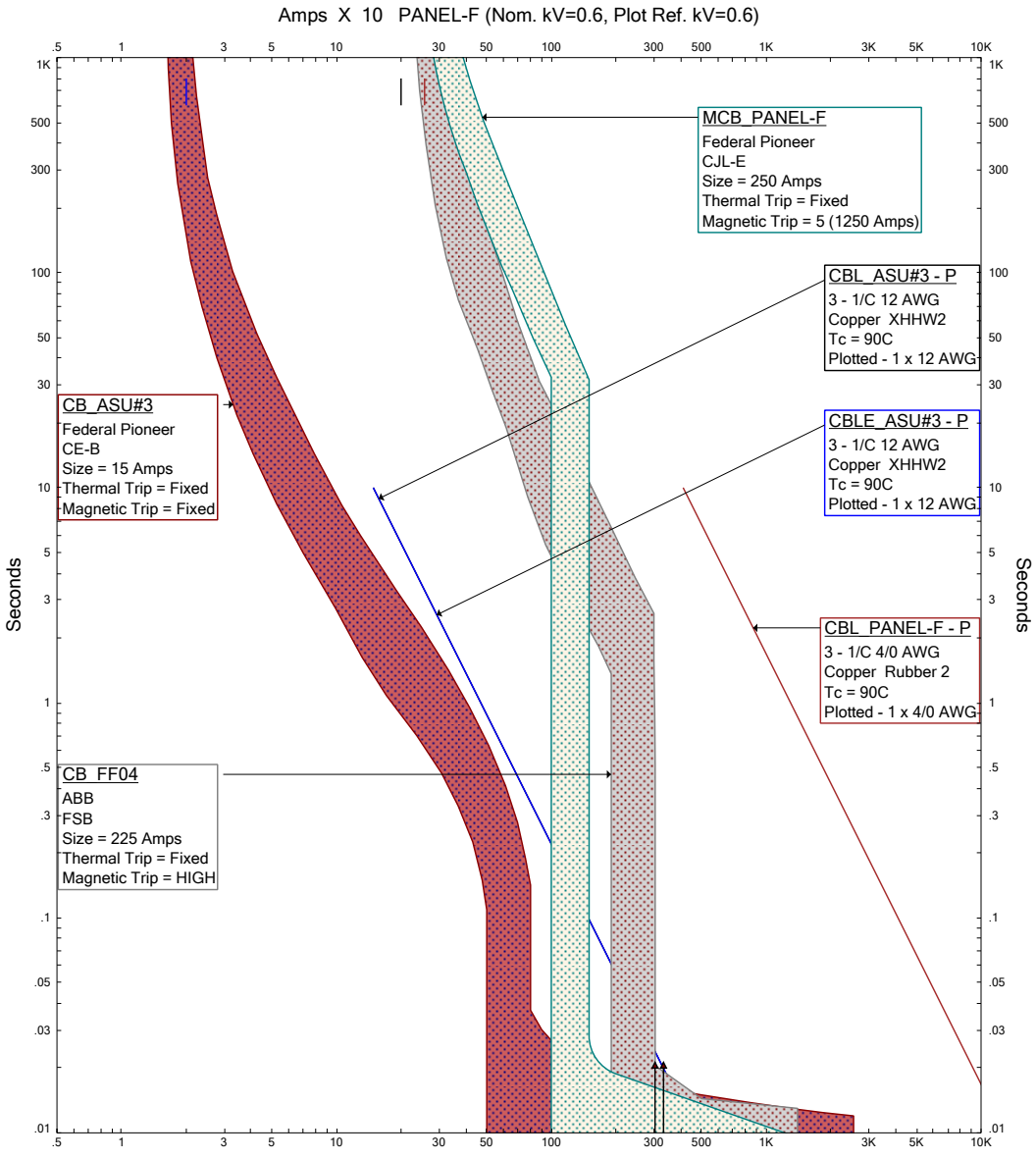
3.1. Methodology

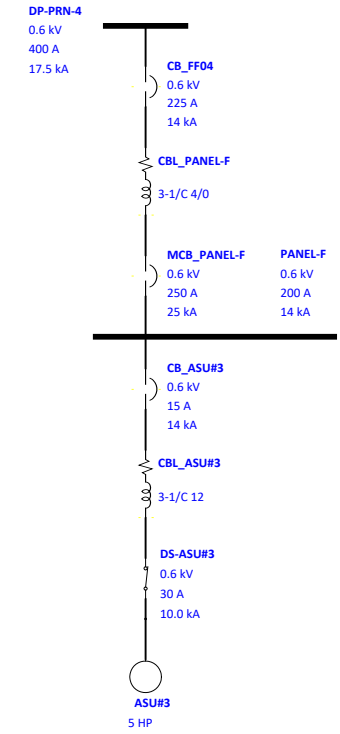
The Protective Device Coordination Study is performed utilizing the ETAP Power System Software. From the modeled distribution system, time-current characteristics curves for protective devices, cables, motors and transformers are plotted on logarithmic time plots (log-log axis). This view is used to visualize the order in which the protective devices will trip in an increasing order of magnitude of time versus current.

ETAP models the exact device make/models and breaker trip settings to show exactly how the device will operate in the field. In addition to protective device time-current plots, transformer damage curves and inrush current are plotted to ensure the transformer is adequately protected but will also not cause nuisance trips due to their magnetizing current. Cable curves are also displayed to show that the feeder and equipment cables are adequately protected.

With the time curves plotted, adequate separation between the downstream protective devices and upstream protective devices must be maintained with minimal overlap to ensure only one device, the nearest device, will trip during a fault.

3.2. Time Current Plots





Amps X 10 PANEL-F (Nom. kV=0.6, Plot Ref. kV=0.6)

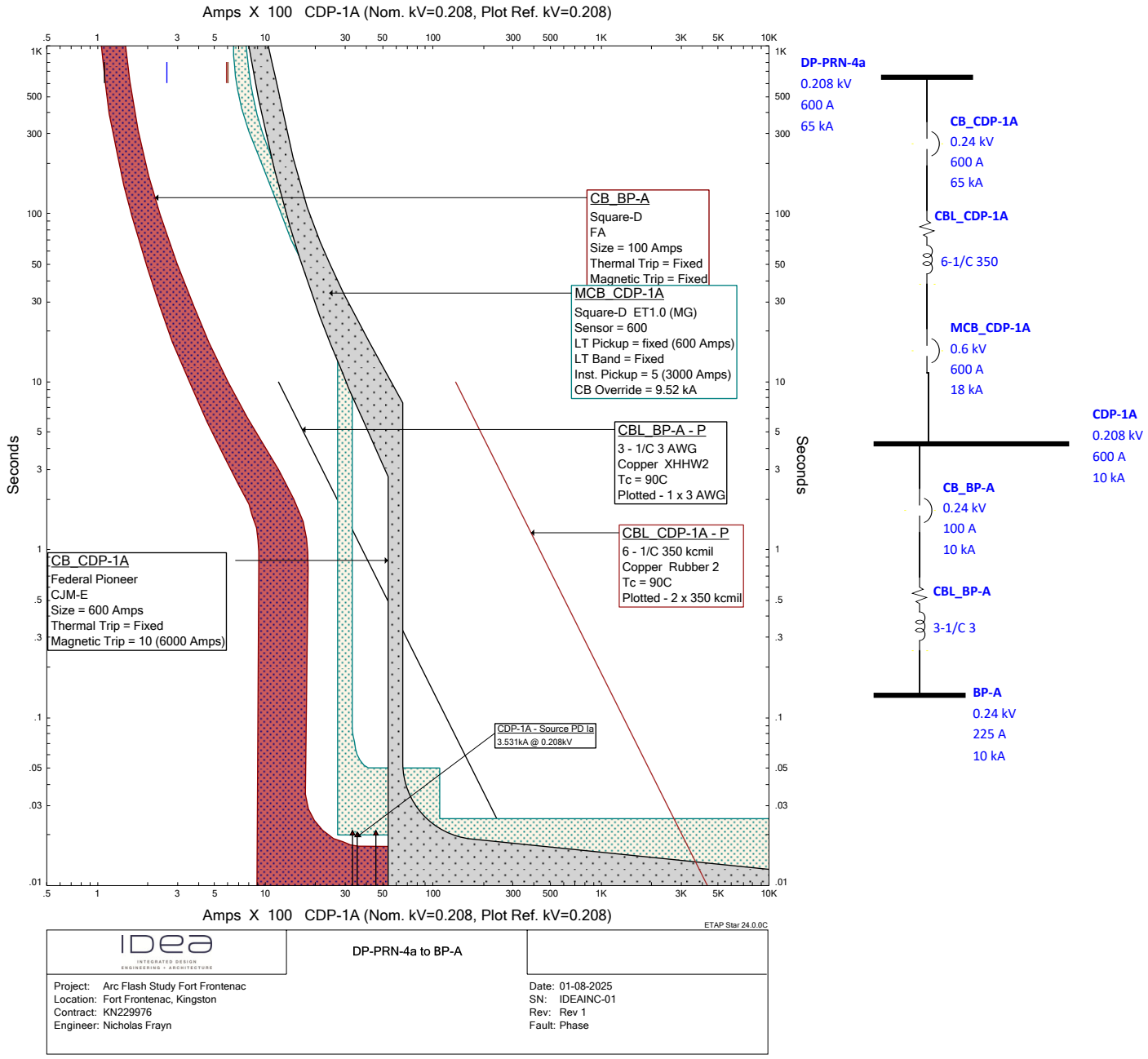
ETAP Star 24.0.0C

IDEA INTEGRATED DESIGN ENGINEERING + ARCHITECTURE

DP-PRN-4 to ASU#3

Project: Arc Flash Study Fort Frontenac
Location: Fort Frontenac, Kingston
Contract: KN229976
Engineer: Nicholas Frayn

Date: 01-08-2025
SN: IDEAINC-01
Rev: Rev 1
Fault: Phase



Amps X 100 CDP-1A (Nom. kV=0.208, Plot Ref. kV=0.208)

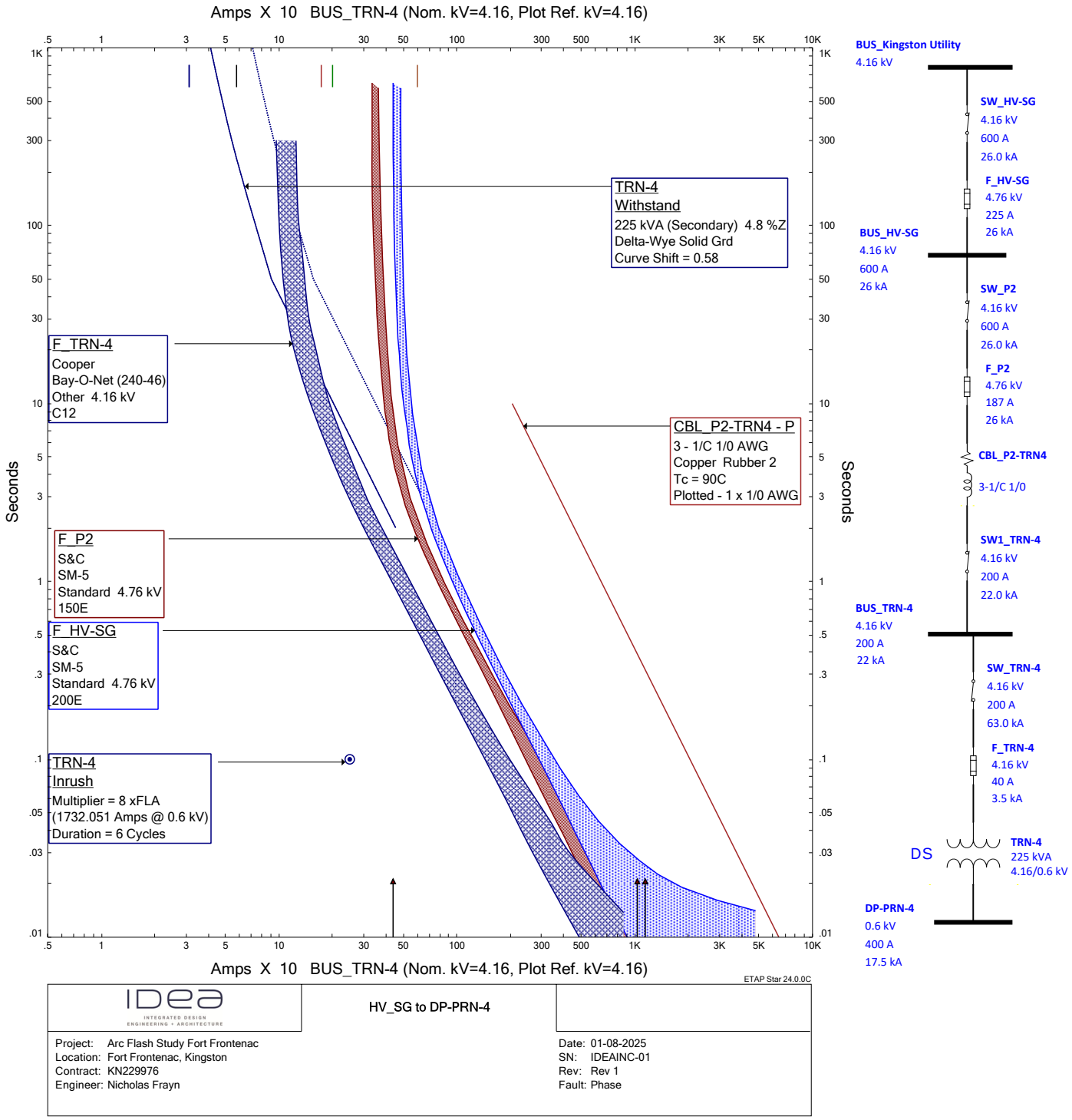
ETAP Star 24.0.0C

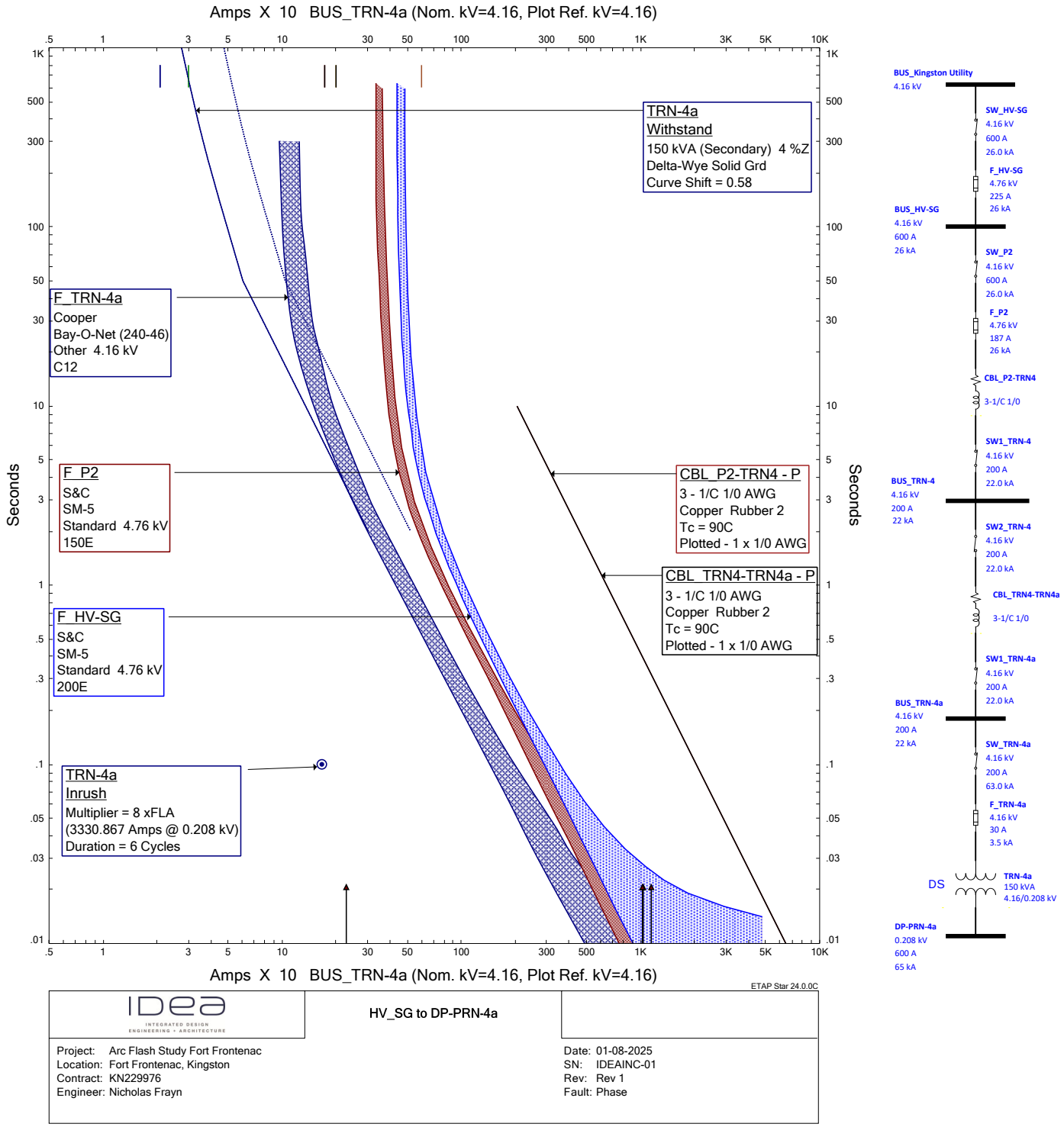
IDEA INTEGRATED DESIGN ENGINEERING + ARCHITECTURE

DP-PRN-4a to BP-A

Project: Arc Flash Study Fort Frontenac
Location: Fort Frontenac, Kingston
Contract: KN229976
Engineer: Nicholas Frayn

Date: 01-08-2025
SN: IDEAINC-01
Rev: Rev 1
Fault: Phase


Amps X 10 BUS_TRN-4 (Nom. kV=4.16, Plot Ref. kV=4.16)
Seconds
TRN-4
Withstand
225 kVA (Secondary) 4.8 %Z
Delta-Wye Solid Grd
Curve Shift = 0.58
F_TRN-4
Cooper
Bay-O-Net (240-46)
Other 4.16 kV
C12
CBL_P2-TRN4 - P
3 - 1/C 1/0 AWG
Copper Rubber 2
Tc = 90C
Plotted - 1 x 1/0 AWG
F_P2
S&C
SM-5
Standard 4.76 kV
150E
F_HV-SG
S&C
SM-5
Standard 4.76 kV
200E
TRN-4
Inrush
Multiplier = 8 xFLA
(1732.051 Amps @ 0.6 kV)
Duration = 6 Cycles
BUS_Kingston Utility
4.16 kV
SW_HV-SG
4.16 kV
600 A
26.0 kA
F_HV-SG
4.76 kV
225 A
26 kA
BUS_HV-SG
4.16 kV
600 A
26 kA
SW_P2
4.16 kV
600 A
26.0 kA
F_P2
4.76 kV
187 A
26 kA
CBL_P2-TRN4
3-1/C 1/0
SW1_TRN-4
4.16 kV
200 A
22.0 kA
BUS_TRN-4
4.16 kV
200 A
22 kA
SW_TRN-4
4.16 kV
200 A
63.0 kA
F_TRN-4
4.16 kV
40 A
3.5 kA
DS
TRN-4
225 kVA
4.16/0.6 kV
DP-PRN-4
0.6 kV
400 A
17.5 kA
Amps X 10 BUS_TRN-4 (Nom. kV=4.16, Plot Ref. kV=4.16)
ETAP Star 24.0.0C
IDEA
INTEGRATED DESIGN ENGINEERING + ARCHITECTURE
HV_SG to DP-PRN-4
Project: Arc Flash Study Fort Frontenac
Location: Fort Frontenac, Kingston
Contract: KN229976
Engineer: Nicholas Frayn
Date: 01-08-2025
SN: IDEAINC-01
Rev: Rev 1
Fault: Phase



Amps X 10 BUS_TRN-4a (Nom. kV=4.16, Plot Ref. kV=4.16)

ETAP Star 24.0.0C

IDEA INTEGRATED DESIGN ENGINEERING + ARCHITECTURE

HV_SG to DP-PRN-4a

Project: Arc Flash Study Fort Frontenac
Location: Fort Frontenac, Kingston
Contract: KN229976
Engineer: Nicholas Frayn

Date: 01-08-2025
SN: IDEAINC-01
Rev: Rev 1
Fault: Phase

3.3. Recommended Device Ratings and Settings

Protective Device Settings Report

Project:	Arc Flash Study Fort Frontenac	**Date:**	01-10-2025
Location:	Fort Frontenac, Kingston	**Revision:**	Rev 1 vs Base
Contract:	KN229976	When Revision vs Base/Revision is Reported:	
Filename:	H:\2024 Projects\24549 DCC Arc Flash\03 ELEC\ETAP Files\24549 - DCC Arc Flash -	= Revision color	

