The following changes in the tender documents are effective immediately. This addendum will form part of the contract documents.

DRAWINGS

1. **Refer to Drawing E-000 RB:**

   .1 Revise General Project Note ‘1’ as indicated.

2. **Refer to Drawing E-001 RA:**

   .1 Clarify breaker size of new main breaker for PMT6-SDC as indicated.
   .2 Update Single Line Reference Note ‘1’ as indicated.

3. **Refer to Drawing E-100 RB:**

   .1 Add a relay to trip the 15kV breaker for PMT-115 as indicated.
   .2 Update Single Line Reference Note ‘4’ as indicated.

4. **Refer to Drawing E-104 RB:**

   .1 Add relays to trip the 15kV breakers as indicated.
   .2 Clarify reference note number for the secondary side of the 225kVA transformer as shown.
   .3 Update Single Line Reference Note ‘2’ as indicated.

5. **Refer to Drawing E-106 RB:**

   .1 Add a relay to trip the 15kV breaker for the feeder to PMT-WWTP as indicated.
   .2 Update Single Line Reference Note ‘2’ as indicated.

6. **Refer to Drawing E-401 RB:**

   .1 Delete the splice in manhole no. 1.
   .2 Add keynote ‘7’ about existing padmount switchgear details as indicated.
   .3 Revise single line diagram keynote #6 as shown.
   .4 Add keynote ‘8’ about relay settings in existing padmount switchgear.
   .5 Clarify feeder to single phase PMTs to align with Drawing E-002.

7. **Refer to Drawing E-402 RB:**

   .1 Revise keynote ‘1’ as indicated to align with other drawings in package.
   .2 Update US-103 and US-105 as indicated to align with other drawings in package.

SPECIFICATIONS

1. **Section 26 05 14 – Power Cable and Terminations (1001V and over)**

    .1 Revise paragraph 2.2.1 to clarify terminations at BC Hydro point of connection.
    .2 Add paragraph 2.2.2 for terminations at locations other than BC Hydro point of connection.
    .3 Insert new paragraph 2.5 for terminations before section on “Primary bus bars and connections”. Shift numbering to suit.

2. **Section 26 05 73 – Coordination Study and Arc Flash Analysis**

    .1 Clarify paragraph 1.4.3, that project files, to be submitted at completion of the project, are to include the model and library files.
    .2 Add paragraph 2.1.3 and 2.1.4 to allow for multiple submissions based on selection of overcurrent protective devices, as indicated.
    .3 Adjust paragraph 3.1.1 as indicated.

3. **Section 26 11 13.01 – Unit Substation to 25kV**

    .1 Add related requirement Section 26 05 14 as shown.
    .2 Revise paragraph 2.2.1 to require that the system is to be capable of tripping overcurrent protective devices, and assemblies, within 25ms.
    .3 Revise paragraphs 2.3.1 and 2.3.2 as shown.

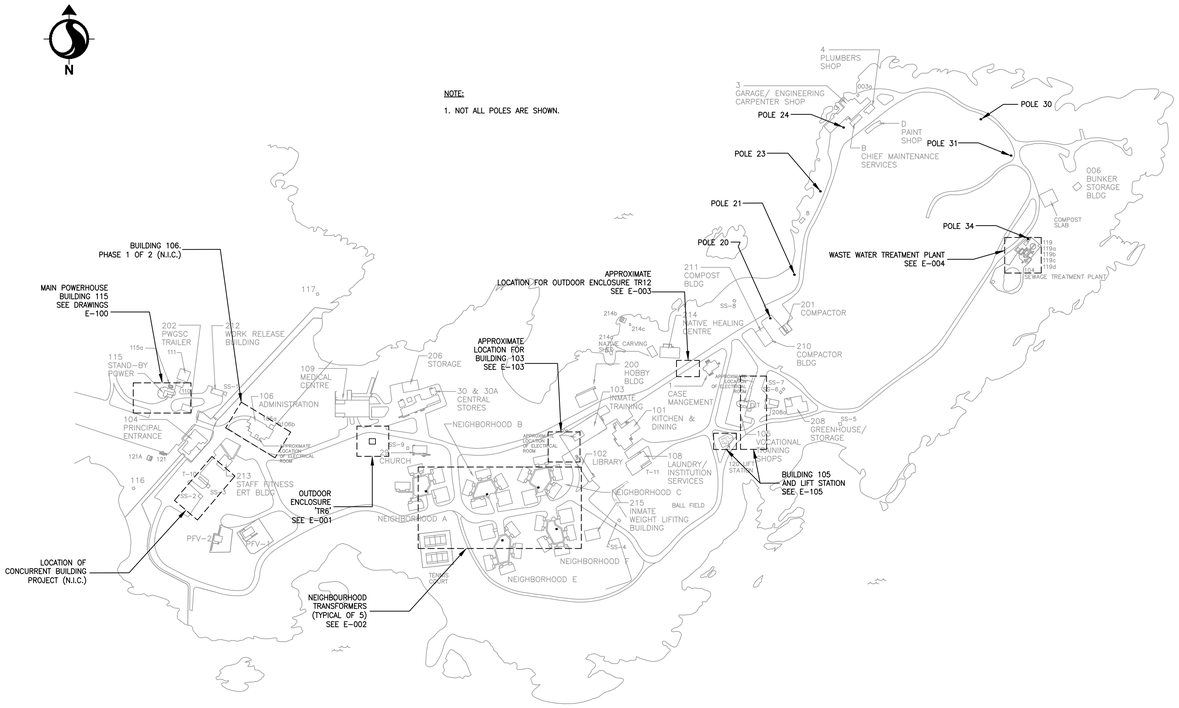
4. **Section 26 12 19 – Pad Mounted Liquid Filled Medium Voltage Transformers**

    .1 Add references ANSI/IEEE C62.11 and CAN/CSA-C2.1-06 as indicated.
    .2 Revise paragraphs 2.1.1 and 2.1.7 to include single phase transformer information.
    .3 Revise paragraph 2.1.3 for HV dead front operation.
    .4 Revise paragraph 2.1.9 for lightning arrester information.
    .5 Add new paragraph 2.1.13 for single phase transformer door and switchboard as shown.

5. **Section 26 24 13 – Switchboards**

    .1 Add 2.2.9 to require isolation of main breaker to branch breakers to prevent escalation of arc flash from feeder breakers to main supply terminations.

END OF ADDENDUM No. 3



1 SITE KEY PLAN
1:3000

DRAWING LIST	
E-000	KEY PLAN AND SYMBOL LEGEND
E-001	OUTDOOR ENCLOSURE TR6
E-002	NEIGHBOURHOODS 'A', 'B', 'C', 'E', 'F'
E-003	OUTDOOR ENCLOSURE TR12
E-004	WASTE WATER TREATMENT PLANT
E-100	MAIN POWER HOUSE (BLDG. 115) SINGLE LINE AND ELECTRICAL DETAILS
E-101	MAIN POWER HOUSE (BLDG. 115) DECONSTRUCTION PLAN
E-102	MAIN POWER HOUSE (BLDG. 115) FLOOR PLAN
E-103	BUILDING 103 – PARTIAL SITE AND FLOOR PLANS
E-104	BUILDING 103 – SINGLE LINE AND ELECTRICAL DETAILS
E-105	BUILDING 105 – PARTIAL SITE AND FLOOR PLANS
E-106	BUILDING 105 – SINGLE LINE AND ELECTRICAL DETAILS
E-200	ELECTRICAL DETAILS
E-201	ELECTRICAL DETAILS
E-202	UPDATED PARTIAL SITE PLAN: HIGH VOLTAGE FEEDER REPLACEMENT
E-203	MAIN POWER HOUSE (BLDG. 115) PHASING NOTES
E-204	BUILDING 103 PHASING NOTES
E-205	BUILDING 105 PHASING NOTES
E-206	WASTE WATER TREATMENT PLANT PHASING NOTES
E-400	EXISTING SITE SINGLE LINE DIAGRAM
E-401	SITE SINGLE LINE DIAGRAM – NEW (1 OF 2)
E-402	SITE SINGLE LINE DIAGRAM – NEW (2 OF 2)

GENERAL PROJECT NOTES:

B

1. PROVIDE SELECTIVELY COORDINATED OVERCURRENT PROTECTIVE DEVICES AND/OR RELAYS AS INDICATED ON DRAWINGS. RELAYS TO COME C/W TRIP SETTINGS FOR SELECTIVE COORDINATION UNDER NORMAL CONDITIONS, AND A SECOND GROUP OF TRIP SETTINGS TO INSTANTANEOUSLY TRIP DEVICES FOR MAINTENANCE OPERATIONS WITHIN 25ms.
2. PROVIDE NON-DESTRUCTION CABLE TESTING USING VERY LOW FREQUENCY METHOD FOR ALL PRIMARY FEEDERS THAT ARE PART OF THIS SCOPE OF WORK. PROVIDE TEST RESULTS TO DEPARTMENTAL REPRESENTATIVE.
3. PRIOR TO EXCAVATING, USE GROUND PENETRATING RADAR TO IDENTIFY ALL UNDERGROUND SERVICES THAT WILL BE AFFECTED BY THE WORK AND PROVIDE DIMENSIONED LAYOUT TO DEPARTMENTAL REPRESENTATIVE. CAREFULLY EXPOSE SERVICES BY HAND WHERE APPROPRIATE.
4. WHERE UNDERGROUND SERVICES ARE ENCOUNTERED DURING EXCAVATION FOR DUCTS, PRECAUTIONS ARE TO BE TAKEN TO MAINTAIN THESE SERVICES – PIPES, CABLES, ETC. – AND IF BROKEN DURING THE PROCESS, ARE TO BE REPAIRED UNDER THIS CONTRACTOR'S SCOPE OF WORK, TO THE SATISFACTION OF THE DEPARTMENTAL REPRESENTATIVE.
5. NO INSTALLED DUCTS IN TRENCHES TO BE LEFT OPEN OVERNIGHT. ALL OPEN TRENCHES IN ROADS SHALL BE COVERED WITH STEEL PLATES.
6. RESTORE ALL LANDSCAPING IN AFFECTED AREAS TO MATCH ORIGINAL LANDSCAPE CONDITIONS.
7. ALL NEW CIRCUIT BREAKERS, 200A OR GREATER, TO BE LSI ELECTRONIC TRIP CIRCUIT BREAKERS.
8. THE TRANSFER SWITCH (WHETHER NOTED AS OPEN TRANSITION OR CLOSED TRANSITION) THAT IS TO BE PROVIDED WILL INITIALLY BE CONNECTED IN AN OPEN TRANSITION. HOWEVER, IT WILL ULTIMATELY BE CONFIGURED AS A CLOSED TRANSITION TRANSFER SWITCH. THE CONTRACTOR IS TO PROVIDE ADDITIONAL MOBILIZATION, MODIFICATION, AND COMMISSIONING SERVICES TO TRANSITION THE TRANSFER SWITCH FROM OPEN TO CLOSED TRANSITION.
9. SHUTDOWNS TO OCCUR ON WEEKENDS OR AS DESIGNATED BY THE DEPARTMENTAL REPRESENTATIVE.
10. PROVIDE TREE PROTECTION FENCES LARGE ENOUGH TO EXTEND TO THE DRIP LINE OF TREES IN CLOSE PROXIMITY TO SITE WORK.
11. ALLOW FOR UP TO TWO VISITS PER DAY TO ENSURE GENERATORS WILL RUN CONTINUOUSLY FOR 26 HOUR PERIOD.
12. PROVIDE CABLE FAULT INDICATORS (CURRENT RESET TYPE) MOUNTED TO CABLES FOR INSTALLATIONS WHERE THE CONCENTRIC NEUTRAL OF CABLES IS INTENDED TO BE USED AS THE RETURN PATH FOR FAULTS ON THE SITE DISTRIBUTION SYSTEM.

SCHEMATIC SYMBOLS	
	DRAW OUT LOW VOLTAGE CIRCUIT BREAKER
	LOW VOLTAGE CIRCUIT BREAKER
	HIGH VOLTAGE CIRCUIT BREAKER
	DRAW OUT HIGH VOLTAGE CIRCUIT BREAKER
	LOAD BREAK SWITCH
	DISCONNECT SWITCH
	FUSE
	TRANSFORMER
	AUTOTRANSFORMER
#	CURRENT TRANSFORMERS (# INDICATES NUMBER OF CTs IN GROUP)
	ZERO SEQUENCE CURRENT TRANSFORMER
#	POTENTIAL TRANSFORMERS (# INDICATES NUMBER OF PTs IN GROUP)
F 4	TRANSFER SWITCH
	FOUR POSITION, T-BLADE SWITCH
M	MOTOR OPERATOR FOR LOAD BREAK SWITCH
ST	SHUNT TRIP
R	RELAY (TYPE AS NOTED)
G L N	AUTOMATIC TRANSFER SWITCH C/W SINGLE ISOLATION/BYPASS
G L N	AUTOMATIC TRANSFER SWITCH C/W DUAL ISOLATION/BYPASS
	NORMALLY OPEN CONTACT
	NORMALLY CLOSED CONTACT
G	GENERATOR
M	REVENUE METER
DMS	DIGITAL INFORMATION METER
	DELTA CONNECTION
Y	WYE CONNECTION
	GROUND CONNECTION
	HIGH VOLTAGE STRESS RELIEF CONE
	POTHEAD
	CAPACITOR
	SURGE PROTECTIVE DEVICE
	LIGHTNING ARRESTOR
PANEL PN2A 42CC1 / PNL N2A	PANELBOARD
	PUSH PULL SWITCH
	MANHOLE
	GROUND BUS
O	OHMMETER
K	KEY SWITCH/KEY INTERLOCK
V	VOLTMETER
	CONNECTION
	MAGNETIC MOTOR STARTER
	MANUAL MOTOR STARTER
	MOTOR OVERLOAD
	BREAK LINE
	CONTINUATION BREAK
#	CABLE FAULT INDICATOR (# INDICATES TYPE, REFER TO DRAWING NOTES)
	DEAD BREAK SEPARABLE INSULATED CONNECTORS

POWER PLAN SYMBOLS	
	COMBINATION DISCONNECT AND MAGNETIC MOTOR STARTER
	DISCONNECT SWITCH
	FUSED DISCONNECT SWITCH
	MAGNETIC MOTOR STARTER
	CONDUIT STUB
	CONDUIT UP
	CONDUIT DOWN

GENERAL SYMBOLS	
#	NOTE REFERENCE
## ####	EQUIPMENT REFERENCE
#	REVISION NUMBER
##	WIRING HOME RUN

ABBREVIATIONS	
EX	EXISTING DEVICE TO REMAIN
RE	REMOVE EXISTING DEVICE
RP	REPLACE EXISTING DEVICE WITH NEW DEVICE
RL	RELOCATE EXISTING DEVICE
ER	EXISTING DEVICE IN RELOCATED POSITION
TYP	TYPICAL
WP	WEATHERPROOF

LEGEND	
P	PRIMARY U/G LINE - NEW TO REMAIN
P	PRIMARY U/G LINE - EXISTING
P	PRIMARY U/G LINE - TO BE REMOVED
S	SECONDARY U/G LINE - NEW TO REMAIN
S	SECONDARY U/G LINE - EXISTING
S	SECONDARY U/G LINE - TO BE REMOVED
COM	COMMUNICATION U/G LINE - EXISTING

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Revision/ Revision	Description/Description	Date/Date
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A	ADDENDUM #1	APR.24.17
0	ISSUED FOR TENDER	MAR.14.17

Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

METCHOSIN, BC

ELECTRICAL HIGH VOLTAGE UPGRADE (PHASE 2 OF 2) WILLIAM HEAD INSTITUTION

Consultant Signature Box Only

Designed by/Concept par
P.Necpal

Drawn by/Dessine par
P.Necpal

PWGSC Project Manager/Administrateur de Projets TPSGC
P. Truong

PWGSC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régionale, Services d'architectural et de génie, TPSGC
P. Paul

Drawing title/Titre du dessin
KEY PLAN AND SYMBOL LEGEND

Project No./No. du projet	Sheet/ Feuille	Revision no./ La Révision no.
R.069376.001	E-000 1 OF 22	

PWGSC – B1 – 1000X707

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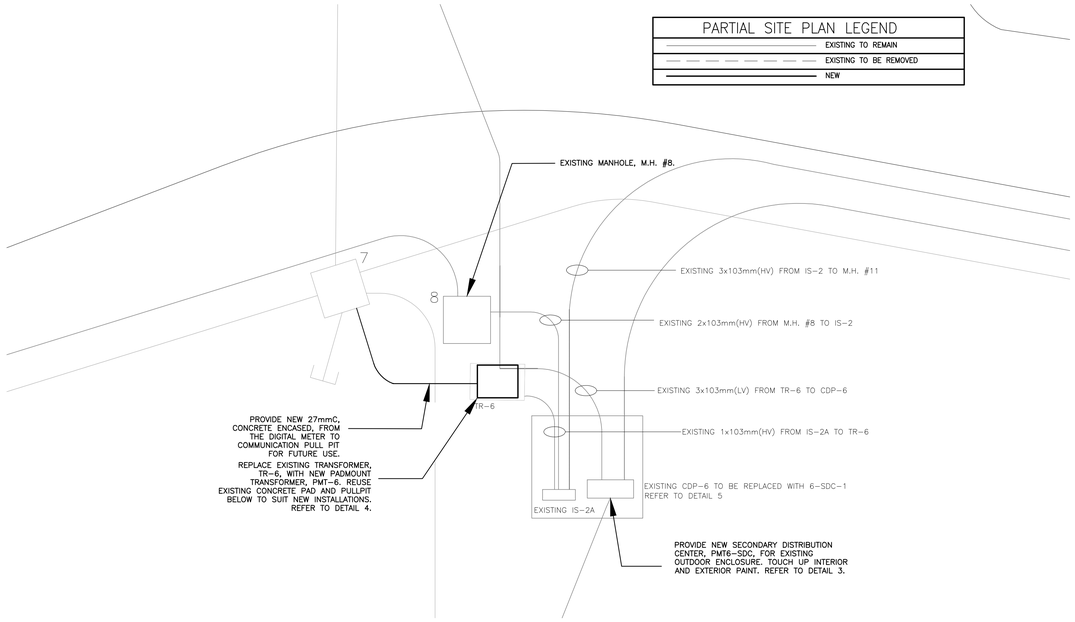


1 / 000 PARTIAL SITE PLAN
1:100

SUGGESTED PHASING NOTES:

1. ARRANGE POWER SHUTDOWN TO CDP-6. PROVIDE TEMPORARY GENERATOR TO POWER HEALTH/SCU BUILDING 109. INTERRUPT POWER TO TRANSFORMER 6, TR6.
2. REMOVE EXISTING TRANSFORMER 6, TR 6, AND INSTALL A NEW PAD MOUNT TRANSFORMER, PMT-6, IN THE SAME LOCATION.
3. REMOVE CDP-6 AND REPLACE WITH NEW SECONDARY DISTRIBUTION CENTER, PMT6-SDC.
4. UTILIZING EXISTING CONDUITS REPLACE EXISTING SECONDARY CONDUCTORS WITH NEW SECONDARY CONDUCTORS FROM NEW PADMOUNT TRANSFORMER, PMT-6, TO NEW SECONDARY DISTRIBUTION CENTER, PMT6-SDC.
5. CUT OVER AND TIE ALL EXISTING LOADS ONE BY ONE FED BY THE TEMPORARY GENERATOR TO THE NEW SECONDARY DISTRIBUTION CENTER, PMT6-SDC. PROVIDE REPORT TO DEPARTMENTAL REPRESENTATIVE OF ANY EXISTING CONDUCTORS THAT DO NOT MEET THE REQUIREMENTS OF THE CURRENT VERSION OF THE CANADIAN ELECTRICAL CODE.
6. REMOVE EXISTING DISTRIBUTION EQUIPMENT NOT REQUIRED FOR LAYOUT.
7. REMOVE TEMPORARY GENERATORS AND COMPLETE ELECTRICAL INSTALLATION.

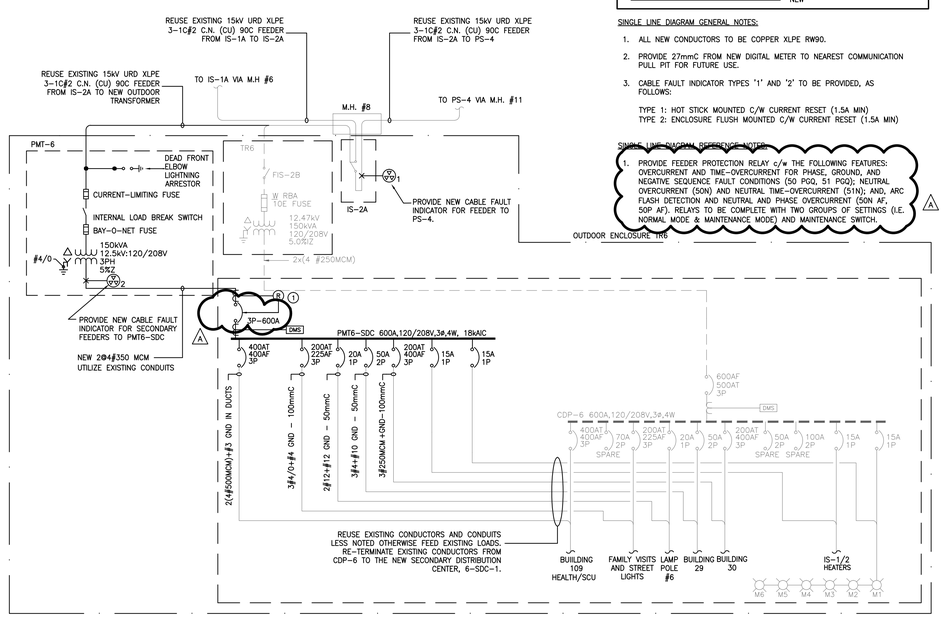
TEMPORARY GENERATOR NOTES:

1. PROVIDE THE FOLLOWING WITH TEMPORARY PRIME POWER RATED GENERATORS FOR BACK-UP:

   1.1 BUILDING 109, HEALTH/SCU – 40kW, 120/208V, 3Ø

   SUPPLY ALL DIESEL FUEL REQUIRED TO RUN GENERATORS AT FULL LOAD WHILE TRANSFORMER 6, TR6, AND CDP-6 IS BEING REPLACED. TIME PERIOD TO EXTEND UNTIL NEW PADMOUNT TRANSFORMER, PMT-6, AND SECONDARY DISTRIBUTION CENTER, 6-SDC-1, IS COMMISSIONED AND SUPPLYING POWER TO HEALTH/SCU CENTER BUILDING 109.
2. GENERATORS TO BE SKID-MOUNTED AND COMPLETE WITH SOUND ATTENUATING, WEATHERPROOF ENCLOSURE, TO 68-72 dB AT 7m AWAY FROM GENERATOR.
3. SAFETY MEANS, PROTECTION AND LOCKOUT TO BE PROVIDED TO PREVENT UNDESIRABLE REVERSE FEED. PROVIDE WARNING LABELS AT ALL CONNECTION POINTS, AS WELL AS, EMERGENCY PLAN & CONTACTS.

5 / – EXISTING CDP-6
N.T.S.



SINGLE DIAGRAM LEGEND

SINGLE LINE DIAGRAM GENERAL NOTES:

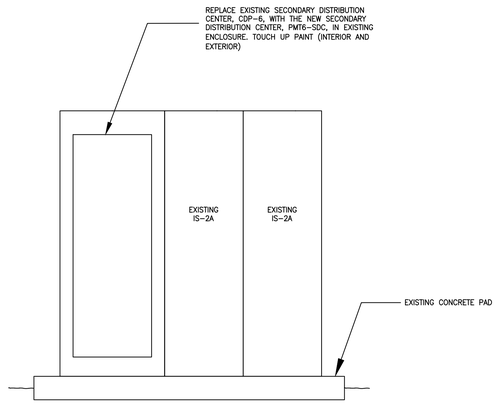
1. ALL NEW CONDUCTORS TO BE COPPER XLPE RW90.
2. PROVIDE 27mmC FROM NEW DIGITAL METER TO NEAREST COMMUNICATION PULL PIT FOR FUTURE USE.
3. CABLE FAULT INDICATOR TYPES '1' AND '2' TO BE PROVIDED, AS FOLLOWS:

   TYPE 1: HOT STICK MOUNTED C/W CURRENT RESET (1.5A MIN)
   TYPE 2: ENCLOSURE FLUSH MOUNTED C/W CURRENT RESET (1.5A MIN)

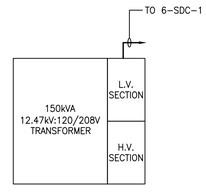
SINGLE LINE DIAGRAM REFERENCE NOTES:

1. PROVIDE FEEDER PROTECTION RELAY c/w THE FOLLOWING FEATURES: OVERCURRENT AND TIME-OVERCURRENT FOR PHASE, GROUND, AND NEGATIVE SEQUENCE FAULT CONDITIONS (50 PQQ, 51 PQQ); NEUTRAL OVERCURRENT (50N) AND NEUTRAL TIME-OVERCURRENT (51N); AND, ARC FLASH DETECTION AND NEUTRAL AND PHASE OVERCURRENT (50N AF, 50P AF). RELAYS TO BE COMPLETE WITH TWO GROUPS OF SETTINGS (I.E. NORMAL MODE & MAINTENANCE MODE) AND MAINTENANCE SWITCH. (A)

2 / – PARTIAL SINGLE LINE DIAGRAM
N.T.S.



3 / – OUTDOOR ENCLOSURE IS-2A & PMT6-SDC ELEVATION DETAIL
N.T.S.



4 / – PMT-6 – PADMOUNT TRANSFORMER PLAN VIEW
N.T.S.

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A	ADDENDUM #3	MAY.05.17
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Revision/ Revision	Description/Description	Date/Date

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CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

METCHOSIN, BC

ELECTRICAL HIGH VOLTAGE UPGRADE (PHASE 2 OF 2) WILLIAM HEAD INSTITUTION

Consultant Signature Box Only

Designed by/Concept par
P.Necpal

Drawn by/Dessine par
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PWGSC Project Manager/Administrateur de Projets TPSGC
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PWGSC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régionale, Services d'architectural et de génie, TPSGC
P. Paul

Drawing title/Titre du dessin
OUTDOOR ENCLOSURE TR6

Project No./No. du projet
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E-001
2 OF 22

Revision no./ La Révision no.