Protective Device Settings - Fuse									
Notes	**Designated Bus**	**Fuse ID**	**Base / Revision ID**	**Manufacturer**	**Model**	**Max kV**	**Speed**	**Size**	**Cont. Amp**
	BUS_Kingston Utility	F_HV-SG	Base	S&C	SM-5	4.76	Standard	200E	225
	BUS_HV-SG	F_P2	Base	S&C	SM-5	4.76	Standard	150E	187
*	BUS_TRN-4	F_TRN-4	Base	Cooper	Bay-O-Net (240-46)	4.16	Other	C12	40
*	BUS_TRN-4a	F_TRN-4a	Base	Cooper	Bay-O-Net (240-46)	4.16	Other	C12	30
	Bus4	F_ACU#C-4	Base	Gould Shawmut (Ferraz)	TRS	0.6	Time Delay	30R	30
	Bus39	F_DUMB WAITER	Base	Gould Shawmut (Ferraz)	CJ	0.6	Other	40A	40

Notes:

1 Rev 1 settings is different from Base

* Device Rating is different from Library

Protective Device Settings - Low Voltage Circuit Breaker with Thermal-Magnetic Trip Device										
Notes	Designated Bus	LVCB ID	Base / Revision ID	Manufacturer	Breaker		Thermal		Magnetic (Inst.)	
					Model	Size	Setting	Trip (Amps)	Setting	Trip (Amps)
	DP-PRN-4	CB_FF04	Base	ABB	FS	225	Fixed	225.000	Fixed	
	DP-PRN-4a	CB_CDP-1A	Base	Federal Pioneer	CJM-E	600	Fixed	600.000	5	3000.000
1	DP-PRN-4a	CB_CDP-1A	Rev 1	Federal Pioneer	CJM-E	600	Fixed	600.000	10	6000.000
	PANEL-F	MCB_PANEL-F	Base	Federal Pioneer	CJL-E	250	Fixed	250.000	5	1250.000
	PANEL-F	CB_SPARE 250A	Base	Federal Pioneer	CJL-E	250	Fixed	250.000	5	1250.000
	PANEL-F	CB_ASU#3	Base	Federal Pioneer	CE-B	15	Fixed	15.000	Fixed	
	PANEL-F	CB_ASU#2	Base	Federal Pioneer	CE-B	15	Fixed	15.000	Fixed	
	PANEL-F	CB_AC	Base	Federal Pioneer	CE-B	15	Fixed	15.000	Fixed	
	PANEL-F	CB_DUMB WAITER	Base	Federal Pioneer	CE-B	20	Fixed	20.000	Fixed	
	PANEL-F	CB_ACU#C-4	Base	Federal Pioneer	CE-B	40	Fixed	40.000	Fixed	
	PANEL-F	CB_ASU#4	Base	Federal Pioneer	CE-B	15	Fixed	15.000	Fixed	
	PANEL-F	CB_ASU#1	Base	Federal Pioneer	CE-B	15	Fixed	15.000	Fixed	
	PANEL-F	CB_ACCR	Base	Federal Pioneer	CE-B	60	Fixed	60.000	Fixed	
	CDP-1A	MCB_CDP-1A	Base	Square-D	MH	600	Fixed	600.000	5X	3000.000
1	CDP-1A	MCB_CDP-1A	Rev 1	Square-D	MGL					
	CDP-1A	CB_BP-A	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-B	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-C	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-D	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-E	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-F	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-G	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-H	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-I	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	
	CDP-1A	CB_BP-J	Base	Square-D	FA 240V	100	Fixed	100.000	Fixed	

Notes:

1 Rev 1 settings is different from Base

* Device Rating is different from Library

Protective Device Settings - Low Voltage Circuit Breaker with Solid State / Microprocessor Trip Device																				
									Long Time				Short-Time / Ground					Inst. / Maintenance	
									Pickup		Delay		Pickup		Delay			Pickup	
Notes	Designated Bus	LVCB ID	Base / Revision ID	Breaker Manufacturer & Model	Trip Device Model	Sensor/ Frame	Rating Plug	Function	Setting	Trip (Amps)	Curve	Band	Setting	Trip (Amps)	Curve	Band	I^xt	Setting	Trip (Amps)
	CDP-1A	MCB_CDP-1A	Base	Square-D MH	MH														
1	CDP-1A	MCB_CDP-1A	Rev 1	Square-D MGL	ET1.0 (MG)	600		Phase	fixed	600	Fixed							5	3000

Notes:

1 Rev 1 settings is different from Base

* Device Rating is different from Library

4. Arc Flash Incident Energy Report

Arc Flash Risk Assessment has become far more recognized in the electrical industry over the past couple years and more specifically in Ontario as the Occupational Health and Safety Act (OHSA) has become more stringent on workplaces putting together protective measure and safety procedures for working with Electrical Equipment. The OHSA references CSA Z462:24 for good practice in electrical safety requirements and procedures.

Arc Flash Risk Assessment is covered via section 4.3.5 of CSA Z462:24. With respect to the frequency of when this analysis should be performed, the standard indicates that 'the incident energy analysis shall be updated when changes occur in the electrical distribution system that could affect the results of the analysis. The incident energy analysis shall also be review for accuracy at intervals not to exceed 5 years.

Performing the incident energy analysis determines the magnitude of energy available at the equipment and the distance of the arc flash boundary. The incident energy is defined as the amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arcing event. As the incident energy magnitude increases, so does that danger to the personnel working around the equipment. The most common injury to personnel is burns through arcs when the incident energy is released. There are four types of energies released during an arcing event. They are thermal energy, blast pressure energy, acoustic energy, and light energy.

Thermal energy causes the most damage to humans, by causing burns to both the skin and respiratory system. Blast pressure energy can cause damage to humans via physical trauma, such as door ejections or shattered equipment striking the person, causing falls and concussions. Acoustic and light energy cause the least harm to people, however the sound and bright intensity can be of the intensity to cause temporary discomfort.

The arc flash boundary is the distance at which the incident energy equals 1.2 cal/cm^2. People are exposed to multiple hazards within the arc flash boundary as listed above, and therefor need to take the appropriate precautions when entering within the boundary. Only qualified personnel should be allowed to work within the boundary, and they are to protect themselves with the appropriate PPE.

4.1. Personal Protective Equipment

Table 2 of CSA Z462:24 lists the selection of arc flash clothing and other PPE for when within the arc flash boundary. The rating of the clothing must also match or exceed the available arc flash energy at the equipment.

Table 2
Selection of arc-rated clothing and other PPE when the incident energy analysis method or an arc flash PPE selection table method is used
(See Clauses 4.3.5.6.2, H.1, H.2, Q.4, and V.4, and Tables H.1, V.1, V.2, and V.3.)

Incident energy exposures equal to 1.2 cal/cm² (5 J/cm²) up to and including 12 cal/cm² (50 J/cm²)
Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy* • Arc-rated long-sleeve shirt and pants or arc-rated coverall or arc flash suit (SR) • Arc-rated faceshield and arc-rated balaclava or arc flash suit hood (SR)† • Arc-rated outerwear (e.g., jacket, parka, rainwear, hard hat liner, high-visibility apparel) (AN)‡ Heavy-duty leather gloves, arc-rated gloves or rubber insulating gloves with protectors (SR)§ Hard hat Safety glasses or safety goggles (SR) Hearing protection Leather footwear**
Incident energy exposures greater than 12 cal/cm² (50 J/cm²)
Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy* • Arc-rated long-sleeve shirt and pants or arc-rated coverall or arc flash suit (SR) • Arc-rated arc flash suit hood • Arc-rated outerwear (e.g., jacket, parka, rainwear, hard hat liner, high-visibility apparel) (AN)‡ Arc-rated gloves or rubber insulating gloves with protectors (SR)§ Hard hat Safety glasses or safety goggles (SR) Hearing protection Leather footwear**

Legend:
SR = selection of one in group is required
AN = as needed

** Arc ratings can be for a single layer, such as an arc-rated shirt and pants or a coverall, or for an arc flash suit or a multi-layer system if tested as a combination consisting of an arc-rated shirt and pants, coverall, and arc flash suit.*
† Faceshields with a wrap-around guarding to protect the face, chin, forehead, ears, and neck area are required by Clause 4.3.7.3.10 c). Where the back of the head is inside the arc flash boundary, a balaclava or an arc flash hood shall be required for full head and neck protection.
‡ The arc rating of outerwear worn over arc-rated clothing that are not used as part of a layered system shall not be required to be equal to or greater than the estimated incident energy exposure.
§ Rubber insulating gloves with protectors provide arc flash protection in addition to shock protection. Higher class rubber insulating gloves with protectors, due to their increased material thickness, provide increased arc flash protection.
*** Footwear other than leather or dielectric may be used, provided it has been tested for and demonstrates no ignition, melting, or dripping at or greater than the estimated incident energy exposure.*

The equipment selected for use within an Arc Flash Boundary from Table 2 also have to meet the standards of Table 4 from CSA Z462:24.

4.2. Job Safety Planning

The Arc Flash risk assessment is only one portion of the standardized best practice for electrical job safety in accordance with CSA Z462:24. Employers are required to put in place an Electrical Safety Program to ensure for each and every electrical job all hazards are identified. With this program a Job

Safety Plan is to be in place in order to identify the risk for each and every job. Section 4.1.7.9.2 identifies that the Job Safety Plan for each job shall have the following requirements:

1. Be completed by a qualified person,
2. Be documented,
3. Include the following information:
    a. A description of the job and task;
    b. Identification of the electrical hazards associated with each task;
    c. A shock risk assessment in accordance with Clause 4.3.4 for task involving shock hazards
    d. An arc flash risk assessment in accordance with Clause 4.3.5 for tasks involving an arc flash hazard;
    e. Work procedures involved, special precautions, and energy source controls; and
    f. An emergency response plan.

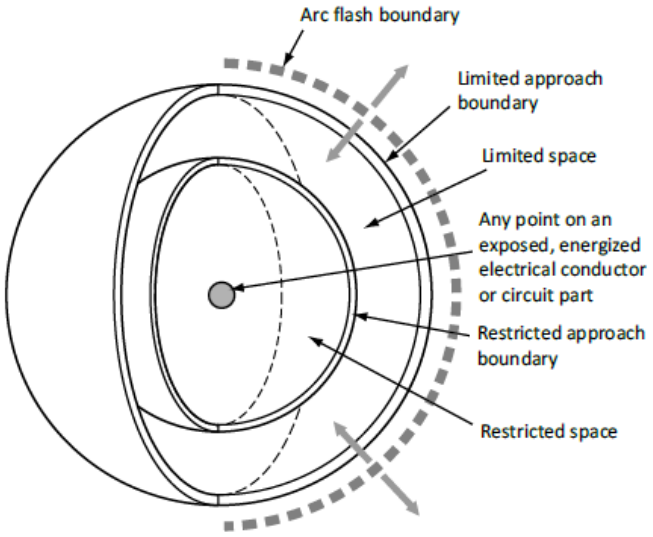
CSA Z462:24 should be reviewed in depth by each employer to create the Job Safety Plan to properly identify the information noted above.

4.3. Shock Risk Assessment

In most cases projects that have an arc flash risk will also have a shock risk component to them in dealing with electrical sources. The shock risk assessment is performed to identify shock hazards, estimate the likelihood of occurrence of injury or damage to health and the potential severity of injury or damage to health, and determine if additional protective measures are required.

By performing a shock risk hazard assessment, the shock protection boundaries will be identified. These are known as the limited and restricted approach boundaries, with each having their own degree of requirements to ensure worker safety. The arc flash boundary, limited approach boundary, and restricted approach boundary are depicted in the image below pulled from CSA Z462.

Limits of approach
(See Clause C.1.3.)



The Arc Flash boundary indicates the proximity to the electrical equipment in which workers are to be wearing arc flash rated clothing.

The limited approach boundary is the area in which no unqualified personnel shall be permitted to approach near energized conductors and circuit parts. Where there is a need for an unqualified person to enter the limited approach boundary, a qualified person shall warn workers of the possible hazards and continuously escort the unqualified person(s) while inside the limited approach boundary.

The restricted approach boundary has the most strict rules for approaching the equipment. Under absolutely no circumstance shall unqualified person(s) be permitted to cross the restricted approach boundary. Qualified persons shall not approach or bring conductive objects closer to the exposed energized electrical conductors or circuit parts operating greater than 30Vac or 60Vdc than the restricted approach boundary specified in Tables 1A and 1B unless at least one of the following applies:

a) The qualified person is insulated or guarded from the energized electrical conductors or circuit parts operating at voltages greater than 30 V ac or 60 V dc. Rubber insulating gloves and sleeves shall be considered insulation only with regard to the energized parts on which work is being performed.

b) The energized electrical conductors or circuit parts are insulated or guarded by a barrier in accordance with Clause 4.3.7.4.8 from the qualified person and from any other conductive object at a different potential.

4.4. Rated Personnel Protective Equipment

In addition to the Arc Flash rating, there are additional standards to the personal protective equipment the qualified personnel are to use within arc flash and shock boundaries. The standards that are to be followed are listed in Table 4 from CSA Z462 below:

Table 4
Standards for personal protective equipment
(See Clause 4.3.7.3.14 and Table A.1.)

Subject	Standard(s)
Apparel — Arc-rated	ASTM F1506
	ASTM F1449
	ASTM F2757
Aprons — Insulating	ASTM F2677
Eye and face protection — General	CSA Z94.3
Face protective products — Arc-rated	ASTM F2178/F2178M
Fall protection	CSA Z259 series of Standards on fall protection
	ASTM F887

Table 4 (Continued)

Subject	Standard(s)
Footwear — Dielectric specification	ASTM F1117
Footwear — Dielectric test method	ASTM F1116
Footwear — Standard performance specification and test method	CSA Z195
Gloves — Arc-rated	ASTM F2675/F2675M
Gloves — Leather protectors	ASTM F696
Gloves and sleeves — Rubber insulating — In-service care	ASTM F496
Gloves – Non-Leather Protectors	ASTM F3258
Gloves — Rubber insulating	ASTM D120
Head protection — Hard hats	CSA Z94.1
Raingear — Arc-rated	ASTM F1891
Rubber protective products — Visual inspection	ASTM F1236
Sleeves — Rubber insulating	ASTM D1051

The shock risk assessment also lists the glove class the qualified worker is to wear when approaching the live equipment. The gloves classifications with respect to equipment voltage are as follows:

Table 3A
Maximum use voltage for rubber insulating gloves
(See Clause 4.3.7.3.7.)

Class designation of glove or sleeve	Maximum AC use Voltage rms, V	Maximum DC use Voltage avg., V	Distances between protector glove cuff and rubber insulating glove cuff, min
00	500	750	13 mm (0.5 in)
0	1000	1500	13 mm (0.5 in)
1	7500	11 250	25 mm (1 in)
2	17 000	25 500	51 mm (2 in)
3	26 500	39 750	76 mm (3 in)
4	36 000	54 000	102 mm (4 in)

Both the protective equipment and gloves listed above are to be maintained on a regular basis, in which CSAZ462 gives guidelines for the appropriate intervals for maintenance of your equipment.

Table 3B
Rubber insulating equipment test intervals
(See Clauses 4.3.7.2.4 and 4.3.7.3.7.)

Type of rubber insulating equipment	When to test	Governing Standard for test voltage
Blankets	Before first issue and every 12 months thereafter	ASTM F479
Covers	Upon indication that insulating value is suspect	ASTM F478
Gloves	Before first issue and every 6 months thereafter	ASTM F496
Line hose	Upon indication that insulating value is suspect	ASTM F478
Sleeves	Before first issue and every 12 months thereafter	ASTM F496

4.5. Methodology

The incident energy analysis method is used in this report to determine the appropriate protective equipment and procedures on is to use during an arc flash, and also produce the arc flash labels stating the ratings of the equipment. The incident energy exposure level is based on the working distance of the worker's face and chest area from a perspective of arc source for the task to be performed. In addition to this the incident energy analysis takes into consideration the characteristics of the overcurrent protective device and its fault clearing time, including its condition of maintenance.

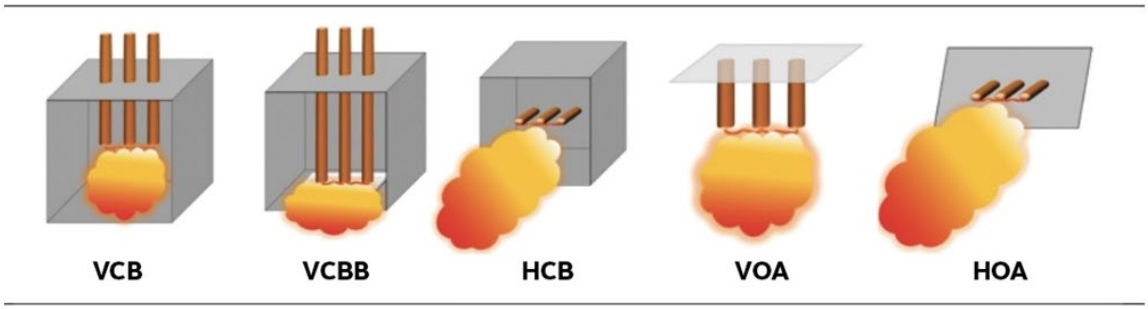
ETAP Power System Software is used to calculate the available arc flash incident energy. The software uses the IEEE 1584 calculation method to determine the available energy and Arc Flash boundary.

The IEEE 1584 method uses updated mathematical models for the calculations. The models take into consideration the system nominal voltage, gap spacing between conductors, electrode configuration, box size, open/enclosed equipment, working distance and coordination information (Time Characteristics Curves). This is why it's important to perform the coordination study and obtain this information for the arc flash analysis.

The electrode configuration is important to take into consideration as it drastically effects how much energy can be released from the equipment. The different types of configurations are:

1. VCB – Vertical conductors/electrodes in a metal box/enclosure
2. VCBB – Vertical conductors/electrodes terminated in a metal box/enclosure's insulating barrier
3. HCB –Horizontal conductors/electrodes in a metal box/enclosure
4. VOA – Vertical conductors/electrodes in open air
5. HOA – Horizontal conductors/electrodes in open air

The five types are illustrated below:



arc flash direction in the various electrode/bus configurations

VCBB, HCB, and HOA were the most recently added configurations to the standard as they were found to greatly increase the incident energy released from the enclosure.

4.6. Arc Incident Energy Summary

Bus Arc Flash Hazard Analysis Summary

Faulted Bus				Fault Current			Trip Device							
ID	Nom. kV	Equipment Type	Gap (mm)	Bolted Fault (kA) Bus	Bolted Fault (kA) PD	PD Arc Fault (kA)	Source Trip Device ID	Trip (cycle)	Open (cycle)	FCT (cycle)	Arc Flash Boundary (ft)	Incident Energy (cal/cm²)	Working Distance (in)	Energy Level
BP-A	0.240	Panelboard	25	6.698	6.698	3.311	CB_BP-A	1.04	0.00	1.04	0.4	0.1	18	Level A
BP-B	0.240	Panelboard	25	4.643	4.643	1.920	CB_BP-B	1.52	0.00	1.52	0.3	0.1	18	Level A
BP-C	0.240	Panelboard	25	3.735	3.735	1.515	CB_BP-C	113.38	0.00	113.38	4.2	6.2	18	Level A
BP-D	0.240	Panelboard	25	4.299	4.299	1.765	CB_BP-D	68.77	0.00	68.77	3.4	4.4	18	Level A
BP-E	0.240	Panelboard	25	3.398	3.398	1.367	CB_BP-E	120.00	0.00	120.00	4.1	5.9	18	Level A
BP-F	0.240	Panelboard	25	3.203	3.203	1.485	CB_BP-F	118.96	0.00	118.96	4.2	6.3	18	Level A
BP-G	0.240	Panelboard	25	3.616	3.616	1.463	CB_BP-G	120.00	0.00	120.00	4.3	6.3	18	Level A
BP-H	0.240	Panelboard	25	3.735	3.735	1.515	CB_BP-H	113.38	0.00	113.38	4.2	6.2	18	Level A
BP-I	0.240	Panelboard	25	3.029	3.029	1.398	CB_BP-I	120.00	0.00	120.00	4.1	6.0	18	Level A
BP-J	0.240	Panelboard	25	2.873	2.873	1.320	CB_BP-J	120.00	0.00	120.00	3.9	5.6	18	Level A
BUS_HV-SG	4.160	Switchgear	104	13.259	13.242	11.487	F_HV-SG	1.53	0.00	1.53	1.4	0.3	36	Level A
BUS_TRN-4	4.160	Cable Bus	104	11.929	11.911	10.354	F_P2	1.52	0.00	1.52	1.5	0.4	36	Level A
BUS_TRN-4a	4.160	Cable Bus	104	11.825	11.806	10.265	F_P2	1.53	0.00	1.53	1.4	0.4	36	Level A
CDP-1A	0.208	Panelboard	25	9.039	9.039	3.531	MCB_CDP-1A	3.60	0.00	3.60	0.9	0.5	18	Level A
DP-PRN-4	0.600	Panelboard	25	4.404	0.617	0.438	F_TRN-4	90.94	0.00	90.94	5.7	10.2	18	Level A
DP-PRN-4a	0.208	Panelboard	25	9.971	0.499	0.228	F_TRN-4a	120.00	0.00	120.00	9.0	20.9	18	Level B
PANEL-F	0.600	Panelboard	25	4.267	4.140	3.327	MCB_PANEL-F	0.94	0.00	0.94	0.3	0.1	18	Level A

Arc Flash Analysis Results:

The results of the Arc Flash Incident Energy summary indicate all electrical equipment except for DP-PRN-4a within the study have an Arc Flash Energy Level Classification of Level A. This states that all energy levels are below 12 cal/cm2 and are within the first class of Arc Flash Personal Protective Equipment. No further reduction of Arc Flash Hazard is deemed necessary at this level.

Please note that by revising the Main Breaker for CDP-1A as per the protective device coordination results, this reduces the Arc Flash Incident Energy at CDP-1A from Level B (15.966 cal/cm2) to Level A (0.488 cal/cm2).

DP-PRN-4a reports an Arc Flash Incident Energy of Level B at 20.924cal/cm2. This is below the maximum arc flash rating of clothing at 40 cal/cm2. However, from modeling properly sized bay-o-net and CLF fuses in the transformer, this reduces down to approximately 10 ca/cm2. Replacing the existing transformer fuses and confirming they're sized appropriately will protect the distribution panel further.

4.7. Arc Flash Labels

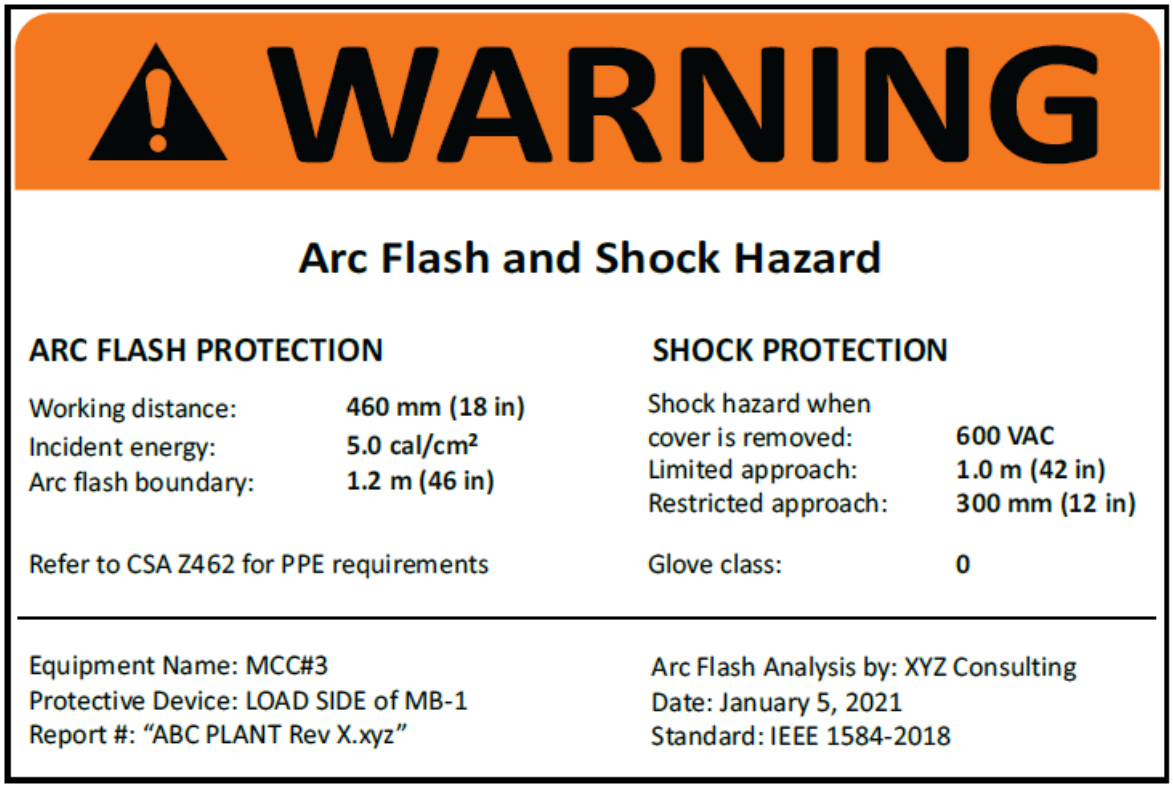
With the incident energy, arc flash boundary, and PPE requirements determined, the information is to be affixed to the equipment in the form of an Arc Flash Label. The Arc Flash labels contain the following information:

1. Nominal System Voltage
2. Arc Flash Boundary
3. At least one of the following:
    a. Available incident energy and the corresponding working distance;
    b. The arc flash PPE minimum arc rating in Table V.1 or V.2 for ac equipment, or V.3 for dc equipment;
    c. Minimum arc-rating of PPE; or
    d. site-specific level of PPE; and
4. date the information required by this Clause was determined.

The label must also:

1. be sufficiently durable to withstand the environment involved.
2. The method of calculation and data to support the information must be documented
3. And the data shall be reviewed for accuracy at intervals not to exceed 5 years

An example of an arc flash label is below:



5. Infrared Thermographic Scanning Report

An infrared thermographic scan should be performed as part of an electrical distribution systems yearly maintenance. Temperature variations can show defects in electrical distribution systems due to the direct correlation of heat loss from current flowing through equipment. Temperature variations can occur because of improper installation (loose connections or lugs), unbalanced loading, undersized equipment due to design error, faulty equipment, and overloaded circuits.

The scan is performed with the equipment covers removed, while under normal operating load to be able to observe any anomalies in temperature variations throughout the internal components and terminations. DCC was notified that the main switchgear was not able to be inspected live, so the two 4160V main switch gear equipment on base were not thermally scanned. The scanning was performed by Eaton personnel with both Arc Flash and Infrared certified training using state of the art equipment exceeding NFPA standards.

The thermographic scan performed by Eaton indicated that no anomalies were present at this building. The thermal images for the equipment can be found in the following:

1. Remaining Equipment with no Anomalies (Remaining Thermal Images - in Appendix B)

6. Phase Balancing Analysis and Equipment Testing

Current and voltage readings were taken at every piece of equipment to determine loading of the distribution system and the voltage drop witnessed from the incoming service to the furthest panel

installed. The results complete with notable observations and solutions are listed below. The complete list of equipment within FF04 including all current and voltage readings can be found in Appendix E.

Observations:

1. All three phase and single phase panels are appropriately balanced from the readings obtained on-site.
2. The voltage drop readings from the incoming electrical service to the furthest downstream electrical equipment are within the appropriate tolerances to meet the requirements of the Canadian Electrical Code.

7. Visual and Mechanical Inspections

A visual and mechanical inspection was performed while the equipment was scanned and analysed during the site visit. Observations were made to note any corrosion, rust, leaks, safety hazards, violations of the Canadian Electrical Code, grounding issues, physical damage, evidence of moisture, electrical arcing, and the overall general condition of the equipment to ensure it is operating as intended. The internal components were checked for discolouration and proper anchorage. Labelling and panel schedules were also observed on-site and noted for compliance. Lastly the age of the equipment was obtained or estimated from the equipment and included within the report. The results complete with notable observations and solutions are listed below. The complete list of equipment within FF04 including all physical observations can be found in Appendices D & E.

Observations:

One panel was identified that the source was unable to be located by the electrician. The panel has no load on it.

Panel CDP-1A:

1. Grounding Issue – No grounding conductor in service conduit. Neutral is grounded to water pipe

Recommendation:

1. **Install grounded conductor from building service to main distribution panel in accordance with CEC section 10.**

Panel BP-A:

1. Missing 1-1/4” and 3/4” knockouts from panel.
2. Excessive dirt and debris present within panel.

Recommendation:

1. **Provide knockout covers.**
2. **Perform panel cleaning.**

Panel BP-B:

1. Bent neutral lug within panel.
2. Conduit fill leaving the panel exceeds Canadian Electrical Code Requirements.
3. Excessive dirt and debris present within panel.

4. Armoured cable leaving the panel is not supported properly.

Recommendation:

1. **Provide new neutral lug for the panel.**
2. **Install additional conduits or upsize the conduit to suit the cables installed in the existing conduit.**
3. **Perform panel clean**
4. **Provide strapping to support the armoured cable leaving the panel.**

Panel BP-C:

1. Circuit 37 wiring is short.

Recommendation:

1. **Extend wiring of circuit 37.**

Panel BP-D:

1. Missing screws in panel cover.
2. Excessive dirt and debris present within panel.

Recommendation:

1. **Provide new screws in panel cover.**
2. **Perform panel cleaning.**

Panel BP-E:

1. Feeder cables are stripped more than required at connection points.
2. Un-used conduit existing the panel is un-capped.

Recommendation:

1. **Trim feeder cables to reduce amount of exposed wire.**
2. **Cap conduit.**

Panel BP-F:

1. Missing knockouts from panel.

Recommendation:

1. **Provide knockout covers.**

Panel BP-G:

1. 5 unsupported raceways present leaving the panel
2. 1 meter of clearance require in front of panel is not met.

Recommendation:

1. **Provide strapping to support raceways.**
2. **Remove owner equipment in front of panel.**

Panel BP-H:

1. Missing knockouts from panel.
2. Un-used conduit existing the panel is un-capped.

Recommendation:

1. **Provide knockout covers.**
2. **Cap conduit.**

Panel BP-I:

1. Excessive dirt and debris in bottom of panel.

Recommendation:

1. **Perform panel clean.**

Panel BP-J:

1. Excessive dirt and debris in bottom of panel.

Recommendation:

1. **Perform panel clean.**

Panel P-F:

1. Panel is rated for 200A but main breaker is rated for 250A and feeder breaker is rated for 225A.

Recommendation:

1. **Main breaker needs to be replaced with 200A breaker.**

General Building:

1. Single Line Diagram missing from Electrical Room

Recommendation:

1. **Print and Frame Single Line Diagram as required by CEC.**

Exterior Transformer TRN-4:

1. Rust on enclosure and minor evidence of moisture within.
2. Rubber gasket is weathered on door.

Recommendation:

1. **Tag transformer to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the Transformer.**
2. **Provide new door gasket.**

Exterior Panel Feeding FF04 DP-PRN-4:

1. Rust on enclosure and minor evidence of moisture within.

2. Rubber gasket is weathered on door.

Recommendation:

1. **Tag panel to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the panel.**
2. **Provide new door gasket.**
3. **Replace panel.**

Exterior Transformer TRN-4a:

1. Rust on enclosure and minor evidence of moisture within.

Recommendation:

1. **Tag transformer to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the transformer.**

Exterior Panel Feeding FF04 DP-PRN-4a:

1. Rust on top of enclosure and minor evidence of moisture within. Enclosure is damaged.
2. Cable terminations do have have Penetrox.
3. Manufacturers nameplate is missing.

Recommendation:

1. **Tag panel to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the panel. Consider purchasing new enclosure if rust worsens.**
2. **Apply penetrox to cable terminations.**
3. **Install lamacoid with panel information.**
4. **Replace panel.**

Appendix A – Single Line Diagram



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LEVEL OF SECURITY | NIVEAU DE SÉCURITÉ
UNCLASS | NON CLASSIFIÉ

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IDEA
INTEGRATED DESIGN
ENGINEERING + ARCHITECTURE

595 Byron Ave., Ottawa Ont. Ca.
Tele: (613) 728-0008 - Email: info@integrateddesign.ca

NO.	DATE	REVISION	APPR.
1	2025-03-14	ISSUED FOR FINAL REPORT	

SCALE | ÉCHELLE
1:150

LOCATION | EMPLACEMENT
388 ONTARIO STREET
KINGSTON
ONTARIO

PROJECT | PROJET
ARC FLASH STUDY
FORT FRONTENAC
KN299976

TRADE | MÉTIER	DATE
ELECTRICAL	2025-03-14

SUBJECT | SUJET
ELECTRICAL
SITE PLAN

PRODUCTION	REVIEWED | REVU	
DESIGNED | ÉTUDIÉ N.F.	ENG O | O ING	DES O | AGENT CONC
DRAWN | DESSINÉ B.R.	CUSTOMER | CLIENT	PROJ MGR | GEST PROJ
CHECKED | VÉRIFIÉ N.F.	SECT OC | CMDT CSG	DES MGR | GEST CONC
COORDINATION		FIRE | INCENDIE

WBS NO. | NO. OTP	PF NO. | NO. DP
N.700114.23.15	PF500659505

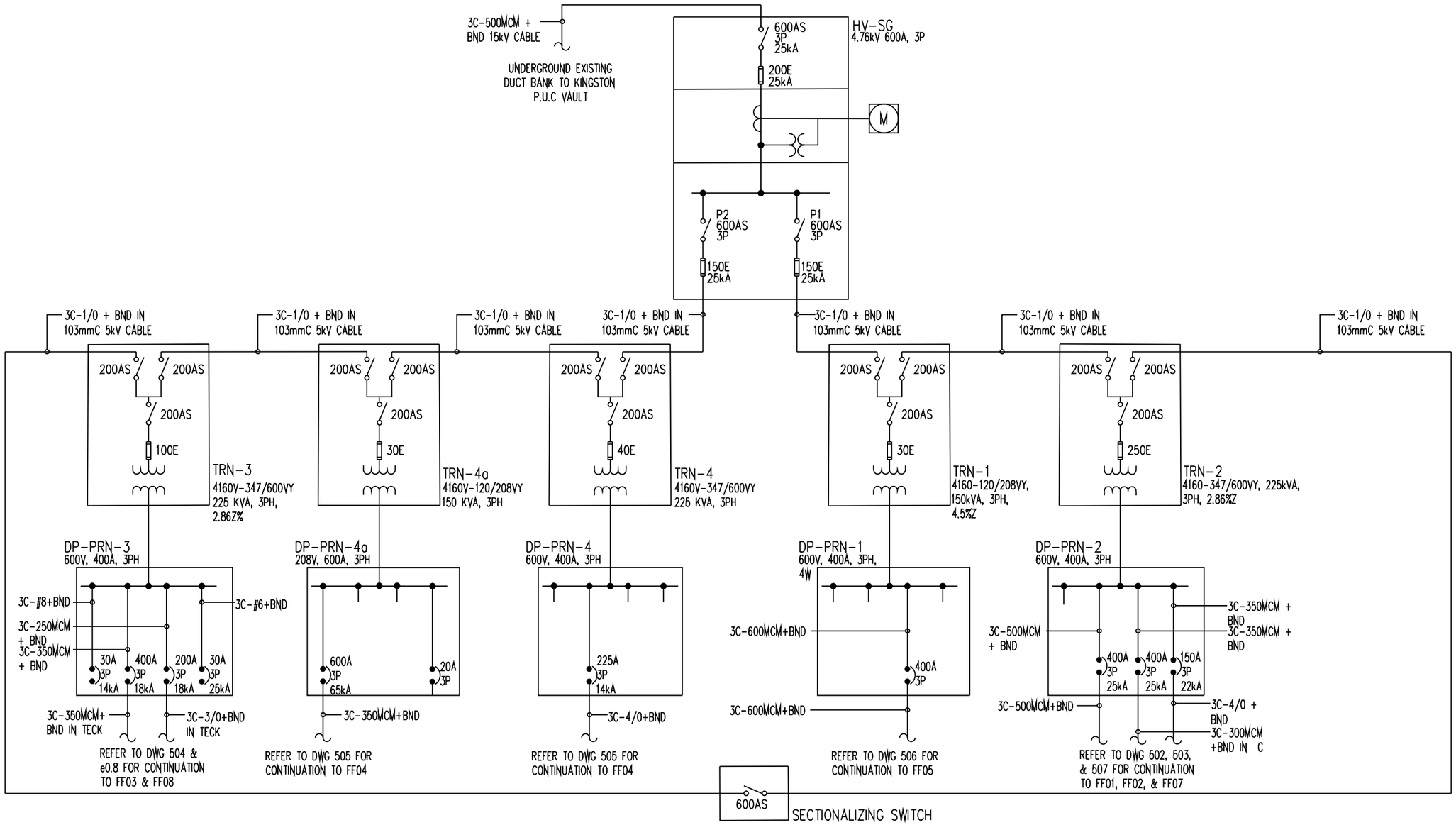
DWG. NO. | NO. DESSIN
K-B35-9306/91-500

Canada

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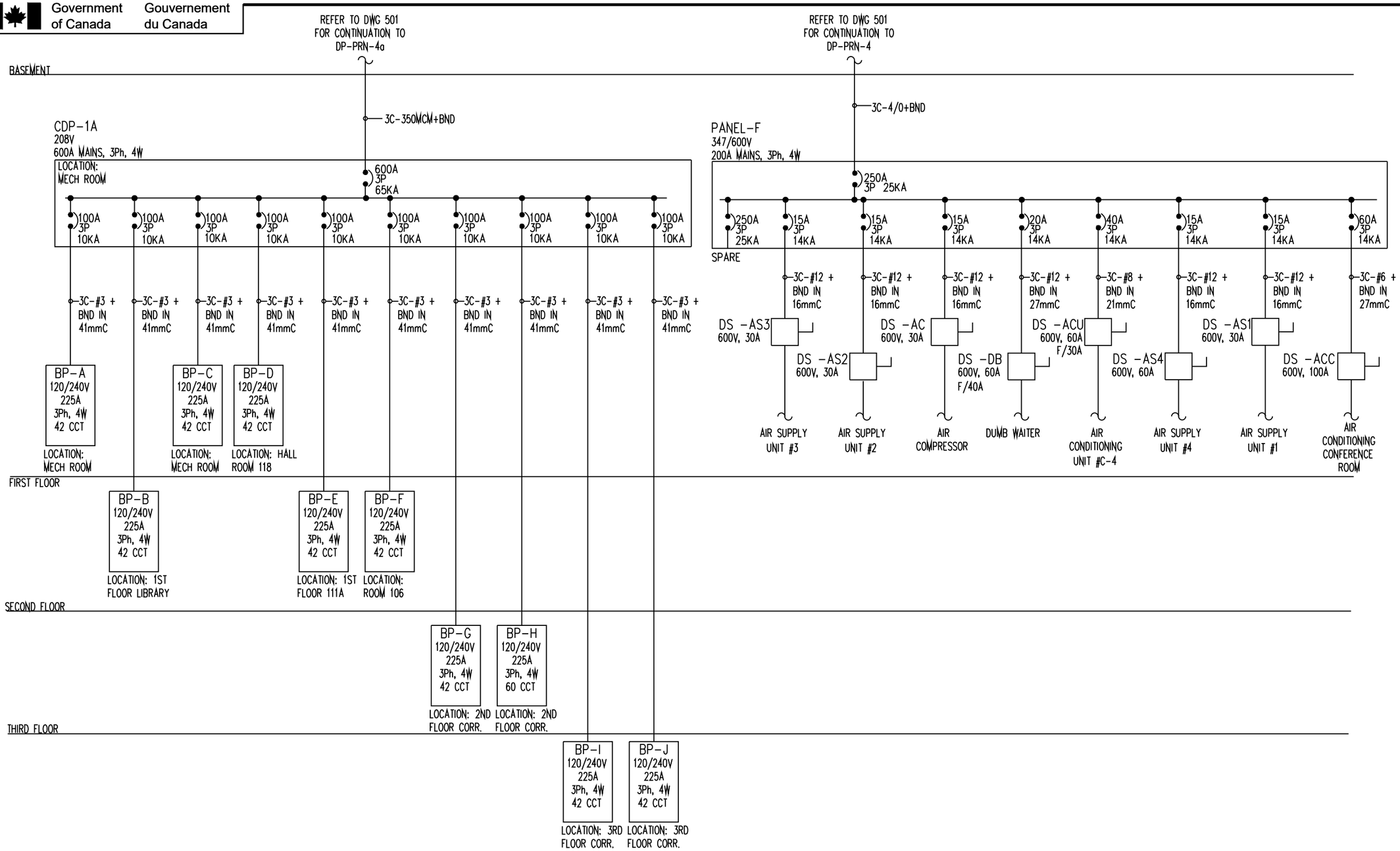
BORDER LAST UPDATED 2011-11-11

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595 Byron Ave., Ottawa Ont. Ca.
Tele: (613) 728-0008 - Email: info@integrateddesign.ca

PROJECT: ARC FLASH STUDY
PROJET: FORT FRONTENAC KN299976
SUBJECT: SINGLE LINE DIAGRAM
SUJET: TRANSFORMER LOOP
DATE: 2025-03-14

APPROVED: / APPROUVÉ PAR:	N.F.	
	N.F.	
SCALE: / ÉCHELLE:	N/A	
WBS NO.: / NO. OTP:	N.700114.23.15	
PF NO.: / NO. DP:	PF500659505	2/10
DWG NO.: / NO. DESSIN:	K-B35-9306/91-501	

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595 Byron Ave., Ottawa Ont. Ca.
Tele: (613) 728-0008 - Email: info@integrateddesign.ca