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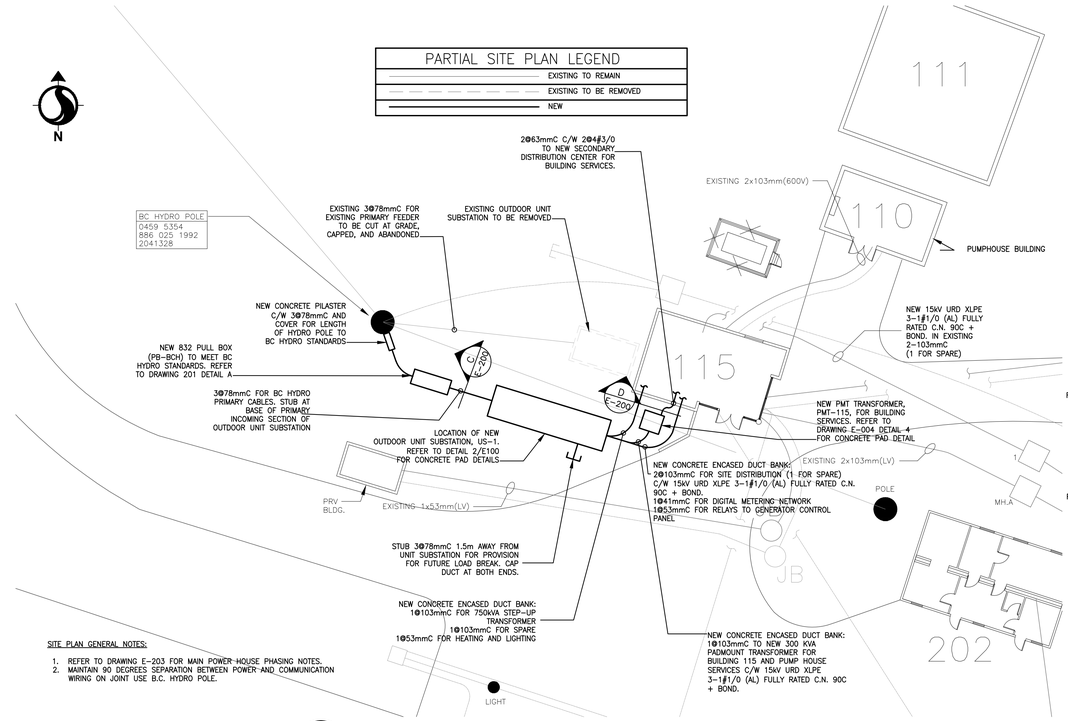
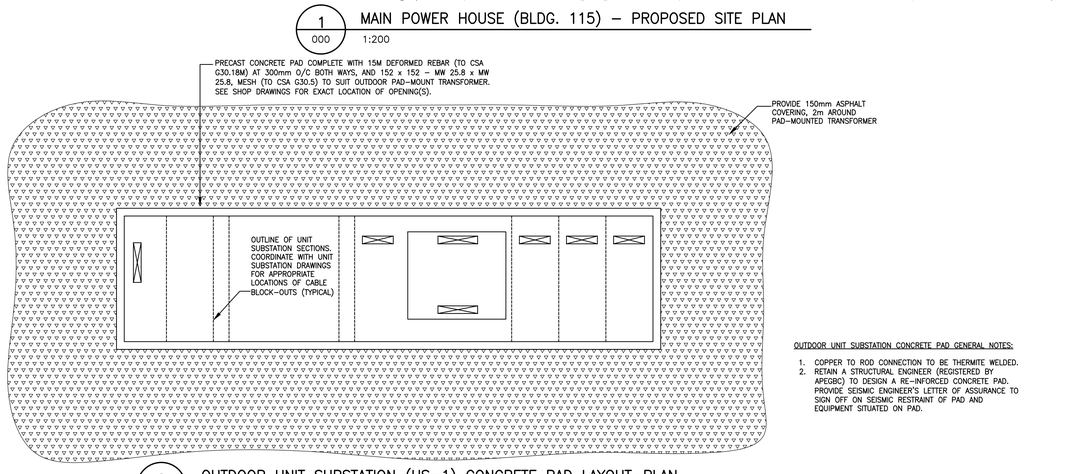


1 / 000 — MAIN POWER HOUSE (BLDG. 115) – PROPOSED SITE PLAN

1:200

SITE PLAN GENERAL NOTES:

1. REFER TO DRAWING E-203 FOR MAIN POWER HOUSE PHASING NOTES.
2. MAINTAIN 90 DEGREES SEPARATION BETWEEN POWER AND COMMUNICATION WIRING ON JOINT USE B.C. HYDRO POLE.

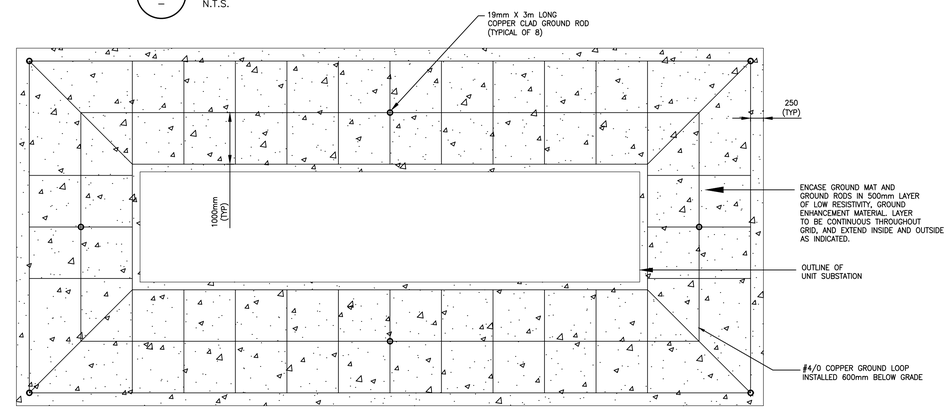


2 / – — OUTDOOR UNIT SUBSTATION (US–1) CONCRETE PAD LAYOUT–PLAN

N.T.S.

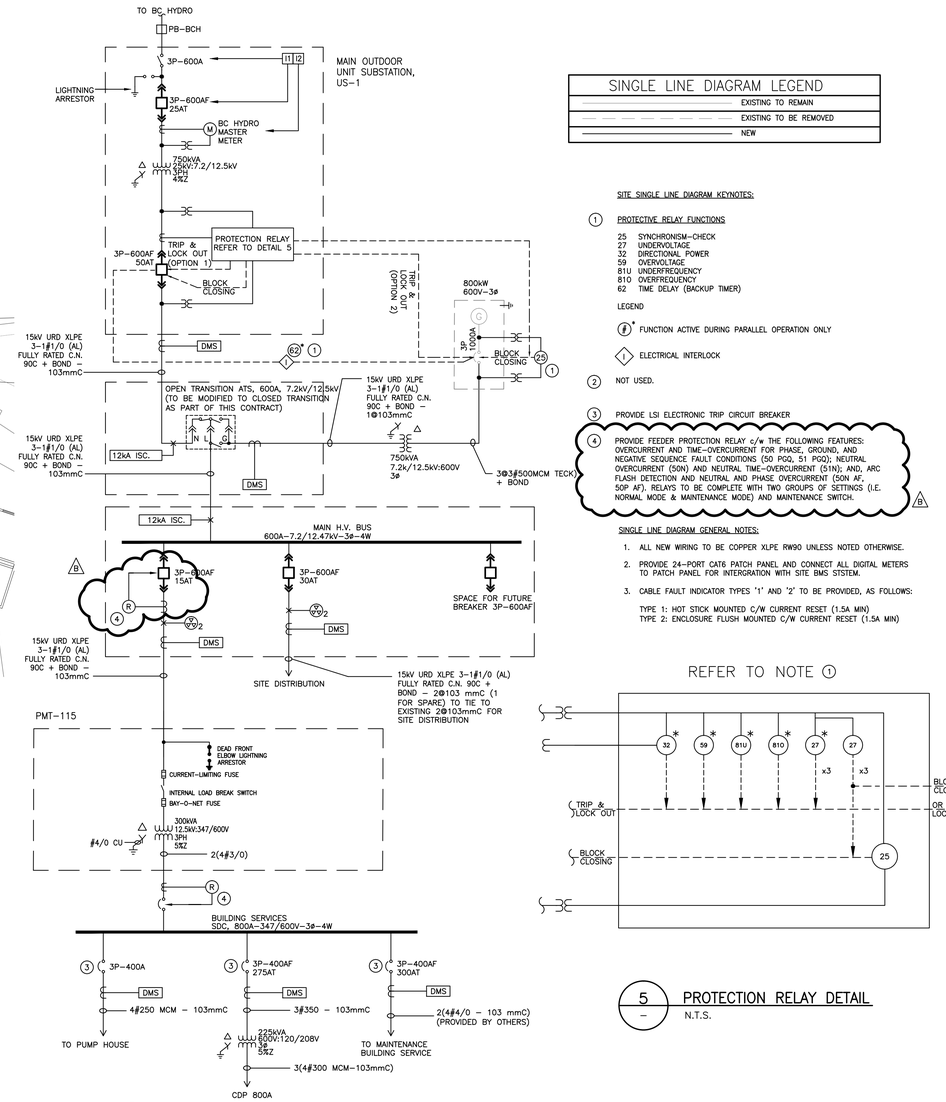
OUTDOOR UNIT SUBSTATION CONCRETE PAD GENERAL NOTES:

1. COPPER TO ROD CONNECTION TO BE THERMITE WELDED.
2. RETAIN A STRUCTURAL ENGINEER (REGISTERED BY APEGBC) TO DESIGN A RE-INFORCED CONCRETE PAD. PROVIDE SEISMIC ENGINEER'S LETTER OF ASSURANCE TO SIGN OFF ON SEISMIC RESTRAINT OF PAD AND EQUIPMENT SITUATED ON PAD.



6 / – — OUTDOOR UNIT SUBSTATION (US–1) GROUNDING DETAILS

N.T.S.



4 / – — MAIN POWERHOUSE SINGLE LINE DIAGRAM

N.T.S.

SINGLE LINE DIAGRAM LEGEND

EXISTING TO REMAIN
EXISTING TO BE REMOVED
NEW

SITE SINGLE LINE DIAGRAM KEYNOTES:

(1) PROTECTIVE RELAY FUNCTIONS

25 SYNCHRONISM–CHECK
27 UNDERVOLTAGE
32 DIRECTIONAL POWER
59 OVERVOLTAGE
81U UNDERFREQUENCY
81O OVERFREQUENCY
62 TIME DELAY (BACKUP TIMER)

LEGEND

(#)* FUNCTION ACTIVE DURING PARALLEL OPERATION ONLY

(I) ELECTRICAL INTERLOCK

(2) NOT USED.