PROJECT: ARC FLASH STUDY
PROJET: FORT FRONTENAC
KN299976
SUBJECT: SINGLE LINE DIAGRAM
SUJET: FF04

DATE: 2025-03-14

APPROVED:	N.F.	
APPROUVÉ PAR:	N.F.	
SCALE: ÉCHELLE:	N/A	
WBS NO.: NO. OTP:	N.700114.23.15	
PF NO.: NO. DP:	PF500659505	6/10
DWG NO.: NO. DESSIN:	K-B35-9306/91-505	

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Appendix B – Thermal Scan Images

DRYCORE
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[redacted]

INFRARED SCAN AND EQUIPMENT PICTURES

[redacted]

FORT FRONTENAC

388 ONTARIO ST.

KINGSTON, ONTARIO

K7K 2X9

5480 Canotek Rd., Unit 1, Ottawa, Ontario K1J 9H5 • Tel: 613-745-7600 • Fax: 613-745-5600

DRYCORE
ELECTRIC • ÉLECTRIQUE

Job Summary

Project Name: Fort Frontenac IR Scan October 2024

Drycore Job Number: 24-348

Service Location: Fort Frontenac 388 Ontario St. Kingston Ontario

Performed for:
Idea Integrated Design
595 Byron Ave.
Ottawa Ontario
K2A 4C4

Customer Contact: Nick Frayn

Performed By:
Drycore Electric,
1-5480 Canotek Rd.
Ottawa Ontario
K1B 5N2

Field Representative: Andrew Beuman

Date of Scan: October 28th to November 1st, 2024

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Floor/ Room Number	Equipment Type	Equipment Identification	IR File Number	Picture File Number
BUILDING FF04				
Dumbwaiter control Room	DISC	Disconnect	2324	2325
HVAC Mech Rm	DISC	Compressor	2176	2177

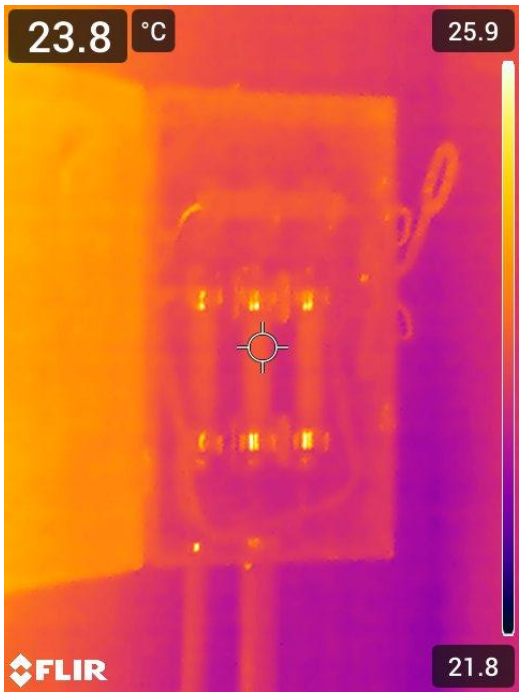
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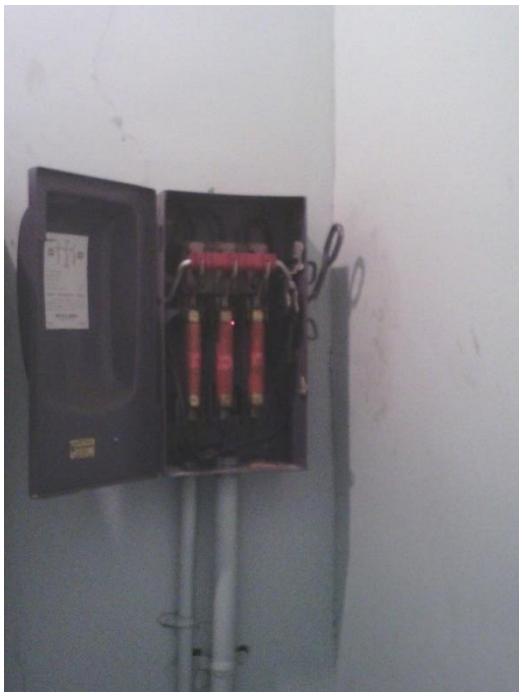
DRYCORE
ELECTRIC • ÉLECTRIQUE

Floor/ Room Number	Equipment Type	Equipment Identification	IR File Number	Picture File Number
	STARTER	Air Supply Unit 3	2178	2179
	STARTER	Return Air Unit 3	2178	2179
North East Mech Room	DISC	DISC 431	2180	2181
CACSA Supply	PANEL	208V QO Panel	2182	2183
Basement Library Rm 6	PANEL	PB-C	2186	2187
Basement Library By stairs	PANEL	BP-B	2188	2189
Electrical/ Mech Room Basement	STARTER	Air Supply 1&4	2210	2211
	STARTER	Return Air 1&4	2212	2213
	PANEL	F Panel	2214	2215
	PANEL	BP-A Panel	2216	2217
	PANEL	CDP-1A	2218	2219
Basement by Mech Rm 10	DISC	AIR Con Conference Rm	2220	2221
	STARTER	Return Air & Supply Starters	2222	2223
	PANEL	BP-E Panel	2224	2225
	PANEL	BP-F Panel	2226	2227
	PANEL	BP-D Panel	2228	2229
2nd Floor	PANEL	BP-H Panel	2230	2231
	PANEL	BP-G Panel	2232	2233
3rd Floor	PANEL	BP-I Panel	2234	2235
	PANEL	BP-J	2236	2237

DRYCORE
ELECTRIC • ÉLECTRIQUE

Location	Building FF04 DUMBWAITER CONTROL RM
Component	DUMBWAITER DISCONNECT
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Picture File Name	FLIR2325
Date	Friday November 1th
Image time	3:17 PM

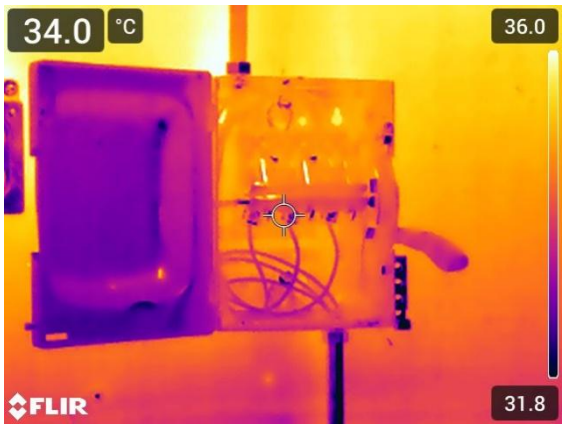




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DRYCORE
ELECTRIC • ÉLECTRIQUE

Location	Building FF04 HVAC MECH ROOM
Component	COMPRESSOR DISCONNECT
IR File Name	FLIR2176
Picture File Name	FLIR2177
Date	WEDNESDAY October 30th
Image time	10:02 AM

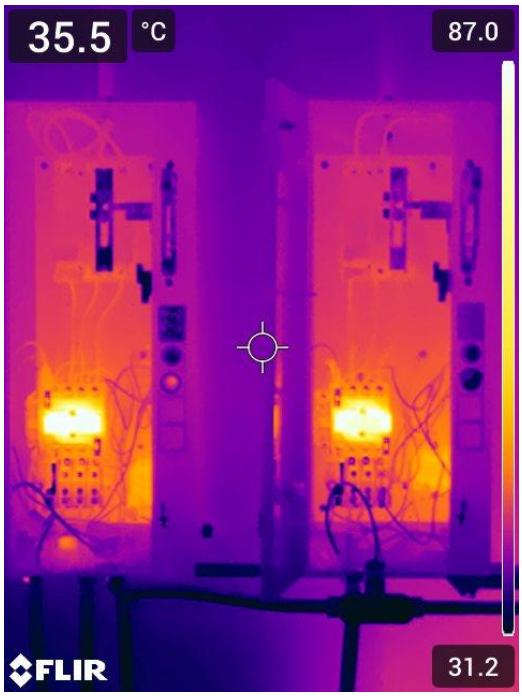




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DRYCORE
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Location	Building FF04 HVAC MECH ROOM
Component	STARTER AIR SUPPLY/RETURN UNIT 3
IR File Name	FLIR2178
Picture File Name	FLIR2179
Date	WEDNESDAY October 30th
Image time	10:11 AM

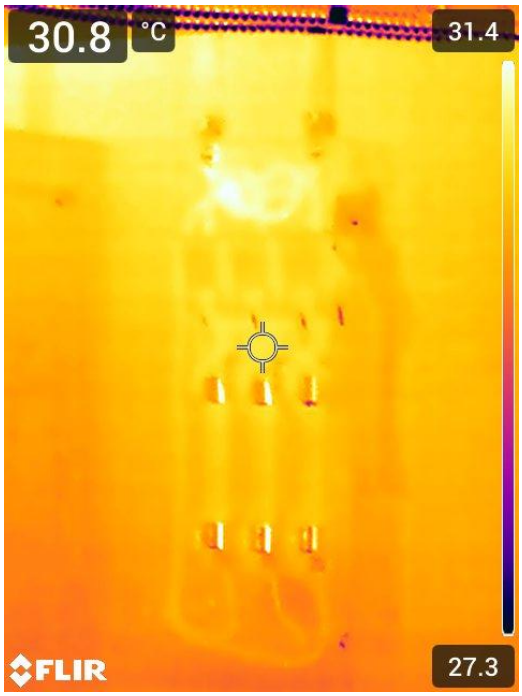




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DRYCORE
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Location	Building FF04 NORTHEAST MECH ROOM
Component	DISCONNECT 431
IR File Name	FLIR2180
Picture File Name	FLIR2181
Date	WEDNESDAY October 30th
Image time	10:34 AM

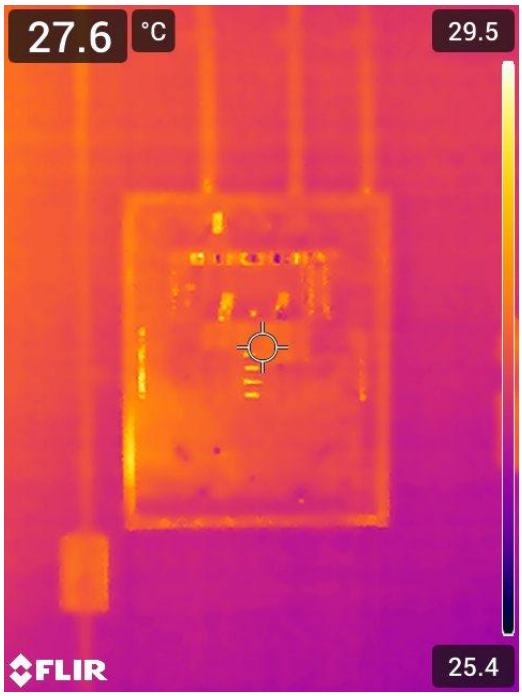




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DRYCORE
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Location	Building FF04 CACSA SUPPLY
Component	208V QO PANEL
IR File Name	FLIR2182
Picture File Name	FLIR2183
Date	WEDNESDAY October 30th
Image time	10:40 AM



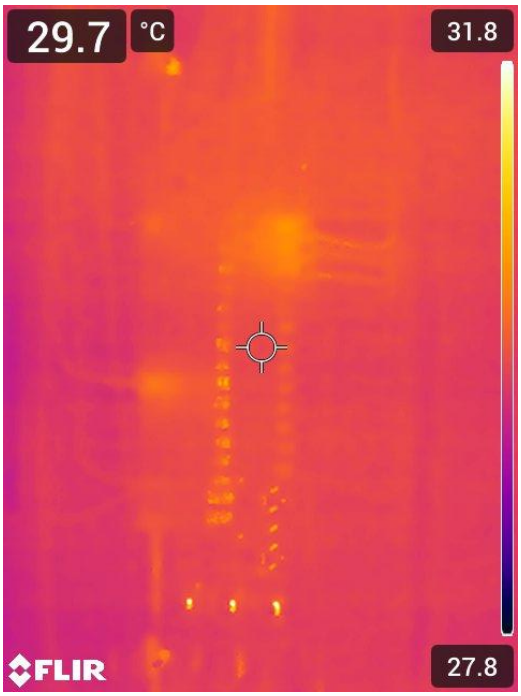


PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	0	**A-N**	121
B PHASE	0	**B-N**	120
C PHASE	N/A	**C-N**	N/A
NEUTRAL	0	**A-B**	210
		A-C	N/A
		B-C	N/A

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Location	Building FF04 BASEMENT LIBRARY RM 6
Component	PANEL BP-C
IR File Name	FLIR2186
Picture File Name	FLIR2187
Date	WEDNESDAY October 30th
Image time	11:09 AM



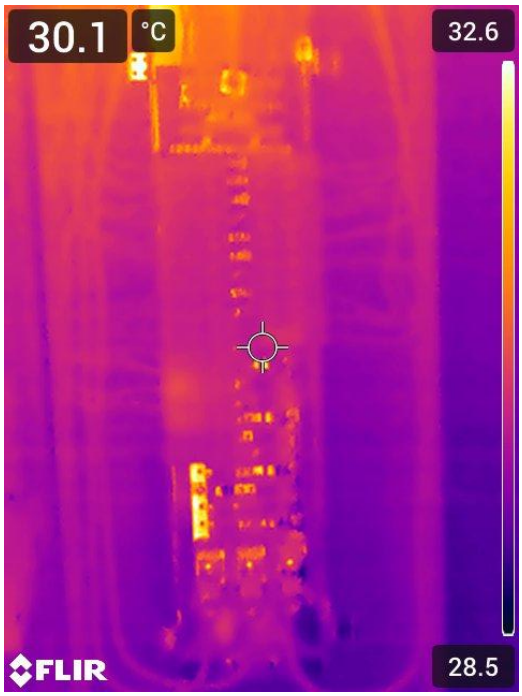


PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	7.6	**A-N**	120
B PHASE	4.6	**B-N**	121
C PHASE	4	**C-N**	121
NEUTRAL	3.5	**A-B**	210
		A-C	210
		B-C	211

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DRYCORE
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Location	Building FF04 BASEMENT LIBRARY BY STAIRS
Component	PANEL BP-B
IR File Name	FLIR2188
Picture File Name	FLIR2189
Date	WEDNESDAY October 30th
Image time	11:25 AM





PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	1.4	**A-N**	120
B PHASE	3	**B-N**	121
C PHASE	3.5	**C-N**	121
NEUTRAL	2.3	**A-B**	210
		A-C	210
		B-C	211

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Location	Building FF04 ELE/MECH ROOM BASEMENT
Component	STARTER SUPPLY 1&4
IR File Name	FLIR2210
Picture File Name	FLIR2211
Date	WEDNESDAY October 30th
Image time	12:40 PM





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DRYCORE
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Location	Building FF04 ELE/MECH ROOM BASEMENT
Component	STARTER RETURN 1&4
IR File Name	FLIR2212
Picture File Name	FLIR2213
Date	WEDNESDAY October 30th
Image time	12:40 PM

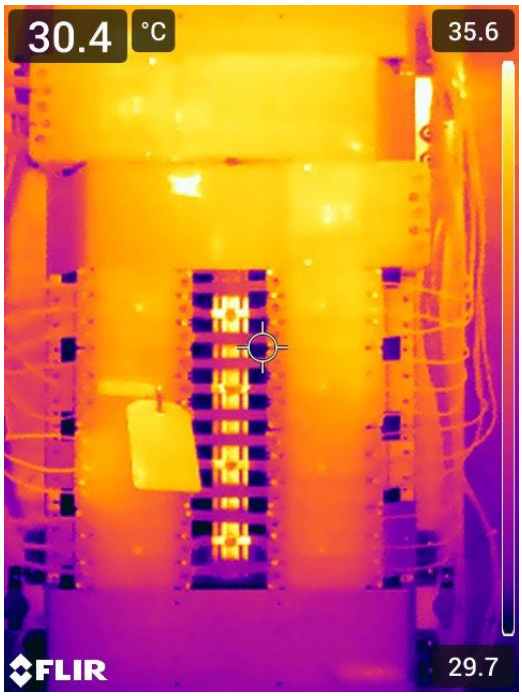




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DRYCORE
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Location	Building FF04 ELE/MECH ROOM BASEMENT
Component	PANEL F
IR File Name	FLIR2214
Picture File Name	FLIR2215
Date	THURSDAY October 31ST
Image time	12:53 PM





PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	10	**A-N**	351
B PHASE	9.4	**B-N**	351
C PHASE	9	**C-N**	350
NEUTRAL	0	**A-B**	610
		A-C	608
		B-C	608

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Location	Building FF04 ELE/MECH ROOM BASEMENT
Component	PANEL BP-A
IR File Name	FLIR2216
Picture File Name	FLIR2217
Date	THURSDAY October 31ST
Image time	1:11 PM



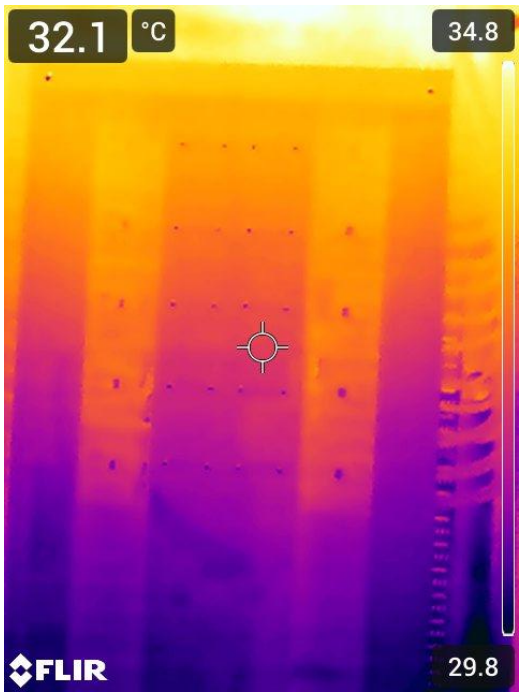


PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	5.4	**A-N**	122
B PHASE	4.9	**B-N**	123
C PHASE	7.7	**C-N**	122
NEUTRAL	2.8	**A-B**	212
		A-C	212
		B-C	213

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Location	Building FF04 ELE/MECH ROOM BASEMENT
Component	PANEL CDP-1A
IR File Name	FLIR2218
Picture File Name	FLIR2219
Date	THURSDAY October 31ST
Image time	1:28 PM





PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	46.75	**A-N**	122
B PHASE	43.96	**B-N**	122
C PHASE	50.6	**C-N**	121
NEUTRAL	0	**A-B**	210
		A-C	210
		B-C	209

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DRYCORE
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Location	Building FF04 BASEMENT BY MECH RM 10
Component	AIR CON CONFERENCE ROOM
IR File Name	FLIR2220
Picture File Name	FLIR2221
Date	THURSDAY October 31ST
Image time	2:18 PM





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Location	Building FF04 BASEMENT BY MECH RM 10
Component	STARTER SUPPLY/ RETURN AIR
IR File Name	FLIR2222
Picture File Name	FLIR2223
Date	THURSDAY October 31ST
Image time	2:23 PM

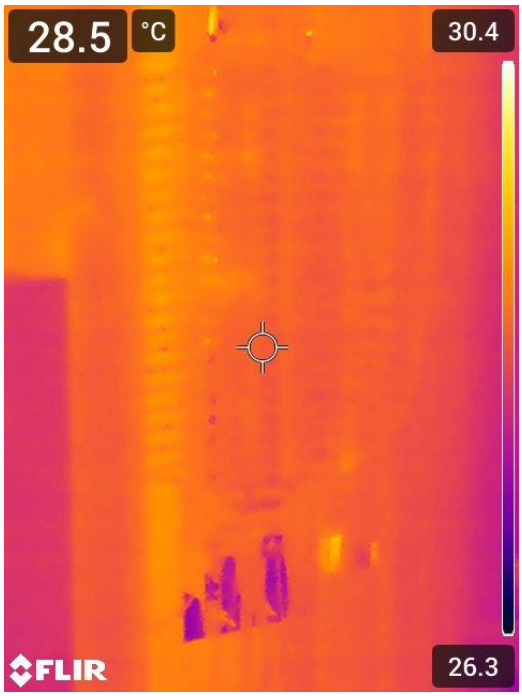


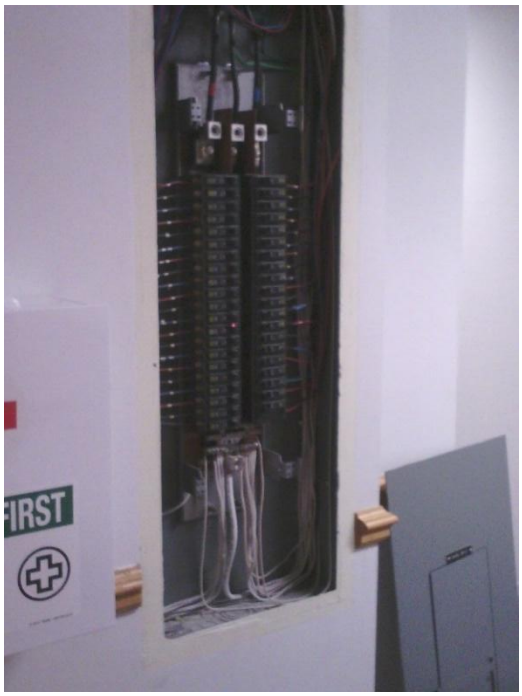


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Location	Building FF04 BASEMENT BY MECH RM 10
Component	PANEL BP-E
IR File Name	FLIR2224
Picture File Name	FLIR2225
Date	THURSDAY October 31ST
Image time	2:31 PM