(3) PROVIDE LSI ELECTRONIC TRIP CIRCUIT BREAKER

(4) PROVIDE FEEDER PROTECTION RELAY c/w THE FOLLOWING FEATURES: OVERCURRENT AND TIME-OVERCURRENT FOR PHASE, GROUND, AND NEGATIVE SEQUENCE FAULT CONDITIONS (50 PGQ, 51 PGQ); NEUTRAL OVERCURRENT (50N) AND NEUTRAL TIME-OVERCURRENT (51N); AND, ARC FLASH DETECTION AND NEUTRAL AND PHASE OVERCURRENT (50N AF, 50P AF); RELAYS TO BE COMPLETE WITH TWO GROUPS OF SETTINGS (I.E. NORMAL MODE & MAINTENANCE MODE) AND MAINTENANCE SWITCH. B

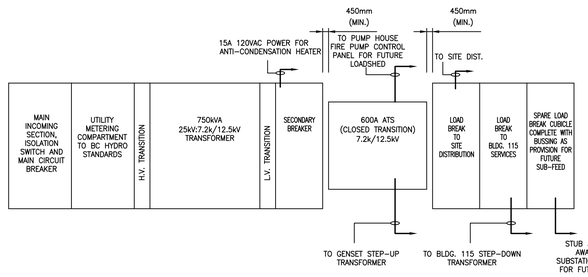
SINGLE LINE DIAGRAM GENERAL NOTES:

1. ALL NEW WIRING TO BE COPPER XLPE RW90 UNLESS NOTED OTHERWISE.
2. PROVIDE 24-PORT CAT6 PATCH PANEL AND CONNECT ALL DIGITAL METERS TO PATCH PANEL FOR INTERGRATION WITH SITE BMS SYSTEM.
3. CABLE FAULT INDICATOR TYPES '1' AND '2' TO BE PROVIDED, AS FOLLOWS:

TYPE 1: HOT STICK MOUNTED C/W CURRENT RESET (1.5A MIN)
TYPE 2: ENCLOSURE FLUSH MOUNTED C/W CURRENT RESET (1.5A MIN)

5 / – — PROTECTION RELAY DETAIL

N.T.S.



3 / – — OUTDOOR UNIT SUBSTATION (US–1) PLAN VIEW

N.T.S.

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique
Stantec

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Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

METCHOSIN, BC

ELECTRICAL HIGH VOLTAGE UPGRADE (PHASE 2 OF 2) WILLIAM HEAD INSTITUTION

Consultant Signature Box Only

Designed by/Concept par
P.Necpal

Drawn by/Dessine par
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PWGSC Project Manager/Administrateur de Projets TPSGC
P. Truong

PWGSC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régionale, Services d'architectural et de génie, TPSGC
P. Paul

Drawing title/Titre du dessin

MAIN POWER HOUSE (BLDG.115)

SINGLE LINE AND ELECTRICAL DETAILS

Project No./No. du projet	Sheet/ Feuille	Revision no./ Le Révision no.
R.069376.001	E-100 6 OF 22	

PWGSC – B1 – 1000X707

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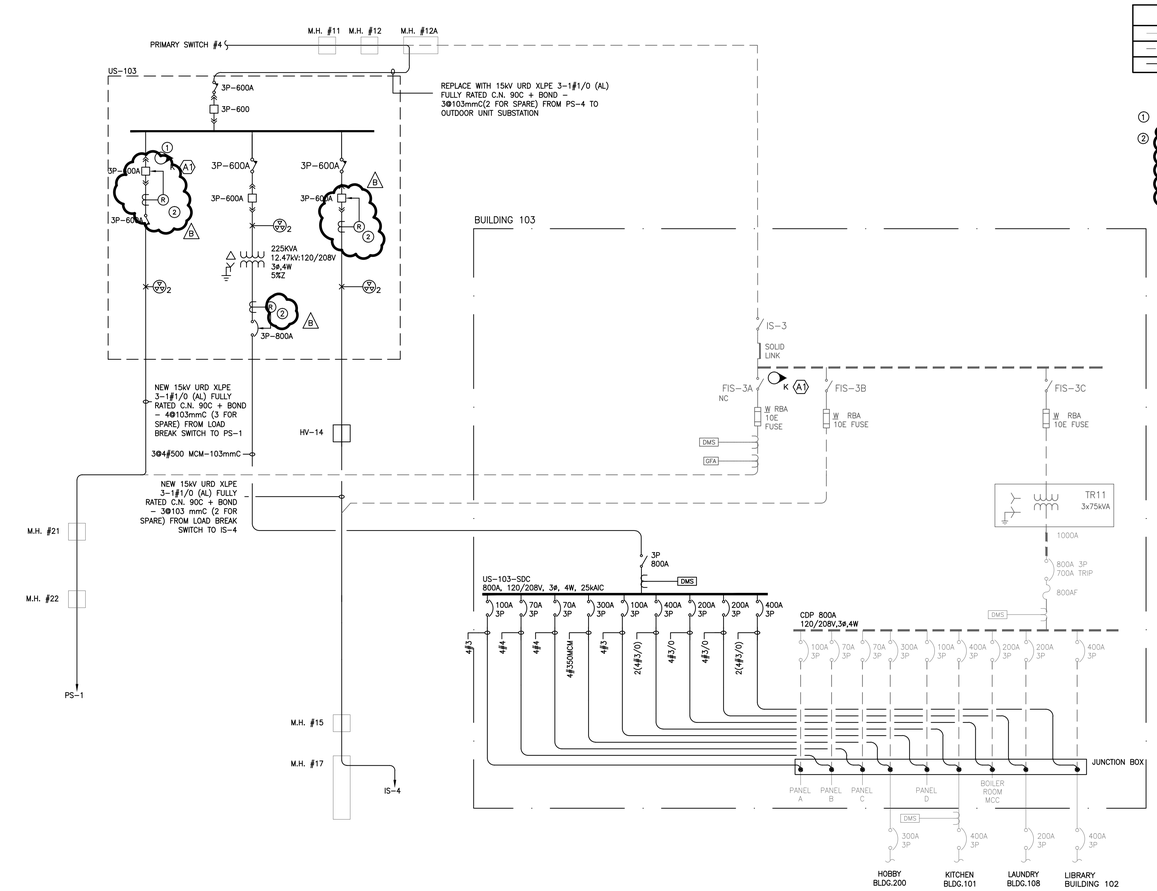


1 — PARTIAL SINGLE LINE DIAGRAM
N.T.S.

SINGLE LINE DIAGRAM LEGEND

———	EXISTING TO REMAIN
- - - - - -	EXISTING TO BE REMOVED
———	NEW

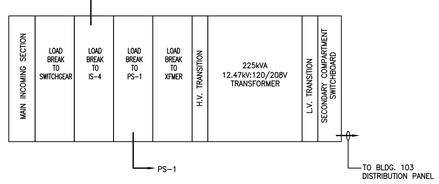
BUILDING 103 SINGLE LINE DIAGRAM KEYNOTES:

1. PROVIDE KIRK-KEY INTERLOCK TO MATCH EXISTING KEY INTERLOCK.
2. PROVIDE FEEDER PROTECTION RELAY c/w THE FOLLOWING FEATURES: OVERCURRENT AND TIME-OVERCURRENT FOR PHASE, GROUND, AND NEGATIVE SEQUENCE FAULT CONDITIONS (50 PDQ, 51 PDQ); NEUTRAL OVERCURRENT (50N) AND NEUTRAL TIME-OVERCURRENT (51N); AND, ARC FLASH DETECTION AND NEUTRAL AND PHASE OVERCURRENT (50N AF, 50P AF). RELAYS TO BE COMPLETE WITH TWO GROUPS OF SETTINGS (I.E. NORMAL MODE & MAINTENANCE MODE) AND MAINTENANCE SWITCH. (B)

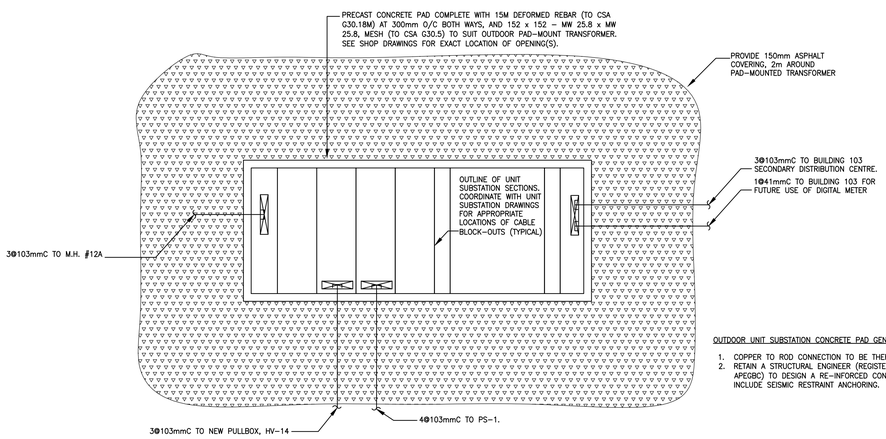
SINGLE LINE DIAGRAM GENERAL NOTES:

1. ALL NEW CONDUCTORS TO BE COPPER XLPE RW90.
2. PROVIDE 1Φ41mmC FROM US-103 TO BUILDING 103 ELECTRICAL ROOM FOR FUTURE USE OF THE DIGITAL METER. CONDUIT TO ENTER PULL BOX. PROVIDE PULL STRING.
3. CABLE FAULT INDICATOR TYPES '1' AND '2' TO BE PROVIDED AS FOLLOWS:

   TYPE 1: HOT STICK MOUNTED C/W CURRENT RESET (1.5A MIN)
   TYPE 2: ENCLOSURE FLUSH MOUNTED C/W CURRENT RESET (1.5A MIN)
4. REFER TO DRAWING E-002 FOR INFO ON KEY INTERLOCK A1.