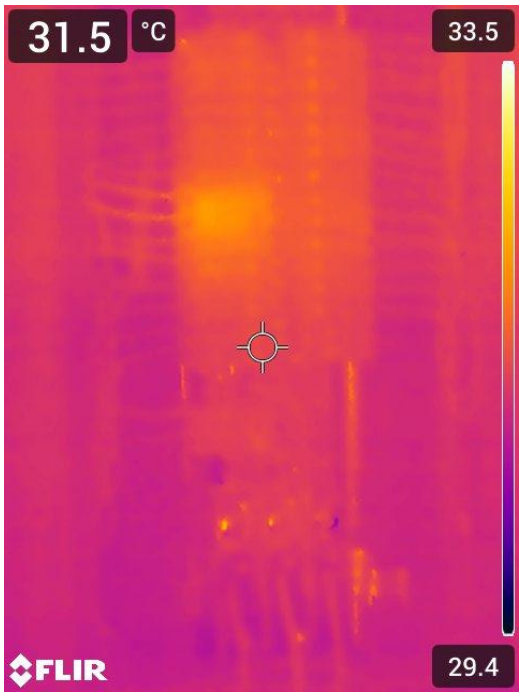


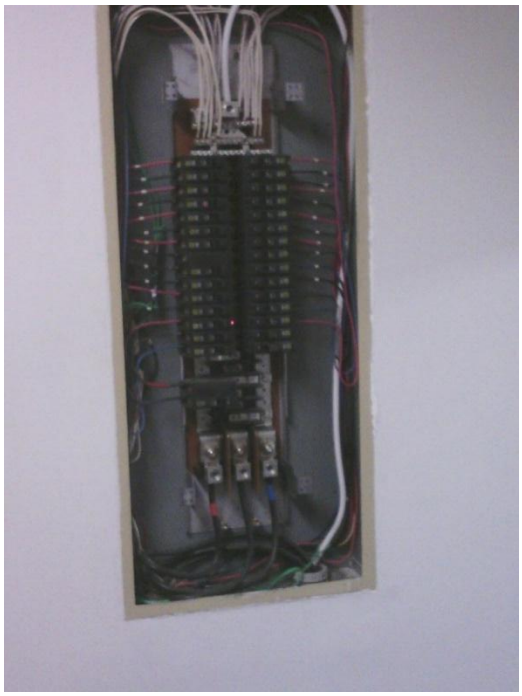
PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	1	**A-N**	120
B PHASE	3.2	**B-N**	121
C PHASE	4	**C-N**	120
NEUTRAL	4.5	**A-B**	210
		A-C	209
		B-C	209

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Location	Building FF04 BASEMENT BY MECH RM 10
Component	PANEL BP-F
IR File Name	FLIR2226
Picture File Name	FLIR2227
Date	THURSDAY October 31ST
Image time	2:39 PM



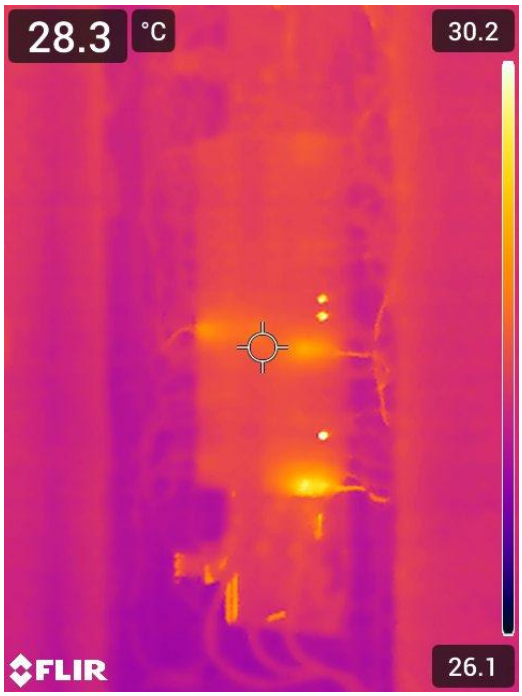


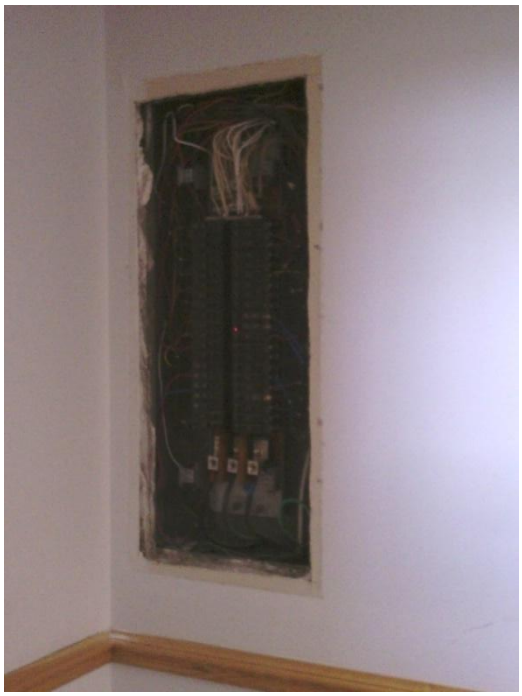
PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	1.7	**A-N**	120
B PHASE	2.2	**B-N**	120
C PHASE	1.7	**C-N**	120
NEUTRAL	.7	**A-B**	210
		A-C	209
		B-C	210

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DRYCORE
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Location	Building FF04 BASEMENT BY MECH RM 10
Component	PANEL BP-D
IR File Name	FLIR2228
Picture File Name	FLIR2229
Date	THURSDAY October 31ST
Image time	2:49 PM



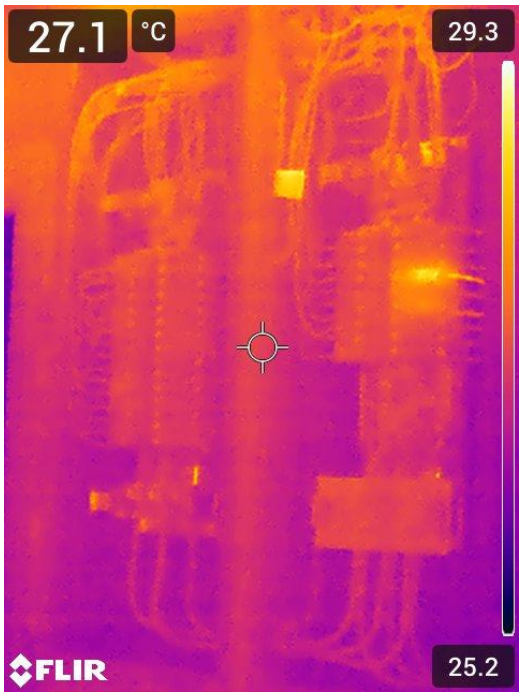


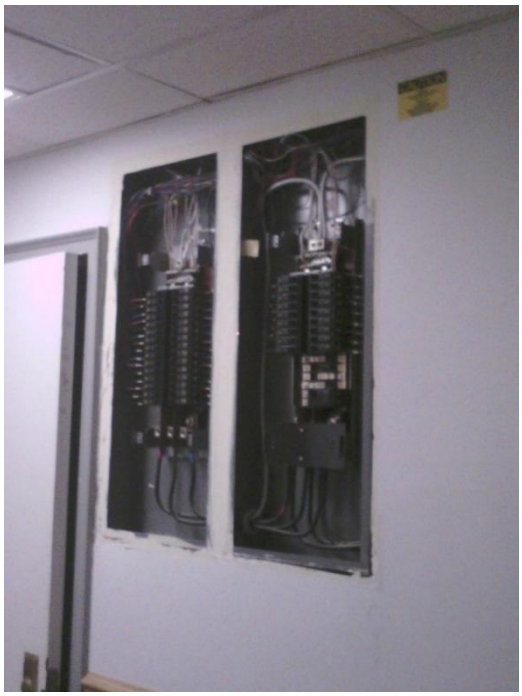
PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	9.4	**A-N**	120
B PHASE	6.9	**B-N**	121
C PHASE	9.3	**C-N**	120
NEUTRAL	3.3	**A-B**	210
		A-C	209
		B-C	210

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Location	Building FF04 SECOND FLOOR
Component	PANEL BP-H
IR File Name	FLIR2230
Picture File Name	FLIR2231
Date	THURSDAY October 31ST
Image time	3:00 PM



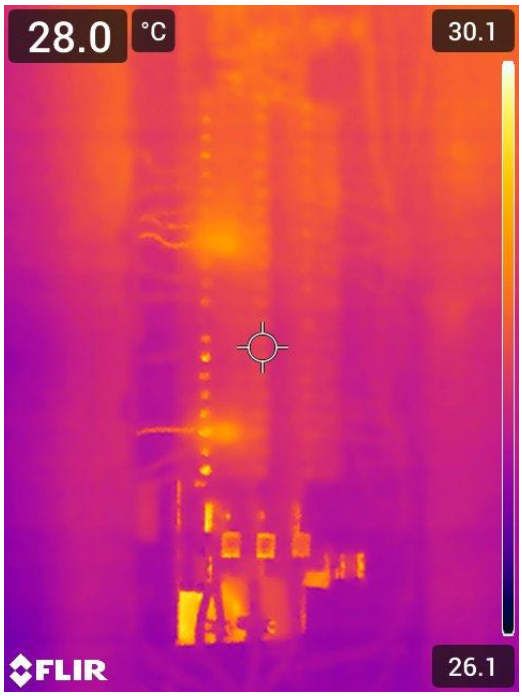


PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	9.7	**A-N**	120
B PHASE	8.1	**B-N**	121
C PHASE	7	**C-N**	120
NEUTRAL	3.4	**A-B**	209
		A-C	209
		B-C	210

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DRYCORE
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Location	Building FF04 SECOND FLOOR
Component	PANEL BP-G
IR File Name	FLIR2232
Picture File Name	FLIR2233
Date	THURSDAY October 31ST
Image time	3:12 PM



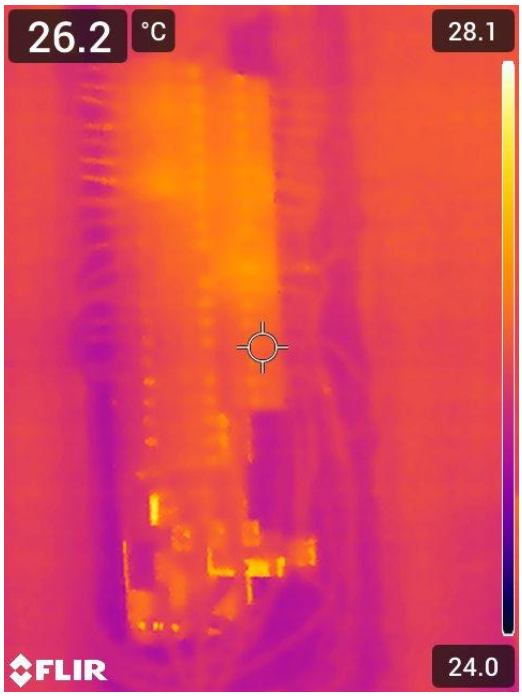


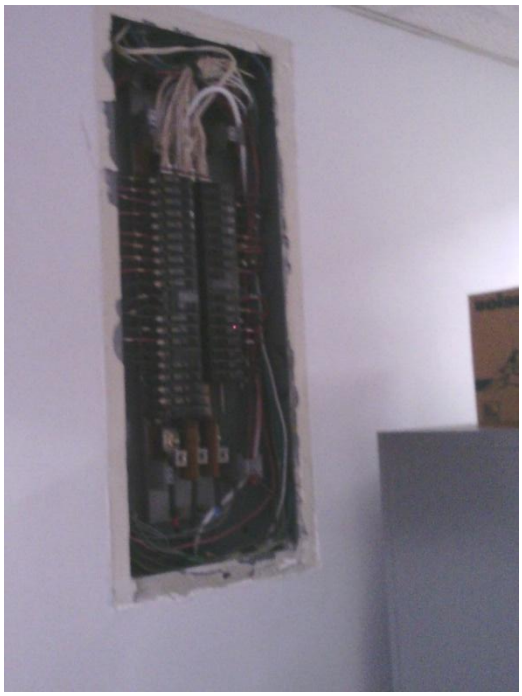
PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	4.8	**A-N**	120
B PHASE	2.1	**B-N**	121
C PHASE	4.7	**C-N**	120
NEUTRAL	3.6	**A-B**	209
		A-C	209
		B-C	210

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DRYCORE
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Location	Building FF04 SECOND FLOOR
Component	PANEL BP-I
IR File Name	FLIR2234
Picture File Name	FLIR2235
Date	THURSDAY October 31ST
Image time	3:21 PM



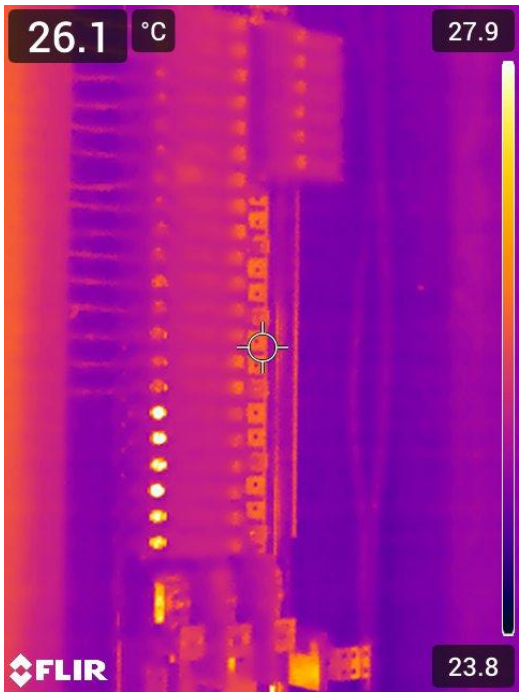


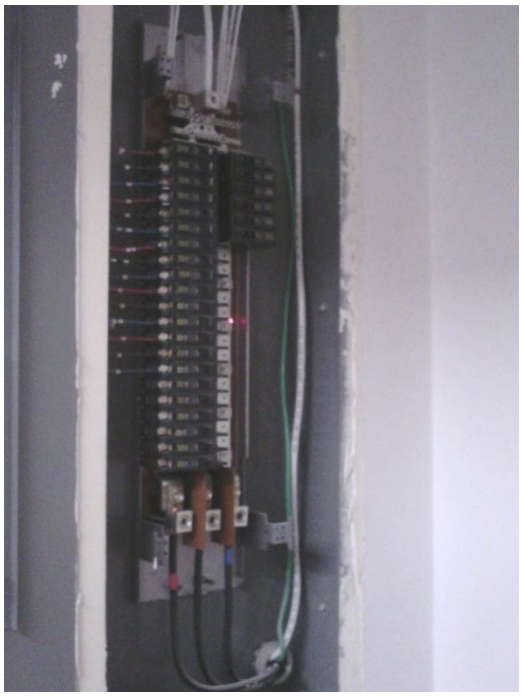
PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	5.4	**A-N**	120
B PHASE	4.3	**B-N**	121
C PHASE	4.7	**C-N**	120
NEUTRAL	2.3	**A-B**	209
		A-C	209
		B-C	210

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DRYCORE
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Location	Building FF04 SECOND FLOOR
Component	PANEL BP-J
IR File Name	FLIR2236
Picture File Name	FLIR2237
Date	THURSDAY October 31ST
Image time	3:29 PM



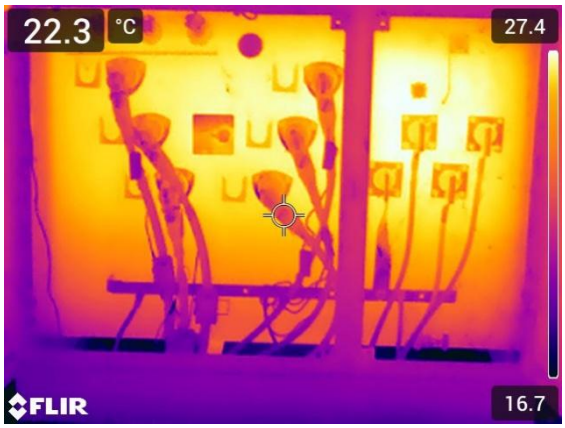


PHASE	LOAD IN AMPS	PHASE	VOLTS
A PHASE	.3	**A-N**	120
B PHASE	1.4	**B-N**	121
C PHASE	.3	**C-N**	120
NEUTRAL	1.5	**A-B**	209
		A-C	210
		B-C	210

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Location	EXTERIOR BY EXIT GATE
Component	TRANSFORMER TRN-4
IR File Name	FLIR2190
Picture File Name	FLIR2191
Date	WEDNESDAY October 30th
Image time	2:11 PM

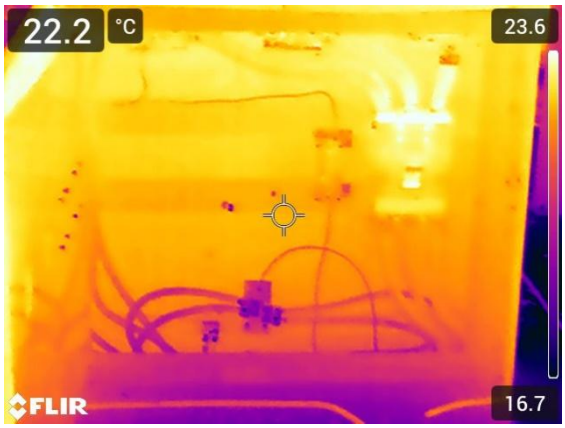




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Location	EXTERIOR BY EXIT GATE
Component	TAP BOX DP-PRN4A
IR File Name	FLIR2192
Picture File Name	FLIR2193
Date	WEDNESDAY October 30th
Image time	3:15 PM





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Location	EXTERIOR BY EXIT GATE
Component	TRANSFORMER TRN-4A
IR File Name	FLIR2194
Picture File Name	FLIR2195
Date	WEDNESDAY October 30th
Image time	3:38 PM

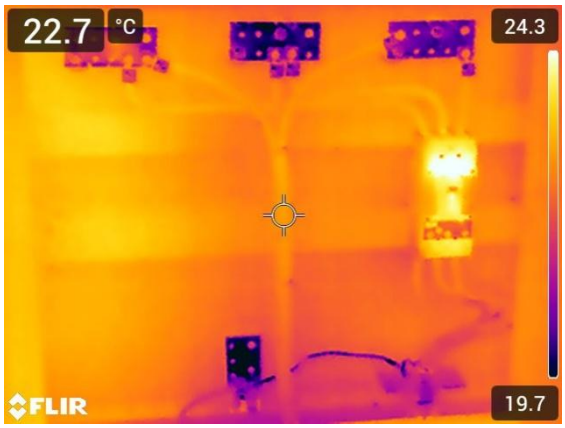




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Location	EXTERIOR BY EXIT GATE
Component	TAP BOX DP-PRN4
IR File Name	FLIR2196
Picture File Name	FLIR2197
Date	WEDNESDAY October 30th
Image time	4:02 PM





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Appendix C – Site Checklist

FF04

Line #	Tasks	Confirmation of Completion	Results/Notes
1	CDP-1A		
2	Refer to panel information sheet & perform visual testing for CDP-1A	☐	
3	Remove panel coverplate	☐	
4	Perform thermal scanning, record photo's for report	☐	
5	Refer to panel information sheet and perform panel testing	☐	
6	Trace and verify all down stream equipment	☐	
7			
8	*Confirm breaker ratings, SCCR ratings, Trip plug settings for the following:*		
9	MCB	☐	600A
10	Breaker 1	☐	100A 10KA
11	Breaker 2	☐	100A 10KA
12	Breaker 3	☐	100A 10KA
13	Breaker 4	☐	100A 10KA
14	Breaker 5	☐	100A 10KA
15	Breaker 6	☐	100A 10KA
16	Breaker 7	☐	100A 10KA
17	Breaker 8	☐	100A 10KA
18	Breaker 9	☐	100A 10KA
19	Breaker 10	☐	100A 10KA
20			
21	*Confirm the following wire sizes, number of cables per phase, & cable type (Cu/Al):*		
22	CDP-1A to BP-A	☐	#3 CU WIRE 1 WIRE PER PHASE
23	CDP-1A to BP-B	☐	#3 CU WIRE 1 WIRE PER PHASE
24	CDP-1A to BP-C	☐	#3 CU WIRE 1 WIRE PER PHASE
25	CDP-1A to BP-D	☐	#3 CU WIRE 1 WIRE PER PHASE
26	CDP-1A to BP-E	☐	#3 CU WIRE 1 WIRE PER PHASE
27	CDP-1A to BP-F	☐	#3 CU WIRE 1 WIRE PER PHASE
28	CDP-1A to BP-G	☐	#3 CU WIRE 1 WIRE PER PHASE
29	CDP-1A to BP-H	☐	#3 CU WIRE 1 WIRE PER PHASE
30	CDP-1A to BP-I	☐	#3 CU WIRE 1 WIRE PER PHASE
31	CDP-1A to BP-J	☐	#3 CU WIRE 1 WIRE PER PHASE
32			
33	*Confirm the following lengths of wire, conduit type, & conduit size:*		
34	CDP-1A to BP-A	☐	40' THROUGH 1 1/2" RIGID
35	CDP-1A to BP-B	☐	80' THROUGH 1 1/2" RIGID
36	CDP-1A to BP-C	☐	110' THROUGH 1 1/2" RIGID
37	CDP-1A to BP-D	☐	90' THROUGH 1 1/2" RIGID
38	CDP-1A to BP-E	☐	125' THROUGH 1 1/2"RIGID
39	CDP-1A to BP-F	☐	135' THROUGH 1 1/2" RIGID
40	CDP-1A to BP-G	☐	115' THROUGH 1 1/2" RIGID
41	CDP-1A to BP-H	☐	110' THROUGH 1 1/2" RIGID
42	CDP-1A to BP-I	☐	145' THROUGH 1 1/2" RIGID
43	CDP-1A to BP-J	☐	155' THROUGH 1 1/2" RIGID
44			
45	BP-A		
46	Refer to panel information sheet & perform visual testing for BP-A	☐	
47	Remove panel coverplate	☐	
48	Perform thermal scanning, record photo's for report	☐	
49	Refer to panel information sheet and perform panel testing	☐	
50	Confirm all breaker ratings	☐	10KA
51	Confirm all breaker SCCR ratings	☐	
52			
53	BP-B		
54	Refer to panel information sheet & perform visual testing for BP-B	☐	
55	Remove panel coverplate	☐	
56	Perform thermal scanning, record photo's for report	☐	
57	Refer to panel information sheet and perform panel testing	☐	

58	Confirm all breaker ratings	☐	10KA
59	Confirm all breaker SCCR ratings	☐	
60			
61	BP-C		
62	Refer to panel information sheet & perform visual testing for BP-C	☐	
63	Remove panel coverplate	☐	
64	Perform thermal scanning, record photo's for report	☐	
65	Refer to panel information sheet and perform panel testing	☐	
66	Confirm all breaker ratings	☐	10KA
67	Confirm all breaker SCCR ratings	☐	
68			
69	BP-D		
70	Refer to panel information sheet & perform visual testing for BP-D	☐	
71	Remove panel coverplate	☐	
72	Perform thermal scanning, record photo's for report	☐	
73	Refer to panel information sheet and perform panel testing	☐	
74	Confirm all breaker ratings	☐	10KA
75	Confirm all breaker SCCR ratings	☐	
76			
77	BP-E		
78	Refer to panel information sheet & perform visual testing for BP-E	☐	
79	Remove panel coverplate	☐	
80	Perform thermal scanning, record photo's for report	☐	
81	Refer to panel information sheet and perform panel testing	☐	
82	Confirm all breaker ratings	☐	10KA
83	Confirm all breaker SCCR ratings	☐	
84			
85	BP-F		
86	Refer to panel information sheet & perform visual testing for BP-F	☐	
87	Remove panel coverplate	☐	
88	Perform thermal scanning, record photo's for report	☐	
89	Refer to panel information sheet and perform panel testing	☐	
90	Confirm all breaker ratings	☐	10KA
91	Confirm all breaker SCCR ratings	☐	
92			
93	BP-G		
94	Refer to panel information sheet & perform visual testing for BP-F	☐	
95	Remove panel coverplate	☐	
96	Perform thermal scanning, record photo's for report	☐	
97	Refer to panel information sheet and perform panel testing	☐	
98	Confirm all breaker ratings	☐	10KA
99	Confirm all breaker SCCR ratings	☐	
100			
101	BP-H		
102	Refer to panel information sheet & perform visual testing for BP-H	☐	
103	Remove panel coverplate	☐	
104	Perform thermal scanning, record photo's for report	☐	
105	Refer to panel information sheet and perform panel testing	☐	
106	Confirm all breaker ratings	☐	10KA
107	Confirm all breaker SCCR ratings	☐	
108			
109	BP-I		
110	Refer to panel information sheet & perform visual testing for BP-H	☐	
111	Remove panel coverplate	☐	
112	Perform thermal scanning, record photo's for report	☐	
113	Refer to panel information sheet and perform panel testing	☐	
114	Confirm all breaker ratings	☐	10KA
115	Confirm all breaker SCCR ratings	☐	
116			
117	BP-J		
118	Refer to panel information sheet & perform visual testing for BP-H	☐	
119	Remove panel coverplate	☐	
120	Perform thermal scanning, record photo's for report	☐	
121	Refer to panel information sheet and perform panel testing	☐	
122	Confirm all breaker ratings	☐	10KA

123	Confirm all breaker SCCR ratings	☐	
124			
125	PANEL F		
126	Refer to panel information sheet & perform visual testing for CDP-1A	☐	
127	Remove panel coverplate	☐	
128	Perform thermal scanning, record photo's for report	☐	
129	Refer to panel information sheet and perform panel testing	☐	
130	Trace and verify all down stream equipment	☐	
131			
132	*Confirm breaker ratings, SCCR ratings, Trip plug settings for the following:*		
133	MCB	☐	250A 25KA
134	Breaker 1	☐	NA SPARE
135	Breaker 2	☐	250A 25KA UNUSED
136	Breaker 3	☐	60A 25KA
137	Breaker 4	☐	15A 14KA
138	Breaker 5	☐	15A 14KA
139	Breaker 6	☐	15A 14KA
140	Breaker 7	☐	15A 14KA
141	Breaker 8	☐	15A 14KA
142	Breaker 9	☐	40A 14KA
143	BREAKER 10		20A 14KA
144	*Confirm the following wire sizes, number of cables per phase, & cable type (Cu/Al):*	☐	
145	PANEL-F to DS (Air Supply Unit #3)	☐	#12 CU WIRE 1 WIRE PER PHASE
146	PANEL-F to DS (Air Supply Unit #2)	☐	#12 CU WIRE 1 WIRE PER PHASE
147	PANEL-F to DS (Air Compressor)	☐	#12 CU WIRE 1 WIRE PER PHASE
148	PANEL-F to DS (Dumb Waiter)	☐	#12 CU WIRE 1 WIRE PER PHASE
149	PANEL-F to DS (Air Condensing Unit #C-4)	☐	#8 CU WIRE 1 WIRE PER PHASE
150	PANEL-F to DS (Air Supply Unit #4)	☐	#12 CU WIRE 1 WIRE PER PHASE
151	PANEL-F to DS (Air Supply Unit #1)	☐	#12 CU WIRE 1 WIRE PER PHASE
152	PANEL-F to DS (Air Condition Conference Room)	☐	#6 CU WIRE 1 WIRE PER PHASE
153			
154	*Confirm the following lengths of wire, conduit type, & conduit size:*		
155	PANEL-F to DS (Air Supply Unit #3)	☐	200' THROUGH 1/2" EMT
156	PANEL-F to DS (Air Supply Unit #2)	☐	200' THROUGH 1/2" EMT
157	PANEL-F to DS (Air Compressor)	☐	200' THROUGH 1/2" EMT
158	PANEL-F to DS (Dumb Waiter)	☐	175' THROUGH 1" EMT
159	PANEL-F to DS (Air Condensing Unit #C-4)	☐	175' THROUGH 3/4" EMT
160	PANEL-F to DS (Air Supply Unit #4)	☐	20' THROUGH 1/2" EMT
161	PANEL-F to DS (Air Supply Unit #1)	☐	20' THROUGH 1/2" EMT
162	PANEL-F to DS (Air Condition Conference Room)	☐	175' THROUGH 1" EMT
163			
164	DS (Air Supply Unit #3) STARTER		
165	Confirm amperage rating	☐	600V
166	Confirm voltage rating	☐	15A
167	Remove cover plate	☐	
168	Perform thermal scanning, record photo's for report	☐	
169	Confirm if fused or unfused	☐	
170	Confirm fuse ratings (if applicable)	☐	
171	Confirm fuse type, series, & manufacturer	☐	BREAKER
172	Confirm SCCR rating	☐	14KA
173	Confirm wire size, number of cables per phase, & cable type (Cu/Al) from DS to Air Supply Unit #3	☐	#12 CU WIRE 1 WIRE PER PHASE 3 PHASE
174	Confirm wire length, conduit type, & conduit size from DS to Air Supply Unit #3	☐	1/2" EMT 30'
175			
176	DS (Air Supply Unit #2)		
177	Confirm amperage rating	☐	15A
178	Confirm voltage rating	☐	600V
179	Remove cover plate	☐	
180	Perform thermal scanning, record photo's for report	☐	
181	Confirm if fused or unfused	☐	BREAKER
182	Confirm fuse ratings (if applicable)	☐	

183	Confirm fuse type, series, & manufacturer	☐	
184	Confirm SCCR rating	☐	14KA
185	Confirm wire size, number of cables per phase, & cable type (Cu/Al) from DS to Air Supply Unit #2	☐	#12 CU WIRE 1 WIRE PER PHASE
186	Confirm wire length, conduit type, & conduit size from DS to Air Supply Unit #2	☐	10' THROUGH 1/2" EMT
187			
188	DS (Air Compressor) MECH ROOM BACK OF BUILDING		COMPRESSOR 442
189	Confirm amperage rating	☐	30A
190	Confirm voltage rating	☐	600V
191	Remove cover plate	☐	
192	Perform thermal scanning, record photo's for report	☐	POWER WAS OFF COULDN'T SCAN
193	Confirm if fused or unfused	☐	NOT FUSED
194	Confirm fuse ratings (if applicable)	☐	
195	Confirm fuse type, series, & manufacturer	☐	
196	Confirm SCCR rating	☐	
197	Confirm wire, number of cables per phase, & cable type (Cu/Al) size from DS to Air Compressor	☐	#12 CU WIRE 1 WIRE PER PHASE
198	Confirm wire length, conduit type, & conduit size from DS to Air Compressor	☐	10' THROUGH 1/2 EMT TRANSITION TO 1/2 LIQUID TIGHT
199			
200	DS (Dumb Waiter)		
201	Confirm amperage rating	☐	60A
202	Confirm voltage rating	☐	600V
203	Remove cover plate	☐	
204	Perform thermal scanning, record photo's for report	☐	
205	Confirm if fused or unfused	☐	FUSED
206	Confirm fuse ratings (if applicable)	☐	40A
207	Confirm fuse type, series, & manufacturer	☐	CAT 35103
208	Confirm SCCR rating	☐	
209	Confirm wire size, number of cables per phase, & cable type (Cu/Al) from DS to Dumb Waiter	☐	#6 CU WIRE 1 WIRE PER PHASE
210	Confirm wire length, conduit type, & conduit size from DS to Dumb Waiter	☐	10' THROUGH 1" LIQUID TIGHT FLEX
211			
212	DS (Air Condensing Unit #C-4) 431		MECH ROOM NORTH EAST
213	Confirm amperage rating	☐	60A 50HP
214	Confirm voltage rating	☐	600V
215	Remove cover plate	☐	
216	Perform thermal scanning, record photo's for report	☐	
217	Confirm if fused or unfused	☐	FUSED
218	Confirm fuse ratings (if applicable)	☐	30A
219	Confirm fuse type, series, & manufacturer	☐	GOULD SHAWMUTT TRI-ONIC TR5R-30 TD
220	Confirm SCCR rating	☐	HRC1-R 30A
221	Confirm wire size, number of cables per phase, & cable type (Cu/Al) from DS to Air Condensing Unit #C-4	☐	#12 CU WIRE 1 WIRE PER PHASE
222	Confirm wire length, conduit type, & conduit size from DS to Air Condensing Unit #C-4	☐	30' THROUGH 1" EMT
223			
224	DS (Air Supply Unit #4) MOTOR STARTER		
225	Confirm amperage rating	☐	20A
226	Confirm voltage rating	☐	600V
227	Remove cover plate	☐	
228	Perform thermal scanning, record photo's for report	☐	
229	Confirm if fused or unfused	☐	BREAKER
230	Confirm fuse ratings (if applicable)	☐	
231	Confirm fuse type, series, & manufacturer	☐	
232	Confirm SCCR rating	☐	UNMARKED
233	Confirm wire size, number of cables per phase, & cable type (Cu/Al) from DS to Air Supply Unit #4	☐	#12 CU WIRE 1 WIRE PER PHASE
234	Confirm wire length, conduit type, & conduit size from DS to Air Supply Unit #4	☐	30' THROUGH 1/2" EMT
235			
236	DS (Air Supply Unit #1) MOTOR STARTER		
237	Confirm amperage rating	☐	15A

238	Confirm voltage rating	☐	600V
239	Remove cover plate	☐	
240	Perform thermal scanning, record photo's for report	☐	
241	Confirm if fused or unfused	☐	BREAKER
242	Confirm fuse ratings (if applicable)	☐	
243	Confirm fuse type, series, & manufacturer	☐	
244	Confirm SCCR rating	☐	14KA
245	Confirm wire size, number of cables per phase, & cable type (Cu/Al) from DS to Air Supply Unit #1	☐	#12 CU WIRE 1 WIRE PER PHASE
246	Confirm wire length, conduit type, & conduit size from DS to Air Supply Unit #1	☐	30' THROUGH 1/2" EMT
247			
248	DS (Air Condition Conference Room) MECH ROOM 10		
249	Confirm amperage rating	☐	100A
250	Confirm voltage rating	☐	600V
251	Remove cover plate	☐	
252	Perform thermal scanning, record photo's for report	☐	
253	Confirm if fused or unfused	☐	BREAKER
254	Confirm fuse ratings (if applicable)	☐	
255	Confirm fuse type, series, & manufacturer	☐	NOT MARKED
256	Confirm SCCR rating	☐	
257	Confirm wire size, number of cables per phase, & cable type (Cu/Al) from DS to Air Condition Conference Room	☐	#8 CU WIRE 1 WIRE PER PHASE
258	Confirm wire length, conduit type, & conduit size from DS to Air Condition Conference Room	☐	30' THROUGH 1" RIGID
259			
260	Equipment/General		
261	Confirm HP rating for Air Supply Unit #1	☐	5HP
262	Confirm HP rating for Air Supply Unit #2	☐	5HP
263	Confirm HP rating for Air Supply Unit #3	☐	5HP
264	Confirm HP rating for Air Supply Unit #4	☐	5HP
265	Confirm HP rating for Air Compressor	☐	
266	Confirm HP rating for Dumb Waiter	☐	
267	Confirm HP rating for Air Conditioning Unit #C-4	☐	
268	Confirm HP rating for Air Conditioning Conference Room	☐	NO RATING PLATE
269	Ensure all relays are located and captured	☐	
270	Measure current on all phases of any piece of equipment found to be anomalous during thermal scans	☐	

TRANSFORMERS USE BAYONET FUSES THAT ARE UNREADABLE WITHOUT DE-ENERGIZATION AND REMOVAL
WE WERE ADVISED BY EATON AND UTILITIES KINGSTON NOT TO TOUCH

Exterior Inspection

Line #	Tasks	Confirmation of Completion	Results/Notes
1	HV Switchgear		
2	*Confirm the following wire sizes, number of cables per phase, & cable type (Cu/Al):*		
3	Incoming service 1 CABLE IN 3 DIFFERENT CONDUITS	☐	500 MCM 15KV CABLE 1 WIRE PER PHASE
4	Feeder P1 to TRN 1	☐	1/0, 5 KV CABLE 1 WIRE PER PHASE
5	Feeder TRN 1 to TRN 2	☐	1/0, 5KV CABLE 1 WIRE PER PHASE
6	Feeder P2 to TRN 3	☐	1/0, 5 KV CABLE 1 WIRE PER PHASE
7	Feeder TRN 3 to TRN 4	☐	1/0, 5 KV CABLE 1 WIRE PER PHASE
8	Feeder TRN 4 to TRN 4a	☐	1/0 5 KV CABLE 1 WIRE PER PHASE
9	Feeder TRN 4a to Sectionaliazing Switch	☐	1/0, 5KV CABLE 1 WIRE PER PHASE
10	Feeder TRN 2 to Sectionaliazing Switch	☐	1/0, 5KV CABLE 1 WIRE PER PHASE
11			
12	*Confirm the following lengths of wire, conduit type, & conduit size:*		
13	HV Switchgear to upstream equipment/location	☐	UNKNOWN
14	Feeder P1 to TRN 1	☐	40' THROUGH 4" DB2
15	Feeder TRN 1 to TRN 2	☐	375' THROUGH 4" DB2
16	Feeder P2 to ~~TRN 3~~ TRN4	☐	250' THROUGH 4" DB2
17	Feeder TRN 3 to TRN 4	☐	225' THROUGH 4" DB2
18	Feeder TRN 4 to TRN 4a	☐	20' THROUGH 4" DB2
19	Feeder TRN 4a to Sectionaliazing Switch	☐	300' THROUGH 4" DB2
20	Feeder TRN 2 to Sectionaliazing Switch	☐	500' THROUGH 4" DB2
21			
22	Refer to panel information sheet & perform visual testing for HV Switchgear	☐	
23	Refer to panel information sheet & perform primary conductor testing	☐	
24	Confirm all upstream equipment from switchgear	☐	KINGSTON UTILITIES EQUIPMENT UNKNOWN
25	Confirm voltage rating	☐	4.76 KV
26	Confirm amperage rating	☐	600A
27	Confirm fuse ratings	☐	200A
28	Confirm fuse type, series, & manufacturers	☐	S&C ELECTRIC CANADA LTD.
29	Confirm fuse SCCR rating	☐	25000 A
30	Confirm main switch amperage rating	☐	200A
31	Confirm main switch SCCR rating	☐	25000A
32	Confirm feeder P1 amperage rating	☐	150A
33	Confirm feeder P1 SCCR rating	☐	25000A
34	Confirm feeder P2 amperage rating	☐	150A
35	Confirm feeder P2 SCCR rating	☐	25000A
36	Open incoming main feeder enclosure and perfrom thermal scanning, record photo's for report	☐	
37	Open main switch enclosure and perfrom thermal scanning, record photo's for report	☐	
38	Open metering enclosure and perform thermal scanning, record photo's for report	☐	
39	Open feeder P1 enclosure and perform thermal scanning, record photo's for report	☐	
40	Open feeder P2 enclosure and perform thermal scanning, record photo's for report	☐	
41			
42	TRN 01		
43	Refer to panel information sheet & perform visual testing for TRN 01	☐	
44	Refer to panel information sheet and perform transformer primary and secondary testing	☐	

92	Confirm primary voltage rating	☐	4160/2400V
93	Confirm secondary voltage rating	☐	347/600V
94	Confirm kVA rating	☐	225 KVA
95	Confirm winding configurations	☐	DELTA/ WYE
96	Confirm impedance rating & X/R ratio	☐	2.86%
97	Open TRN 03 enclosure and perform thermal scanning, record photo's for report	☐	
98	Confirm over current protection device	☐	BAYONET Fuses: UK advised not to touch
99	Confirm if FF03 & 08 is supplied by main tap at TRN 03 or if its fed from distribution panel PRN-3	☐	DP-PRN-3
100	Remove cover panel from PRN-3 and perform thermal scanning, record photo's for report	☐	
101	Confirm breaker ratings within PRN-3	☐	PANEL INFORMATION SHEETS
102	Confirm breaker SCCR ratings within PRN-3	☐	
103			
104	DP-PRN-3		
105	Refer to panel information sheet & perform visual testing for DP-PRN-3	☐	INFORMATION ON INFORMATION SHEETS
106	Remove panel coverplate	☐	
107	Perform thermal scanning, record photo's for report	☐	
108	Refer to panel information sheet and perform panel testing	☐	
109	Confirm all breaker ratings	☐	
110	Confirm all breaker SCCR ratings	☐	
111			
112	TRN 04		
113	Refer to panel information sheet & perform visual testing for TRN 01	☐	LABEL WAS NOT VISIBLE AS WEATHERED
114	Refer to panel information sheet and perform transformer primary and secondary testing	☐	
115	Confirm primary voltage rating	☐	
116	Confirm secondary voltage rating	☐	347/600V
117	Confirm kVA rating	☐	
118	Confirm winding configurations	☐	DELTA/ WYE
119	Confirm impedance rating & X/R ratio	☐	
120	Open TRN 04 enclosure and perform thermal scanning, record photo's for report	☐	
121	Confirm over current protection device	☐	Bayonet Fuses: advised by UK not to touch
122	Confirm if FF04 is supplied by main tap at TRN 03 or if its fed from distribution panel PRN-4	☐	DP-PRN-4
123	Remove cover panel from PRN-4 and perform thermal scanning, record photo's for report	☐	
124	Confirm breaker ratings within PRN-4	☐	
125	Confirm breaker SCCR ratings within PRN-4	☐	
126			
127	DP-PRN-4		
128	Refer to panel information sheet & perform visual testing for DP-PRN-4	☐	
129	Remove panel coverplate	☐	
130	Perform thermal scanning, record photo's for report	☐	
131	Refer to panel information sheet and perform panel testing	☐	
132	Confirm all breaker ratings	☐	
133	Confirm all breaker SCCR ratings	☐	
134			
135	TRN 04a		
136	Refer to panel information sheet & perform visual testing for TRN 01	☐	
137	Refer to panel information sheet and perform transformer primary and secondary testing	☐	
138	Confirm primary voltage rating	☐	4160/2400V
139	Confirm secondary voltage rating	☐	120/208V