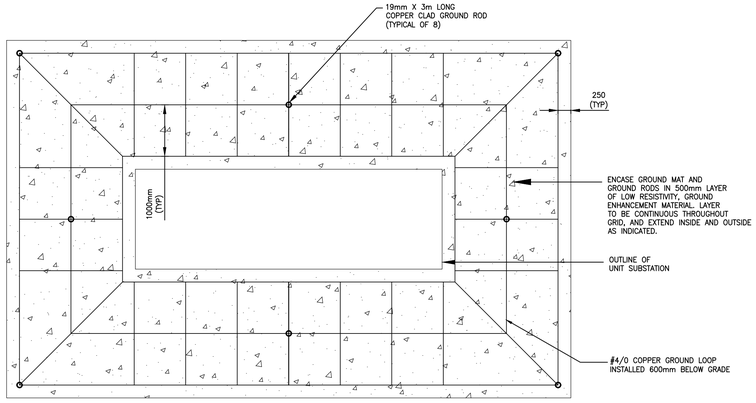
3 — OUTDOOR UNIT SUBSTATION (US-103) PLAN VIEW
N.T.S.



OUTDOOR UNIT SUBSTATION CONCRETE PAD GENERAL NOTES:

1. COPPER TO ROD CONNECTION TO BE THERMITE WELDED.
2. RETAIN A STRUCTURAL ENGINEER (REGISTERED BY APEGBC) TO DESIGN A RE-INFORCED CONCRETE PAD. INCLUDE SEISMIC RESTRAINT ANCHORING.

2 — OUTDOOR UNITSUBSTATION (US-103) CONCRETE PAD LAY-OUT PLAN
N.T.S.



2 — OUTDOOR UNIT SUBSTATION (US-103) GROUNDING DETAILS
N.T.S.

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Revision/ Revision	Description/Description	Date/Date
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Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

METCHOSIN, BC

ELECTRICAL HIGH VOLTAGE UPGRADE (PHASE 2 OF 2) WILLIAM HEAD INSTITUTION

Consultant Signature Box Only

Designed by/Concept par
P.Necpal

Drawn by/Dessine par
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P. Paul

Drawing title/Titre du dessin

BUILDING 103

SINGLE LINE AND ELECTRICAL DETAILS

Project No./No. du projet	Sheet/Feuille	Revision no./ Lo Révision no.
R.069376.001	E-104	
	10 OF 22	

PWGSC – B1 – 1000X707

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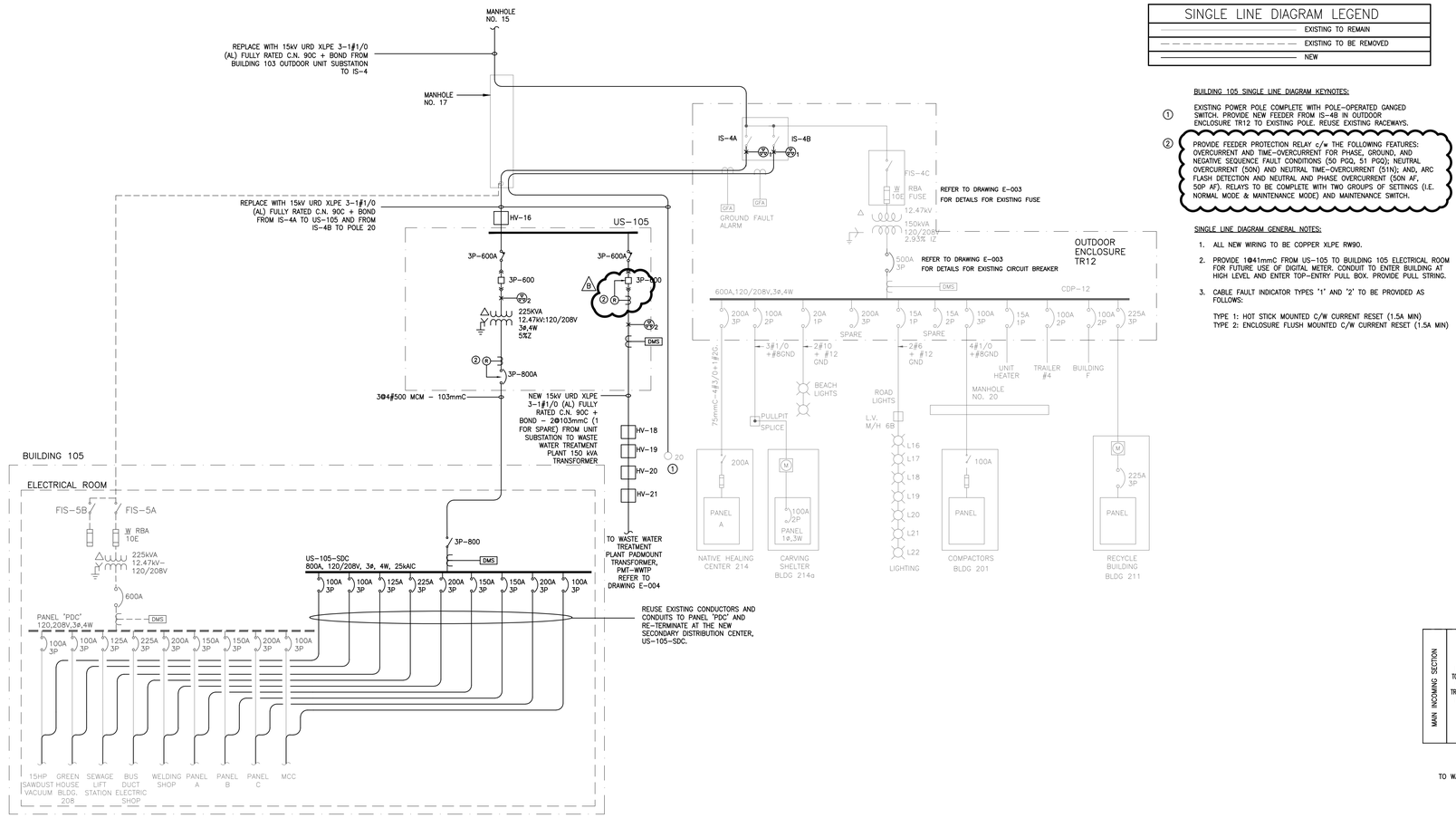


3 — PARTIAL SINGLE LINE DIAGRAM
N.T.S.

SINGLE LINE DIAGRAM LEGEND

- EXISTING TO REMAIN
- EXISTING TO BE REMOVED
- NEW

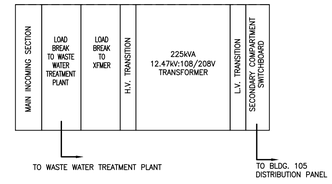
BUILDING 105 SINGLE LINE DIAGRAM KEYNOTES:

1. EXISTING POWER POLE COMPLETE WITH POLE-OPERATED GANGED SWITCH. PROVIDE NEW FEEDER FROM IS-4B IN OUTDOOR ENCLOSURE TR12 TO EXISTING POLE. REUSE EXISTING RACEWAYS.
2. PROVIDE FEEDER PROTECTION RELAY c/w THE FOLLOWING FEATURES: OVERCURRENT AND TIME-OVERCURRENT FOR PHASE, GROUND, AND NEGATIVE SEQUENCE FAULT CONDITIONS (50 PGQ, 51 PGQ); NEUTRAL OVERCURRENT (50N) AND NEUTRAL TIME-OVERCURRENT (51N); AND, ARC FLASH DETECTION AND NEUTRAL AND PHASE OVERCURRENT (50N AF, 50P AF). RELAYS TO BE COMPLETE WITH TWO GROUPS OF SETTINGS (I.E. NORMAL MODE & MAINTENANCE MODE) AND MAINTENANCE SWITCH. (B)

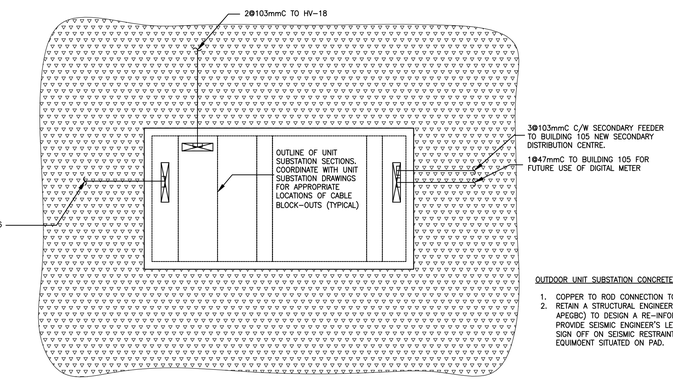
SINGLE LINE DIAGRAM GENERAL NOTES:

1. ALL NEW WIRING TO BE COPPER XLPE RW90.
2. PROVIDE 1Ø41mmC FROM US-105 TO BUILDING 105 ELECTRICAL ROOM FOR FUTURE USE OF DIGITAL METER. CONDUIT TO ENTER BUILDING AT HIGH LEVEL AND ENTER TOP-ENTRY PULL BOX. PROVIDE PULL STRING.
3. CABLE FAULT INDICATOR TYPES '1' AND '2' TO BE PROVIDED AS FOLLOWS:

   TYPE 1: HOT STICK MOUNTED C/W CURRENT RESET (1.5A MIN)
   TYPE 2: ENCLOSURE FLUSH MOUNTED C/W CURRENT RESET (1.5A MIN)



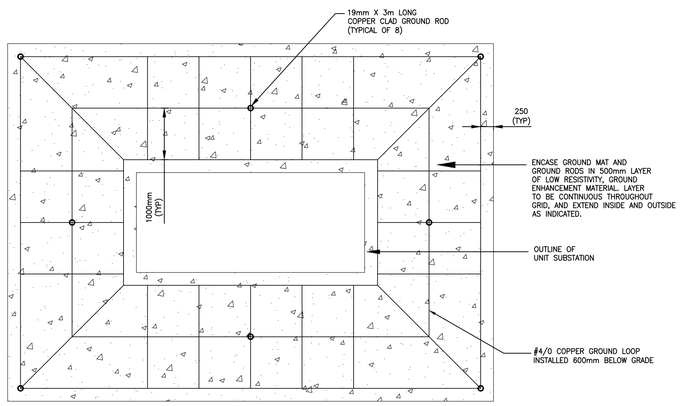
2 — OUTDOOR UNIT SUBSTATION PLAN VIEW
N.T.S.