140	Confirm kVA rating	☐	150 KVA
141	Confirm winding configurations	☐	DELTA/ WYE
142	Confirm impedance rating & X/R ratio	☐	
143	Open TRN 04a enclosure and perform thermal scanning, record photo's for report	☐	
144	Confirm over protection device	☐	
145	Confirm if FF04 is supplied by main tap at TRN 03 or if its fed from distribution panel PRN-4a	☐	DP-PRN-4a
146	Remove cover panel from PRN-4a and perform thermal scanning, record photo's for report	☐	
147	Confirm breaker ratings within PRN-4a	☐	
148	Confirm breaker SCCR ratings within PRN-4a	☐	
149			
150	DP-PRN-4a		
151	Refer to panel information sheet & perform visual testing for DP-PRN-4a	☐	REFER TO Panel Information Sheet
152	Remove panel coverplate	☐	
153	Perform thermal scanning, record photo's for report	☐	
154	Refer to panel information sheet and perform panel testing	☐	
155	Confirm all breaker ratings	☐	
156	Confirm all breaker SCCR ratings	☐	
157			
158	Switchgear FF10		
159	*Confirm the following wire sizes, number of cables per phase, & cable type (Cu/Al):*	☐	
160	Incoming service	☐	1/0 15KV CABLE CU 1 WIRE PER PHASE
161	Switchgear to TX FF10	☐	BUS BARS
162		☐	
163	*Confirm the following lengths of wire, conduit type, & conduit size:*	☐	
164	Incoming service	☐	50' THROUGH 3" DB2
165	Switchgear to TX FF10	☐	BUS BARS 40MM X 8MM CU
166			
	Refer to panel information sheet & perform visual testing for Switchgear FF10	☐	
	Refer to panel information sheet & perform primary conductor testing for Switchgear FF10	☐	
167	Confirm main switch rating	☐	4.8-5.5 KV
168	Confirm main switch SCCR rating	☐	60KA
169	Open switchgear enclosure and perform thermal scanning, record photo's for report	☐	
170	Confirm metering specifications	☐	
171	Confirm fuse ratings	☐	100E
172	Confirm fuse type, series, & manufacturers	☐	CAT.NO.130 150R4 4, 16KV, AMP 100E TCC 153-4
173	Confirm fuse SCCR rating	☐	
174			
175	TX FF10		
176	Confirm primary voltage rating	☐	4160V
177	Confirm secondary voltage rating	☐	347/600V
178	Confirm kVA rating	☐	600KVA
179	Confirm winding configurations	☐	DELTA/ WYE
180	Confirm impedance rating & X/R ratio	☐	5.8%
181	Open TX FF10 enclosure and perform thermal scanning, record photo's for report	☐	Connection cabinet not opened as not enough clearance to fence and seal cracked and broken
182	Confirm over current protection device	☐	100A FUSE IN MAIN SWITCHGEAR
183			
184	Sectionalizing Switch		
185	Is it Normally Closed or Normally Open?	☐	
186	Perform Thermal Scan	☐	
187			

Appendix D – Site Panel Information

Arc Flash Study Fort Frontenac – KN299976
Visual Inspection Sheet
388 Ontario St, Kingston, Ontario, K7K 2X9
IDEA #24549

NOTE: These sequences of operation and the test parameters are written to convey the general sequence of events and the expected minimum test parameters measured and testes. This testing document does not convey or attempt to convey the requirements for the contractor's safety program, lockout/tagout or compliance with the CSA Standard Z462 for Arc Flash and Low Voltage Safety. Safety procedures and protocols are the responsibility of the constructor to develop and implement.

PANEL INSPECTION NOTES:

1. Electrician to ensure interior pictures have been recorded for all panels within this inspection document. All recorded pictures are to be sent to IDEA Inc. alongside this completed document.
2. CEC violations inspection is to include the presence of any stored equipment obstructing all electrical equipment listed below.

FF04

Distribution Panel – CDP-1A:

Visual Testing

1.	Make/Model/Age of Equipment	Square D/HCM3691-6MCCU/
2.	Voltage Rating	600V
3.	Amperage Rating	600A
4.	Number of Circuits	48CCTS
5.	Phase (1/3)	3
6.	MLO or MCB	MCB
7.	MCB Rating (If Applicable)	600A
8.	Short Circuit Current Rating (kA)	
9.	Corrosion/Rust/Leaks Present?	NO
10.	Panel Location (Floor #, Room #)	MECHANICAL ROOM BY GATE
11.	Physical Damage Present?	NO
12.	Evidence of Moisture or Intrusions?	NO
13.	General Condition of Components	GOOD
14.	Bus Bar Condition	GOOD
15.	Verify Panel Labeling	GOOD
16.	Verify Panel Directories	PRESENT
17.	Condition of Cable Connections	GOOD
18.	CEC Violations Present?	NO
19.	Insulation Bushing at Entrance	YES
20.	Appropriate Anchoring Present?	YES
21.	Evidence of Arcing?	NONE
22.	Notes	grounding issue - no ground in service conduit neutral grounded to water pipe.

Panel Testing

1.	Voltage Phase A to Neutral	122
2.	Voltage Phase B to Neutral	122
3.	Voltage Phase C to Neutral	121
4.	Voltage Phase A to B	210.4
5.	Voltage Phase A to C	210.6
6.	Voltage Phase B to C	209.7
7.	Current Phase A	46.75
8.	Current Phase B	43.96
9.	Current Phase C	50.6
10.	Current on Neutral	0
11.	Current on Ground	
12.	Notes	

Distribution Panel – PANEL-F

Visual Testing

1.	Make/Model/Age of Equipment	Federal Pioneer/CDP/
2.	Voltage Rating	347/600V
3.	Amperage Rating	200A
4.	Number of Circuits	36CCTS
5.	Phase (1/3)	3
6.	MLO or MCB	MCB
7.	MCB Rating (If Applicable)	225A
8.	Short Circuit Current Rating (kA)	15KA
9.	Corrosion/Rust/Leaks Present?	NO
10.	Panel Location (Floor #, Room #)	MECHANICAL RM BY GATE
11.	Physical Damage Present?	NO
12.	Evidence of Moisture or Intrusions?	NO
13.	General Condition of Components	GOOD
14.	Bus Bar Condition	GOOD
15.	Verify Panel Labeling	PRESENT
16.	Verify Panel Directories	PRESENT
17.	Condition of Cable Connections	GOOD
18.	CEC Violations Present?	NONE
19.	Insulation Bushing at Entrance	YES
20.	Appropriate Anchoring Present?	YES
21.	Evidence of Arcing?	NONE
22.	Notes	

Panel Testing

1.	Voltage Phase A to Neutral	351
2.	Voltage Phase B to Neutral	351
3.	Voltage Phase C to Neutral	350
4.	Voltage Phase A to B	610
5.	Voltage Phase A to C	608
6.	Voltage Phase B to C	608
7.	Current Phase A	10
8.	Current Phase B	9.4
9.	Current Phase C	9
10.	Current on Neutral	
11.	Current on Ground	0
12.	Notes	

Branch Panel – BP-A:

Visual Testing

1.	Make/Model/Age of Equipment	Square D/QBL-442/
2.	Voltage Rating	120/240V
3.	Amperage Rating	225A
4.	Number of Circuits	42cct
5.	Phase (1/3)	3
6.	MLO or MCB	MLO
7.	MCB Rating (If Applicable)	
8.	Short Circuit Current Rating (kA)	
9.	Corrosion/Rust/Leaks Present?	NO
10.	Panel Location (Floor #, Room #)	MECHANICAL ROOM BESIDE GATE
11.	Physical Damage Present?	NO
12.	Evidence of Moisture or Intrusions?	NO
13.	General Condition of Components	GOOD
14.	Bus Bar Condition	GOOD
15.	Verify Panel Labeling	PRESENT
16.	Verify Panel Directories	PRESENT
17.	Condition of Cable Connections	GOOD
18.	CEC Violations Present?	Missing knockouts 1 1/4 and 3/4,
19.	Insulation Bushing at Entrance	YES
20.	Appropriate Anchoring Present?	YES
21.	Evidence of Arcing?	NONE
22.	Notes	needs a cleaning

Panel Testing

1.	Voltage Phase A to Neutral	122
2.	Voltage Phase B to Neutral	123
3.	Voltage Phase C to Neutral	122
4.	Voltage Phase A to B	212
5.	Voltage Phase A to C	212
6.	Voltage Phase B to C	213
7.	Current Phase A	5.4
8.	Current Phase B	4.9
9.	Current Phase C	7.7
10.	Current on Neutral	2.8
11.	Current on Ground	
12.	Notes	

Branch Panel – BP-B:

Visual Testing

1.	Make/Model/Age of Equipment	Square D/QBL-442/
2.	Voltage Rating	120/240V
3.	Amperage Rating	225A
4.	Number of Circuits	42cct
5.	Phase (1/3)	3
6.	MLO or MCB	MLO
7.	MCB Rating (If Applicable)	
8.	Short Circuit Current Rating (kA)	
9.	Corrosion/Rust/Leaks Present?	NO
10.	Panel Location (Floor #, Room #)	LIBRARY NEXT TO JANITORS CLOSET
11.	Physical Damage Present?	NO
12.	Evidence of Moisture or Intrusions?	NO
13.	General Condition of Components	GOOD, BENT NEUTRAL LUG
14.	Bus Bar Condition	GOOD
15.	Verify Panel Labeling	GOOD
16.	Verify Panel Directories	PRESENT
17.	Condition of Cable Connections	GOOD
18.	CEC Violations Present?	Conduit fill leaving panel
19.	Insulation Bushing at Entrance	YES
20.	Appropriate Anchoring Present?	YES
21.	Evidence of Arcing?	NONE
22.	Notes	CLEANING RECOMMEDED, BX TO BE TIED

Panel Testing

1.	Voltage Phase A to Neutral	120
2.	Voltage Phase B to Neutral	121
3.	Voltage Phase C to Neutral	121
4.	Voltage Phase A to B	210
5.	Voltage Phase A to C	210
6.	Voltage Phase B to C	211
7.	Current Phase A	1.4
8.	Current Phase B	3
9.	Current Phase C	3.5
10.	Current on Neutral	2.3
11.	Current on Ground	0
12.	Notes	

Branch Panel – BP-C:

Visual Testing

1. Make/Model/Age of Equipment	Square D/QBL-442/
2. Voltage Rating	120/240V
3. Amperage Rating	225A
4. Number of Circuits	42cct
5. Phase (1/3)	3
6. MLO or MCB	MLO
7. MCB Rating (If Applicable)	
8. Short Circuit Current Rating (kA)	
9. Corrosion/Rust/Leaks Present?	NO
10. Panel Location (Floor #, Room #)	Mech Room
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	NO
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	GOOD
16. Verify Panel Directories	PRESENT
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	CCT37, wire is short should be extended.
19. Insulation Bushing at Entrance	YES
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NONE
22. Notes	

Panel Testing

1. Voltage Phase A to Neutral	120
2. Voltage Phase B to Neutral	121
3. Voltage Phase C to Neutral	121
4. Voltage Phase A to B	210
5. Voltage Phase A to C	210
6. Voltage Phase B to C	211
7. Current Phase A	7.6
8. Current Phase B	4.6
9. Current Phase C	4
10. Current on Neutral	3.5
11. Current on Ground	0
12. Notes	

Branch Panel – BP-D:

Visual Testing

1. Make/Model/Age of Equipment	Square D/QBL-442/
2. Voltage Rating	120/240V
3. Amperage Rating	225A
4. Number of Circuits	42cct
5. Phase (1/3)	3
6. MLO or MCB	MLO
7. MCB Rating (If Applicable)	
8. Short Circuit Current Rating (kA)	
9. Corrosion/Rust/Leaks Present?	NO
10. Panel Location (Floor #, Room #)	HALL ROOM 118
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	NO
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	GOOD
16. Verify Panel Directories	PRESENT
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	NONE
19. Insulation Bushing at Entrance	YES
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NONE
22. Notes	Needs cleaning, missing screws in panel

Panel Testing

1. Voltage Phase A to Neutral	120
2. Voltage Phase B to Neutral	121
3. Voltage Phase C to Neutral	120
4. Voltage Phase A to B	201
5. Voltage Phase A to C	209
6. Voltage Phase B to C	210
7. Current Phase A	9.4
8. Current Phase B	6.9
9. Current Phase C	9.3
10. Current on Neutral	3.3
11. Current on Ground	0
12. Notes	

Branch Panel – BP-E:

Visual Testing

1. Make/Model/Age of Equipment	Square D/QBL-442/
2. Voltage Rating	120/240V
3. Amperage Rating	225A
4. Number of Circuits	42cct
5. Phase (1/3)	3
6. MLO or MCB	MLO
7. MCB Rating (If Applicable)	
8. Short Circuit Current Rating (kA)	
9. Corrosion/Rust/Leaks Present?	NO
10. Panel Location (Floor #, Room #)	1ST FLOOR 111A
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	NO
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	GOOD
16. Verify Panel Directories	PRESENT
17. Condition of Cable Connections	Feed cables stripped too long at connection points
18. CEC Violations Present?	Unused conduit not capped exiting the panel
19. Insulation Bushing at Entrance	YES
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NONE
22. Notes	

Panel Testing

1. Voltage Phase A to Neutral	120
2. Voltage Phase B to Neutral	121
3. Voltage Phase C to Neutral	120
4. Voltage Phase A to B	210
5. Voltage Phase A to C	209
6. Voltage Phase B to C	209
7. Current Phase A	1
8. Current Phase B	3.2
9. Current Phase C	4
10. Current on Neutral	4.5
11. Current on Ground	0
12. Notes	

Branch Panel – BP-F:

Visual Testing

1. Make/Model/Age of Equipment	Square D/QBL-442/
2. Voltage Rating	120/240V
3. Amperage Rating	225A
4. Number of Circuits	42cct
5. Phase (1/3)	3
6. MLO or MCB	MLO
7. MCB Rating (If Applicable)	
8. Short Circuit Current Rating (kA)	
9. Corrosion/Rust/Leaks Present?	NO
10. Panel Location (Floor #, Room #)	1ST FLOOR RM 106
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	NO
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	GOOD
16. Verify Panel Directories	PRESENT
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	Knockouts missing in panel
19. Insulation Bushing at Entrance	YES
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NONE
22. Notes	

Panel Testing

1. Voltage Phase A to Neutral	120
2. Voltage Phase B to Neutral	120
3. Voltage Phase C to Neutral	120
4. Voltage Phase A to B	210
5. Voltage Phase A to C	209
6. Voltage Phase B to C	210
7. Current Phase A	1.7
8. Current Phase B	2.2
9. Current Phase C	1.7
10. Current on Neutral	.7
11. Current on Ground	0
12. Notes	

Branch Panel – BP-G:

Visual Testing

1.	Make/Model/Age of Equipment	Square D/QBL-342/
2.	Voltage Rating	120/240V
3.	Amperage Rating	225A
4.	Number of Circuits	42cct
5.	Phase (1/3)	3
6.	MLO or MCB	MLO
7.	MCB Rating (If Applicable)	
8.	Short Circuit Current Rating (kA)	10KA
9.	Corrosion/Rust/Leaks Present?	NONE
10.	Panel Location (Floor #, Room #)	LEVEL 2 HALL
11.	Physical Damage Present?	NO
12.	Evidence of Moisture or Intrusions?	NO
13.	General Condition of Components	GOOD
14.	Bus Bar Condition	GOOD
15.	Verify Panel Labeling	GOOD
16.	Verify Panel Directories	PRESENT
17.	Condition of Cable Connections	GOOD
18.	CEC Violations Present?	5 unsupported raceways - 1 M working space
19.	Insulation Bushing at Entrance	YES
20.	Appropriate Anchoring Present?	GOOD
21.	Evidence of Arcing?	NONE
22.	Notes	

Panel Testing

1.	Voltage Phase A to Neutral	120
2.	Voltage Phase B to Neutral	121
3.	Voltage Phase C to Neutral	120
4.	Voltage Phase A to B	209
5.	Voltage Phase A to C	209
6.	Voltage Phase B to C	210
7.	Current Phase A	4.8
8.	Current Phase B	2.1
9.	Current Phase C	4.7
10.	Current on Neutral	3.6
11.	Current on Ground	0
12.	Notes	

Branch Panel – BP-H:

Visual Testing

1.	Make/Model/Age of Equipment	Square D/QBL-430/
2.	Voltage Rating	120/240V
3.	Amperage Rating	225A
4.	Number of Circuits	30cct + 30cct (double tub)
5.	Phase (1/3)	3
6.	MLO or MCB	MLO
7.	MCB Rating (If Applicable)	
8.	Short Circuit Current Rating (kA)	10KA
9.	Corrosion/Rust/Leaks Present?	NO
10.	Panel Location (Floor #, Room #)	2ND FLOOR HALL BESIDE 212B
11.	Physical Damage Present?	NO
12.	Evidence of Moisture or Intrusions?	NO
13.	General Condition of Components	GOOD
14.	Bus Bar Condition	GOOD
15.	Verify Panel Labeling	GOOD
16.	Verify Panel Directories	PRESENT
17.	Condition of Cable Connections	GOOD
18.	CEC Violations Present?	Uncapped raceway, missing knockouts in panel
19.	Insulation Bushing at Entrance	GOOD
20.	Appropriate Anchoring Present?	GOOD
21.	Evidence of Arcing?	NONE
22.	Notes	

Panel Testing

1.	Voltage Phase A to Neutral	120
2.	Voltage Phase B to Neutral	121
3.	Voltage Phase C to Neutral	120
4.	Voltage Phase A to B	209
5.	Voltage Phase A to C	209
6.	Voltage Phase B to C	210
7.	Current Phase A	9.7
8.	Current Phase B	8.1
9.	Current Phase C	7
10.	Current on Neutral	3.4
11.	Current on Ground	.3
12.	Notes	

Branch Panel – BP-I:

Visual Testing

1. Make/Model/Age of Equipment	Square D/QBL-442/
2. Voltage Rating	120/240V
3. Amperage Rating	225A
4. Number of Circuits	42cct
5. Phase (1/3)	3
6. MLO or MCB	MLO
7. MCB Rating (If Applicable)	
8. Short Circuit Current Rating (kA)	10KA
9. Corrosion/Rust/Leaks Present?	NO
10. Panel Location (Floor #, Room #)	3RD FLOOR OUTSIDE 321
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	NO
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	GOOD
16. Verify Panel Directories	PRESENT
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	NO
19. Insulation Bushing at Entrance	YES
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NONE
22. Notes	Vacuum as bottom of panel is full of plaster

Panel Testing

1. Voltage Phase A to Neutral	120
2. Voltage Phase B to Neutral	121
3. Voltage Phase C to Neutral	120
4. Voltage Phase A to B	209
5. Voltage Phase A to C	209
6. Voltage Phase B to C	210
7. Current Phase A	5.4
8. Current Phase B	4.3
9. Current Phase C	4.7
10. Current on Neutral	2.3
11. Current on Ground	0
12. Notes	

Panel found, not on survey
cannot find where fed from

Branch Panel – BP-J:

Visual Testing

1. Make/Model/Age of Equipment	Square D/QBL-442/	Square D QOC20V100C
2. Voltage Rating	120/240V	120/240 V
3. Amperage Rating	225A	125A
4. Number of Circuits	42cct	20CCT
5. Phase (1/3)	3	1
6. MLO or MCB	MLO	
7. MCB Rating (If Applicable)		
8. Short Circuit Current Rating (kA)	10KA	
9. Corrosion/Rust/Leaks Present?	NO	NO
10. Panel Location (Floor #, Room #)		CACSC Supply room next to Mech room north east
11. Physical Damage Present?	NO	NO
12. Evidence of Moisture or Intrusions?	NO	NO
13. General Condition of Components	GOOD	GOOD
14. Bus Bar Condition	GOOD	GOOD
15. Verify Panel Labeling	GOOD	GOOD
16. Verify Panel Directories	PRESENT	PRESENT
17. Condition of Cable Connections	GOOD	GOOD
18. CEC Violations Present?	NO	NO
19. Insulation Bushing at Entrance	YES	NO
20. Appropriate Anchoring Present?	YES	YES
21. Evidence of Arcing?	NONE	NONE
22. Notes	VACUUM	Feed with 3/4 EMT #10 cu wire