OUTDOOR UNIT SUBSTATION CONCRETE PAD GENERAL NOTES:

1. COPPER TO ROD CONNECTION TO BE THERMITE WELDED.
2. RETAIN A STRUCTURAL ENGINEER (REGISTERED BY APEGBC) TO DESIGN A RE-INFORCED CONCRETE PAD. PROVIDE SEISMIC ENGINEER'S LETTER OF ASSURANCE TO SIGN OFF ON SEISMIC RESTRAINT OF PAD AND EQUIMOENT SITUATED ON PAD.

1 — OUTDOOR UNIT SUBSTATION CONCRETE PAD LAY-OUT PLAN
N.T.S.



1 — OUTDOOR UNIT SUBSTATION GROUNDING DETAILS
N.T.S.

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Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

METCHOSIN, BC

ELECTRICAL HIGH VOLTAGE UPGRADE (PHASE 2 OF 2) WILLIAM HEAD INSTITUTION

Consultant Signature Box Only

Designed by/Concept par
P.Necpal

Drawn by/Dessiné par
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Drawing title/Titre du dessin

BUILDING 105

SINGLE LINE AND ELECTRICAL DETAILS

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.069376.001	E-106 12 OF 22	

PWGSC – B1 – 1000X707

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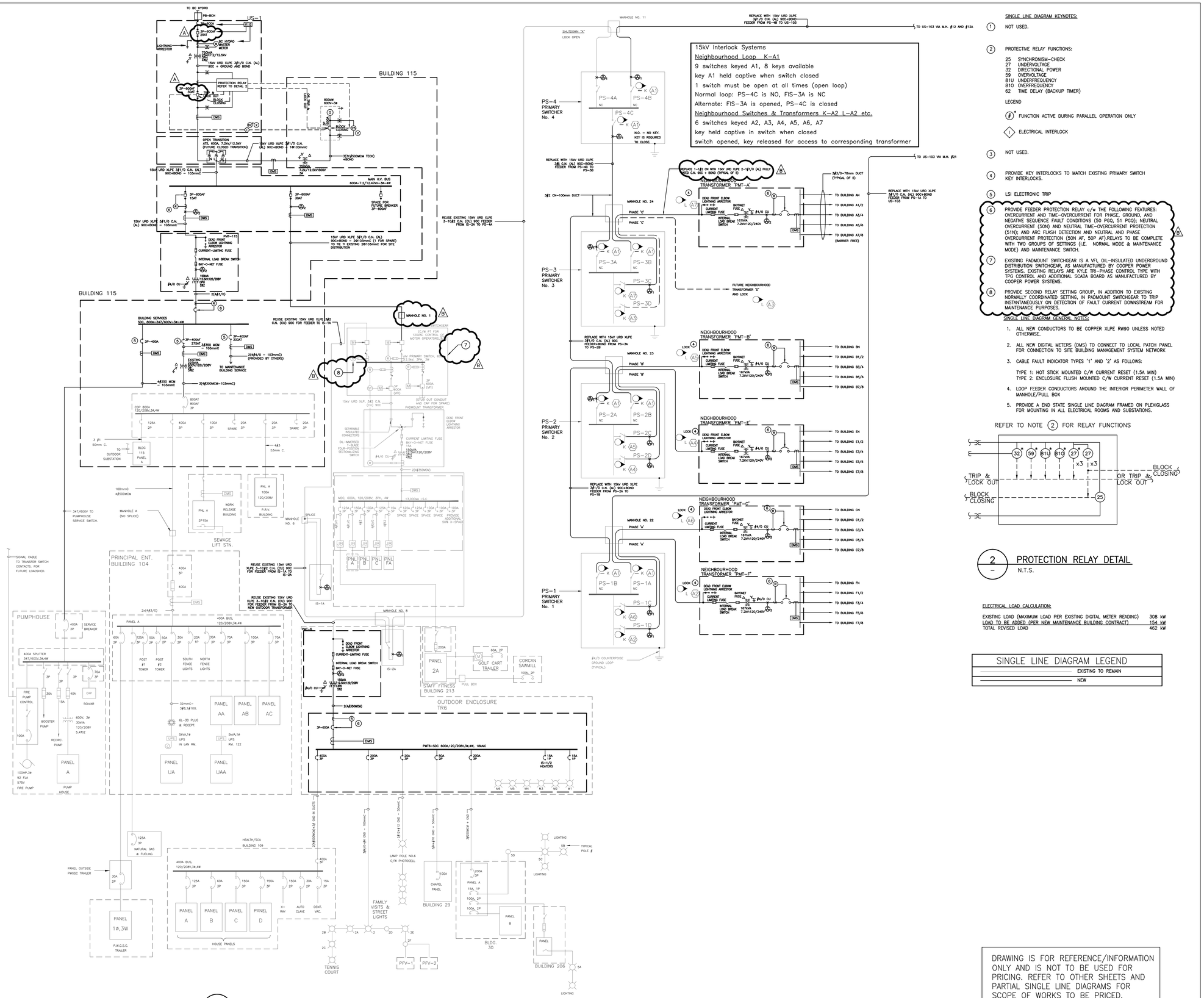

1 — SITE SINGLE LINE DIAGRAM – NEW
N.T.S.

SINGLE LINE DIAGRAM KEYNOTES:

1. NOT USED.
2. PROTECTIVE RELAY FUNCTIONS:
   - 25 SYNCHRONISM-CHECK
   - 27 UNDERVOLTAGE
   - 32 DIRECTIONAL POWER
   - 59 OVERVOLTAGE
   - 81U UNDERFREQUENCY
   - 81O OVERFREQUENCY
   - 62 TIME DELAY (BACKUP TIMER)

   LEGEND
   - (F)* FUNCTION ACTIVE DURING PARALLEL OPERATION ONLY
   - ELECTRICAL INTERLOCK
3. NOT USED.
4. PROVIDE KEY INTERLOCKS TO MATCH EXISTING PRIMARY SWITCH KEY INTERLOCKS.
5. LSI ELECTRONIC TRIP
6. PROVIDE FEEDER PROTECTION RELAY C/W THE FOLLOWING FEATURES: OVERCURRENT AND TIME-OVERCURRENT FOR PHASE, GROUND, AND NEGATIVE SEQUENCE FAULT CONDITIONS (50 POQ, 51 POQ); NEUTRAL OVERCURRENT (50N) AND NEUTRAL TIME-OVERCURRENT PROTECTION (51N); AND ARC FLASH DETECTION AND NEUTRAL AND PHASE OVERCURRENT PROTECTION (50N AF, 50P AF).RELAYS TO BE COMPLETE WITH TWO GROUPS OF SETTINGS (I.E. NORMAL MODE & MAINTENANCE MODE) AND MAINTENANCE SWITCH.
7. EXISTING PADMOUNT SWITCHGEAR IS A VFI, OIL-INSULATED UNDERGROUND DISTRIBUTION SWITCHGEAR, AS MANUFACTURED BY COOPER POWER SYSTEMS. EXISTING RELAYS ARE KYLE TRI-PHASE CONTROL TYPE WITH TPG CONTROL AND ADDITIONAL SCADA BOARD AS MANUFACTURED BY COOPER POWER SYSTEMS.
8. PROVIDE SECOND RELAY SETTING GROUP, IN ADDITION TO EXISTING NORMALLY COORDINATED SETTING, IN PADMOUNT SWITCHGEAR TO TRIP INSTANTANEOUSLY ON DETECTION OF FAULT CURRENT DOWNSTREAM FOR MAINTENANCE PURPOSES.

SINGLE LINE DIAGRAM GENERAL NOTES:

1. ALL NEW CONDUCTORS TO BE COPPER XLPE RW90 UNLESS NOTED OTHERWISE.
2. ALL NEW DIGITAL METERS (DMS) TO CONNECT TO LOCAL PATCH PANEL FOR CONNECTION TO SITE BUILDING MANAGEMENT SYSTEM NETWORK
3. CABLE FAULT INDICATOR TYPES '1' AND '2' AS FOLLOWS:
   TYPE 1: HOT STICK MOUNTED C/W CURRENT RESET (1.5A MIN)
   TYPE 2: ENCLOSURE FLUSH MOUNTED C/W CURRENT RESET (1.5A MIN)
4. LOOP FEEDER CONDUCTORS AROUND THE INTERIOR PERIMETER WALL OF MANHOLE/PULL BOX
5. PROVIDE A END STATE SINGLE LINE DIAGRAM FRAMED ON PLEXIGLASS FOR MOUNTING IN ALL ELECTRICAL ROOMS AND SUBSTATIONS.

REFER TO NOTE (2) FOR RELAY FUNCTIONS

2 — PROTECTION RELAY DETAIL
N.T.S.