Panel Testing

1. Voltage Phase A to Neutral	120	121
2. Voltage Phase B to Neutral	121	120
3. Voltage Phase C to Neutral	120	
4. Voltage Phase A to B	209	210
5. Voltage Phase A to C	210	
6. Voltage Phase B to C	210	
7. Current Phase A	.3	0
8. Current Phase B	1.4	0
9. Current Phase C	.3	
10. Current on Neutral	1.5	0
11. Current on Ground	.2	
12. Notes		

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Transformer – TRN-4:

Visual Testing

1. Make/Model/Age of Equipment	NO LABEL
2. Voltage Rating	NO LABEL
3. Amperage Rating	NO LABEL
4. Number of Circuits	
5. Phase (1/3)	3
6. MLO or MCB	
7. MCB Rating (If Applicable)	
8. Short Circuit Current Rating (kA)	
9. Corrosion/Rust/Leaks Present?	RUST ON ENCLOSURE
10. Panel Location (Floor #, Room #)	GATE BEHIND FF04
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	MINOR MOISTURE
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	NA
16. Verify Panel Directories	NA
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	NO
19. Insulation Bushing at Entrance	NO
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NONE
22. Notes	Rubber gasket should be replaced

Transformer Testing (Primary)

1. Voltage Phase A to B	NO VOLTAGE DUE TO HIGH VOLTAGE TERMINATIONS
2. Voltage Phase A to C	
3. Voltage Phase B to C	
4. Current Phase A	
5. Current Phase B	
6. Current Phase C	
7. Current on Ground	
8. Notes	

Transformer Testing (Secondary)

1. Voltage Phase A to Neutral	347
2. Voltage Phase B to Neutral	350
3. Voltage Phase C to Neutral	346
4. Voltage Phase A to B	608
5. Voltage Phase A to C	605
6. Voltage Phase B to C	606
7. Current Phase A	9.7
8. Current Phase B	9.4
9. Current Phase C	9.3
10. Current on Neutral	
11. Current on Ground	
12. Notes	

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Distribution Panel – DP-PRN-4:

Visual Testing

1. Make/Model/Age of Equipment	no label
2. Voltage Rating	no label
3. Amperage Rating	no label
4. Number of Circuits	4 breaker locations
5. Phase (1/3)	3
6. MLO or MCB	MLO
7. MCB Rating (If Applicable)	BREAKER FEEDING F PNL
8. Short Circuit Current Rating (kA)	14KA
9. Corrosion/Rust/Leaks Present?	RUST ON ENCLOSURE DOOR
10. Panel Location (Floor #, Room #)	BEHIND FF04 BY GATE
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	MINOR MOISTURE ON DOOR
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	NA
16. Verify Panel Directories	NA
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	NO
19. Insulation Bushing at Entrance	NO
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NONE
22. Notes	Rubber seal should be replaced

Panel Testing

1. Voltage Phase A to Neutral	355.2
2. Voltage Phase B to Neutral	356.4
3. Voltage Phase C to Neutral	354.2
4. Voltage Phase A to B	616.5
5. Voltage Phase A to C	614.5
6. Voltage Phase B to C	614.5
7. Current Phase A	6.2
8. Current Phase B	9
9. Current Phase C	9.5
10. Current on Neutral	
11. Current on Ground	.5
12. Notes	

MFG SEPT-95

Transformer – TRN-4a:

Visual Testing

1. Make/Model/Age of Equipment	
2. Voltage Rating	4160V 120/208V
3. Amperage Rating	
4. Number of Circuits	NA
5. Phase (1/3)	3
6. MLO or MCB	
7. MCB Rating (If Applicable)	
8. Short Circuit Current Rating (kA)	
9. Corrosion/Rust/Leaks Present?	MINOR
10. Panel Location (Floor #, Room #)	BEHIND FF04 BY GATE
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	MINOR
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	NA
16. Verify Panel Directories	NA
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	NO
19. Insulation Bushing at Entrance	NO
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NO
22. Notes	Tap changer set to 3

Transformer Testing (Primary)

1. Voltage Phase A to B	NO VOLTAGE DUE TO HIGH VOLTAGE TERMINATIONS
2. Voltage Phase A to C	
3. Voltage Phase B to C	
4. Current Phase A	
5. Current Phase B	
6. Current Phase C	
7. Current on Ground	
8. Notes	

Transformer Testing (Secondary)

1.	Voltage Phase A to Neutral	122.6
2.	Voltage Phase B to Neutral	122.7
3.	Voltage Phase C to Neutral	122.6
4.	Voltage Phase A to B	212
5.	Voltage Phase A to C	212
6.	Voltage Phase B to C	212.5
7.	Current Phase A	39.5
8.	Current Phase B	33.1
9.	Current Phase C	18.3
10.	Current on Neutral	12.2
11.	Current on Ground	2.7
12.	Notes	

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Distribution Panel – DP-PRN-4a:

Visual Testing

1. Make/Model/Age of Equipment	no markings	
2. Voltage Rating	no marking	
3. Amperage Rating	NO RATING PLATE	
4. Number of Circuits	SPACE FOR 4 BREAKERS	
5. Phase (1/3)	3 PHASE 4 WIRE	
6. MLO or MCB	Breaker Feeder CD1 main Federal pioneer Horizon m:csm3600 EF 600A	GATE BREAKER 20A CUTLER HAMMER FDB 18KA@240VAC
7. MCB Rating (If Applicable)		
8. Short Circuit Current Rating (kA)	65KA @ 240V	
9. Corrosion/Rust/Leaks Present?	RUSTY ENCLOSURE TOP IS BAD	
10. Panel Location (Floor #, Room #)	BEHIND FF04 BY GATE	
11. Physical Damage Present?	TOP OF ENCLOSURE DAMAGED	
12. Evidence of Moisture or Intrusions?	YES	
13. General Condition of Components	OK	
14. Bus Bar Condition	GOOD	
15. Verify Panel Labeling	GOOD	
16. Verify Panel Directories	GOOD	
17. Condition of Cable Connections	CABLE TERMINATIONS NEED PENETROX	
18. CEC Violations Present?	NO	
19. Insulation Bushing at Entrance	NA	
20. Appropriate Anchoring Present?	YES	
21. Evidence of Arcing?	NONE	
22. Notes	Gate fed through transformer pit	

Panel Testing

1. Voltage Phase A to Neutral	122
2. Voltage Phase B to Neutral	122
3. Voltage Phase C to Neutral	122
4. Voltage Phase A to B	211
5. Voltage Phase A to C	211
6. Voltage Phase B to C	212
7. Current Phase A	16.7
8. Current Phase B	31.2
9. Current Phase C	24.9
10. Current on Neutral	9.1
11. Current on Ground	
12. Notes	

Main High Voltage Switch Gear at TRN1 Location:

Visual Testing

1. Make/Model/Age of Equipment	S&C ELECTRIC CANADA LTD.
2. Voltage Rating	4.76 KV
3. Amperage Rating	600
4. Number of Circuits	
5. Phase (1/3)	3
6. MLO or MCB	FUSED
7. MCB Rating (If Applicable)	FUSED AT 200A FUSES ARE SMU-40 S&C ELECTRIC FUSES
8. Short Circuit Current Rating (kA)	25KA STANDARD SPEED FUSES
9. Corrosion/Rust/Leaks Present?	RUST ON INTERIOR OF DOOR MAIN SWITCH, SW1 AND SW2
10. Panel Location (Floor #, Room #)	OUTSIDE BEHIND FF05
11. Physical Damage Present?	NO
12. Evidence of Moisture or Intrusions?	MINOR RUST AT REAR VENT
13. General Condition of Components	GOOD
14. Bus Bar Condition	GOOD
15. Verify Panel Labeling	GOOD
16. Verify Panel Directories	YES
17. Condition of Cable Connections	GOOD
18. CEC Violations Present?	NO
19. Insulation Bushing at Entrance	NO
20. Appropriate Anchoring Present?	YES
21. Evidence of Arcing?	NO
22. Notes	

SW1
FUSED AT 150 E
SW2
FUSED AT 150 E

FUSES ARE THE SAME
S&C ELECTRIC CANADA
KV NOMINAL 4.8
KV NOMINAL 5.5
AMPS INT 25,000
STANDARD SPEED
TCC 153-2

Primary Conductor Testing

1. Voltage Phase A to Neutral	NO VOLTAGE DUE TO KINGSTON UTILITIES SHUTDOWN
2. Voltage Phase B to Neutral	
3. Voltage Phase C to Neutral	
4. Voltage Phase A to B	
5. Voltage Phase A to C	
6. Voltage Phase B to C	
7. Current Phase A	
8. Current Phase B	
9. Current Phase C	
10. Current on Neutral	
11. Current on Ground	
12. Notes	

Appendix E – Kingston Utilities Information

Short Circuit Study Report

Service Address: 317 St, Kingston, Ontario

Study Location: Primary side of the transformer for 317 Ontario St.

Date: September 12, 2024

Max. Short-circuit Info.

LLL,Amp	LLG,Amp	LL,Amp	LG,Amp
13242	11920	11499	7720
R1, ohm	X1,ohm	R0,ohm	X0,ohm
0.0336	0.1875	0.0773	0.5954

Min. Short-circuit Info.

LLL,Amp	LLG,Amp	LL,Amp	LG,Amp
2256	2242	1954	1786
R1, ohm	X1,ohm	R0,ohm	X0,ohm
0.5000	0.9517	0.3532	1.9399

This report was prepared by Utilities Kingston on behalf of Kingston Hydro for IDEA. The material in it reflects Utilities Kingston's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on decisions to be mad based on it, are the responsibility of such third parties, Utilities Kingston accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Appendix F – Arc Flash Labels

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**0.1**				
Arc Flash Boundary	**0.4**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-A** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**0.1**				
Arc Flash Boundary	**0.3**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-B** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**6.2**				
Arc Flash Boundary	**4.2**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-C** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**4.4**				
Arc Flash Boundary	**3.4**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-D** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**5.9**				
Arc Flash Boundary	**4.1**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-E** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**6.3**				
Arc Flash Boundary	**4.2**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-F** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**6.3**				
Arc Flash Boundary	**4.3**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-G** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**6.2**				
Arc Flash Boundary	**4.2**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-H** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**6.0**				
Arc Flash Boundary	**4.1**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-I** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**240**	**VAC**
Incident Energy in cal/cm²	**5.6**				
Arc Flash Boundary	**3.9**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **BP-J** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**36**	**in**	Shock Hazard when covers removed	**4160**	**VAC**
Incident Energy in cal/cm²	**0.3**				
Arc Flash Boundary	**1.4**	**ft**	Limited approach	**5.0**	**ft**
			Restricted approach	**2.2**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**1**	

Equipment: **BUS_HV-SG** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**36**	**in**	Shock Hazard when covers removed	**4160**	**VAC**
Incident Energy in cal/cm²	**0.4**				
Arc Flash Boundary	**1.5**	**ft**	Limited approach	**5.0**	**ft**
			Restricted approach	**2.2**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**1**	

Equipment: **BUS_TRN-4** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**36**	**in**	Shock Hazard when covers removed	**4160**	**VAC**
Incident Energy in cal/cm²	**0.4**				
Arc Flash Boundary	**1.4**	**ft**	Limited approach	**5.0**	**ft**
			Restricted approach	**2.2**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**1**	

Equipment: **BUS_TRN-4a** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**208**	**VAC**
Incident Energy in cal/cm²	**16.2**				
Arc Flash Boundary	**7.7**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **CDP-1A** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**600**	**VAC**
Incident Energy in cal/cm²	**10.2**		Limited approach	**3.5**	**ft**
Arc Flash Boundary	**5.7**	**ft**	Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**0**	

Equipment: **DP-PRN-4** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when covers removed	**208**	**VAC**
Incident Energy in cal/cm²	**20.9**		Limited approach	**3.5**	**ft**
Arc Flash Boundary	**9.0**	**ft**	Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**00**	

Equipment: **DP-PRN-4a** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Arc Flash and Shock Hazard Present

ARC FLASH PROTECTION			SHOCK PROTECTION		
Working Distance	**18**	**in**	Shock Hazard when		
Incident Energy in cal/cm²	**0.1**		covers removed	**600**	**VAC**
Arc Flash Boundary	**0.3**	**ft**	Limited approach	**3.5**	**ft**
			Restricted approach	**1.0**	**ft**
Refer to CSA Z462 for PPE requirements			Gloves class	**0**	

Equipment: **PANEL-F** 03-10-2025 Std. IEEE 1584

Arc Flash Analysis by: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**0.1**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**0.4**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-A** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**0.1**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**0.3**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-B** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**6.2**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**4.2**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-C** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**4.4**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**3.4**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-D** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**5.9**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**4.1**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-E** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**6.3**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**4.2**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-F** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**6.3**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**4.3**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-G** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**6.2**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**4.2**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-H** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**6.0**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**4.1**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-I** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**5.6**		couvercles enlevés	**240**	**VAC**
Périmètre d’éclats d’arcs	**3.9**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **BP-J** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**36**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**0.3**		couvercles enlevés	**4160**	**VAC**
Périmètre d’éclats d’arcs	**1.4**	**ft**	Périmètre d’accès limite	**5.0**	**ft**
			Périmètre d’accès restreint	**2.2**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**1**	

Équipement: **BUS_HV-SG** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**36**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**0.4**		couvercles enlevés	**4160**	**VAC**
Périmètre d’éclats d’arcs	**1.5**	**ft**	Périmètre d’accès limite	**5.0**	**ft**
			Périmètre d’accès restreint	**2.2**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**1**	

Équipement: **BUS_TRN-4** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**36**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**0.4**		couvercles enlevés	**4160**	**VAC**
Périmètre d’éclats d’arcs	**1.4**	**ft**	Périmètre d’accès limite	**5.0**	**ft**
			Périmètre d’accès restreint	**2.2**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**1**	

Équipement: **BUS_TRN-4a** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**16.2**		couvercles enlevés	**208**	**VAC**
Périmètre d’éclats d’arcs	**7.7**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **CDP-1A** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand couvercles enlevés	**600**	**VAC**
Énergie incidente cal/cm²	**10.2**		Périmètre d’accès limite	**3.5**	**ft**
Périmètre d’éclats d’arcs	**5.7**	**ft**	Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**0**	

Équipement: **DP-PRN-4** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand couvercles enlevés	**208**	**VAC**
Énergie incidente cal/cm²	**20.9**		Périmètre d’accès limite	**3.5**	**ft**
Périmètre d’éclats d’arcs	**9.0**	**ft**	Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**00**	

Équipement: **DP-PRN-4a** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Risque d’éclats d’arcs et de choc électrique ÉPI approprié requis

PROTECTION D’ÉCLATS D’ARCS			PROTECTION DE CHOC ÉLECTRIQUE		
Distance de travail	**18**	**in**	Choc électrique quand		
Énergie incidente cal/cm²	**0.1**		couvercles enlevés	**600**	**VAC**
Périmètre d’éclats d’arcs	**0.3**	**ft**	Périmètre d’accès limite	**3.5**	**ft**
			Périmètre d’accès restreint	**1.0**	**ft**
Se référer à Z462 pour ÉPI approprié requis			Classe de gants	**0**	

Équipement: **PANEL-F** 03-09-2025 Std. IEEE 1584

Étude d’éclats d’arcs par: IDEA Inc. File: 24549 - DCC Arc Flash - FF04

Appendix G – Cost Estimate

Project: **Arc Flash Study Fort Frontenac - KN229976** Date: 14-Mar-25

Phase **Class D Budget Cost Estimate - Building FF04** File Ref: 24549

SECTIONAL COST SUMMARY

Group Item	Element	Element Subtotal	Subtotal	-20.00%	20.00%
1	**TRN-4**		**$ 3,300**	**$ 2,640.0**	**$ 3,960.0**
1.1	Tag transformer to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the Transformer.	$ -			
1.2	Provide new door gasket	$ 300		$ 240.0	$ 360.0
1.3	Replace bay-o-net and CLF fuses	$ 3,000		$ 2,400.0	$ 3,600.0
2	**TRN-4a**		**$ 3,000**	**$ 2,400.0**	**$ 3,600.0**
2.1	Tag transformer to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the Transformer.	$ -		$ -	$ -
2.2	Replace bay-o-net and CLF fuses	$ 3,000		$ 2,400.0	$ 3,600.0
3	**DP-PRN-4**		**$ 40,300**	**$ 32,240.0**	**$ 48,360.0**
3.1	Tag panel to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the panel.	$ -		$ -	$ -
3.2	Provide new door gasket	$ 300		$ 240.0	$ 360.0
3.3	Replace panel	$ 40,000		$ 32,000.0	$ 48,000.0
4	**DP-PRN-4a**		**$ 41,060**	**$ 32,848.0**	**$ 49,272.0**
4.1	Tag panel to be monitored and perform thermal scan every one to two years. Moisture and rust can cause faulty connections within the panel.	$ -		$ -	$ -
4.2	Apply penetrox to cable terminations	$ 650		$ 520.0	$ 780.0
4.3	Install lamacoid with panel information	$ 150		$ 120.0	$ 180.0
4.4	Revise instantaneous trip rating of braeker CB-CDP-1A from 5 to 10	$ 260		$ 208.0	$ 312.0
4.5	Replace panel	$ 40,000		$ 32,000.0	$ 48,000.0
5	**Panel CDP-1A**		**$ 15,000**	**$ 12,000.0**	**$ 18,000.0**
5.1	Install grounded conductor from building service to main distribution panel in accordance with CEC section 10.	$ 1,000		$ 800.0	$ 1,200.0
5.2	Replace main breaker from MH to MGL type to apply series rating with branch breakers	$ 14,000		$ 11,200.0	$ 16,800.0
6	**Panel BP-A**		**$ 300**	**$ 240.0**	**$ 360.0**
6.1	Install knockout covers	$ 150		$ 120.0	$ 180.0
6.2	Perform panel clean	$ 150		$ 120.0	$ 180.0
7	**Panel BP-B**		**$ 1,470**	**$ 1,176.0**	**$ 1,764.0**
7.1	Provide new neutral lug for panel	$ 570		$ 456.0	$ 684.0
7.2	Conduit fill leaving panel exceeds CEC. Install additional conduits or upsize the conduit to suit the cables installed in the existing conduit.	$ 450		$ 360.0	$ 540.0
7.3	Perform panel clean	$ 150		$ 120.0	$ 180.0
7.4	Provide strapping to properly support conduits leaving panel	$ 300		$ 240.0	$ 360.0
8	**Panel BP-C**		**$ 300**	**$ 240.0**	**$ 360.0**
8.1	Extend wiring of circuit 37	$ 300		$ 240.0	$ 360.0
9	**Panel BP-D**		**$ 300**	**$ 240.0**	**$ 360.0**
9.1	Provide new screws for panel cover	$ 150		$ 120.0	$ 180.0
9.2	Perform panel clean	$ 150		$ 120.0	$ 180.0
10	**Panel BP-E**		**$ 450**	**$ 360.0**	**$ 540.0**
10.1	Trim feeder cables to reduce amount of exposed wire.	$ 300		$ 240.0	$ 360.0
10.2	Cap un-used conduit leaving panel	$ 150		$ 120.0	$ 180.0
11	**Panel BP-F**		**$ 150**	**$ 120.0**	**$ 180.0**
11.1	Install knockout covers	$ 150		$ 120.0	$ 180.0

Project: **Arc Flash Study Fort Frontenac - KN229976** Date: 14-Mar-25

Phase **Class D Budget Cost Estimate - Building FF04** File Ref: 24549

SECTIONAL COST SUMMARY

Group Item	Element	Element Subtotal	Subtotal	-20.00%	20.00%
12	**Panel BP-G**		**$ 300**	**$ 240.0**	**$ 360.0**
12.1	Provide strapping to properly support conduits leaving panel	$ 300		$ 240.0	$ 360.0
12.2	Remove owner equipment infront of panel	$ -			
13	**Panel BP-H**		**$ 300**	**$ 240.0**	**$ 360.0**
13.1	Install knockout covers	$ 150		$ 120.0	$ 180.0
13.2	Cap un-used conduit leaving panel	$ 150		$ 120.0	$ 180.0
14	**Panel BP-I**		**$ 150**	**$ 120.0**	**$ 180.0**
14.1	Perform panel clean	$ 150		$ 120.0	$ 180.0
15	**Panel BP-J**		**$ 150**	**$ 120.0**	**$ 180.0**
15.1	Perform panel clean	$ 150		$ 120.0	$ 180.0
16	**Panel F**		**$ 7,500**	**$ 6,000.0**	**$ 9,000.0**
16.1	Replace main breaker with 200A breaker	$ 7,500		$ 6,000.0	$ 9,000.0
17	**General Building**		**$ 150**	**$ 120.0**	**$ 180.0**
17.1	Print and frame Single Line Diagram as required by CEC.	$ 150		$ 120.0	$ 180.0
	TOTAL BUDGET ESTIMATE		**$ 114,180** (+/- 20%)	$91,344	$137,016

Note: The above estimates are exclusive of the following:

Professional Design Fees

Hydro utility company charges and levies

US / Canada Tarrifs