ELECTRICAL LOAD CALCULATION:

EXISTING LOAD (MAXIMUM LOAD PER EXISTING DIGITAL METER READING)	308 kW
LOAD TO BE ADDED (PER NEW MAINTENANCE BUILDING CONTRACT)	154 kW
TOTAL REVISED LOAD	462 kW

SINGLE LINE DIAGRAM LEGEND	
	EXISTING TO REMAIN
	NEW

DRAWING IS FOR REFERENCE/INFORMATION ONLY AND IS NOT TO BE USED FOR PRICING. REFER TO OTHER SHEETS AND PARTIAL SINGLE LINE DIAGRAMS FOR SCOPE OF WORKS TO BE PRICED.

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Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

METCHOSIN, BC

ELECTRICAL HIGH VOLTAGE UPGRADE (PHASE 2 OF 2) WILLIAM HEAD INSTITUTION

Consultant Signature Box Only

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Drawn by/Dessine par
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PWGSC Project Manager/Administrateur de Projets TPSGC
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P. Paul

Drawing title/Titre du dessin

SITE SINGLE LINE DIAGRAM - NEW (1 OF 2)

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.069376.001	E-401 21 OF 22	

PWGSC – B1 – 1000X707

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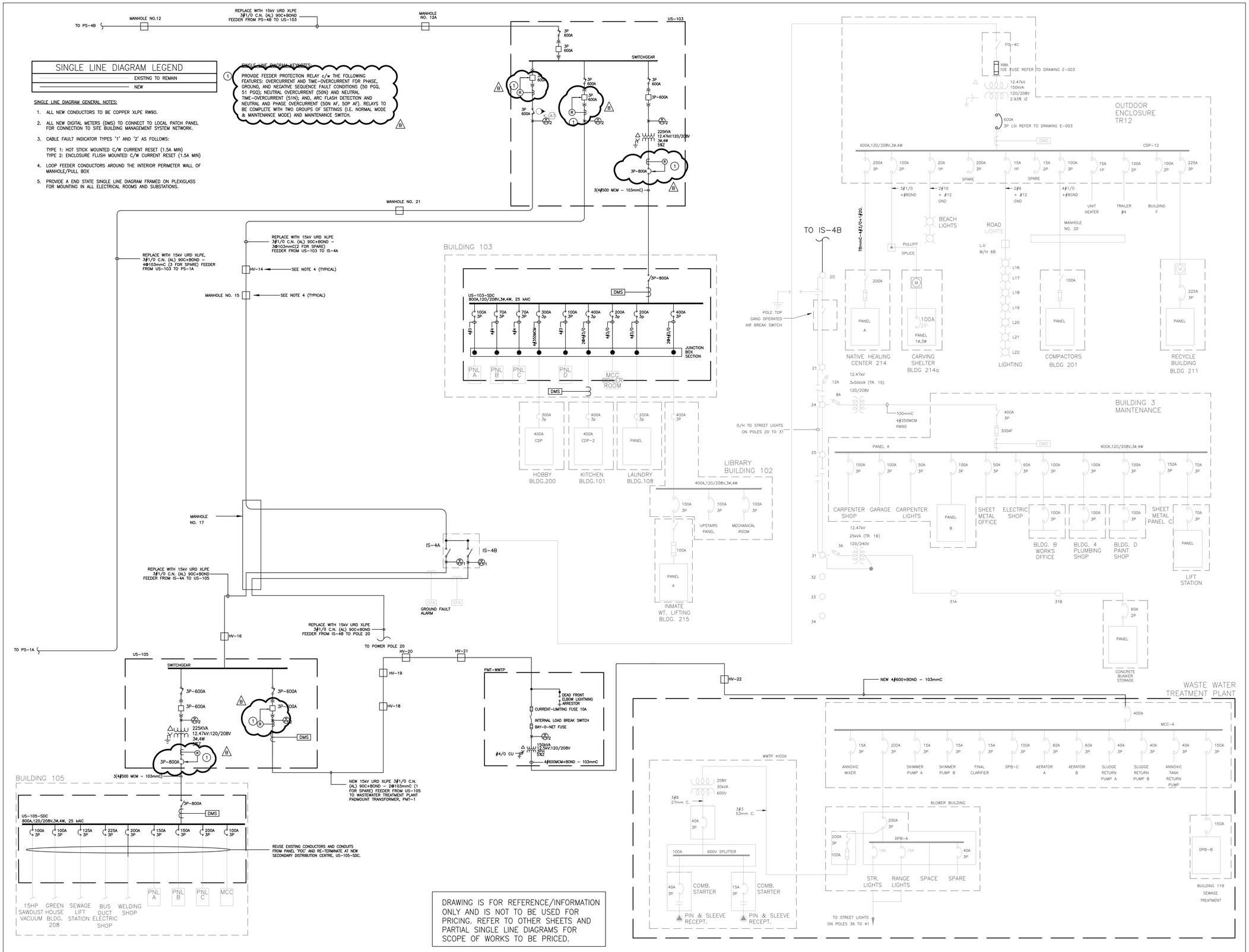

1 / – SITE SINGLE LINE DIAGRAM – NEW
N.T.S.

0 10 20 30 40 50 60 70 80 90 100mm

PWGSC – B1 – 1000X707

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Revision/ Revision	Description/Description	Date/Date
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Client/client

CORRECTIONAL SERVICE CANADA

Project title/Titre du projet

METCHOSIN, BC

ELECTRICAL HIGH VOLTAGE UPGRADE (PHASE 2 OF 2) WILLIAM HEAD INSTITUTION

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PWGSC Project Manager/Administrateur de Projets TPSGC
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PWGSC, Regional Manager, Architectural and Engineering Services/ Gestionnaire régionale, Services d'architectural et de génie, TPSGC
P. Paul

Drawing title/Titre du dessin

SITE SINGLE LINE DIAGRAM - NEW (2 OF 2)

Project No./No. du projet: **R.069376.001**

Sheet/Feuille: E-402

22 OF 22

Revision no./ La Révision no.:

115614121

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 - Common Work Results for Electrical

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C68.3-97(R2006), Shielded and Concentric Neutral Power Cables Rated 5-46 kV.

.2 CSA-C233.1-87(R2004), Gapless Metal Oxide Surge Arresters for Alternating Current Systems.

.2 National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)

.1 NEMA WC3-1992/ICEA S-19-81, Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

.2 NEMA WC74/ICEA S-93-639-2012, 5-46kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

.2 Provide product data in accordance with Section 01 01 50 – General Instructions.

.1 Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse or recycling in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 CONCENTRIC NEUTRAL POWER CABLES (5001 - 15000 V)

.1 Concentric neutral power cable: to NEMA WC74-1992/ICEAS-66-524, AEIC CS5, ICEA S-66-524 and CSA-C68.3.

.2 Single aluminum conductor, size as indicated.

.3 Semi-conducting strand shield.

.4 Class 2 compact round stranding per ASTM B4596:

.1 All strand interstices to be filled during stranding operation and each wire and successive layers of wires to be sealed with approved sealing compound.

.2 Acceptable products: Canada Wire "STRAND BLOCK"; Pirelli "STRANDSEAL."

.5 Insulation: tree-retardant cross-linked thermo-setting polyethylene (TR-XLPE) rated 90°C and 15 kV for 100 % voltage level.

.6 Semi-conducting insulation shielding layer.

.7 Copper neutral wires applied helically over insulation shield equivalent to 100 % full capacity.

.8 Separator tape over neutral wires.

.9 Insulation shield of semi-conducting thermo-setting XLPE applies as a co-extrusion with the insulation and the conductor shield.

.1 Semi-conducting insulation shield to be marked with words "SEMI-CONDUCTING – REMOVE WHEN SPLICING OR TERMINATING."

.10 Jacket, encapsulating linear low density polythethylene.

.11 Acceptable manufacturers: General Cable, Nexans, Noramco, Pirelli

2.2 CABLE TERMINATORS

.1 At BC Hydro incoming service location: Single piece indoor cable terminator 25 kV, 125kV BIL for 25kV primary system, consisting of:

.1 External insulation –non-skirted tubular design, constructed of tracking resistant silicone rubber.

.2 One-piece, non-skirted, silicone rubber termination with solderless mechanical ground assembly, and shall accommodate Tape (ribbon), Wire, or Shielded cables.

.3 Termination of a pre- stretched cold shrink design, installed without the application of a heat source.

.4 Stress relief control device.

.5 Installation procedure shall not require silicone grease.

.6 Aluminum compression connector to terminate connector.

.7 Cross arm mounting bracket complete with ground connection stud.

.2 Terminations at locations other than at BC Hydro incoming service: Single piece indoor cable terminator 15 kV, 95 kV BIL for 15 kV primary system, consisting of:

.1 Dead break elbow connectors 600 A, 15 kV, 95 kV BIL, consisting of:

.1 Arc follower.

.2 Male contact, tin-plated copper.

.3 Elbow connector housing, moulded EPDM compound.

.4 Conductor contact, copper crimp type.

.5 Voltage test point with hot stick removable cap.

.6 Grounding eye moulded in elbow housing.

.7 Moulded stress relief in elbow housing.

.8 Moulded outer jacket conductive shield.

Part 3 Execution

3.1 INSTALLATION

.1 Install concentric neutral power cables in ductbank and conduit in accordance with manufacturer's instructions.

.2 Provide supports and accessories for installation of high voltage power cable.

.3 Install stress cones, terminations and splices in accordance with manufacturer's instructions

.4 Install grounding in accordance with local inspection authority having jurisdiction.

.5 Provide cable identification tags and identify each phase conductor of power cable.

.6 Terminate cables with cable terminators as indicated and where necessary to complete the primary distribution system. Install all cable terminations to the manufacturers' specifications and instructions.

.7 Install cable terminations to each phase of a three-phase system in primary switch enclosure as per manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Use of qualified tradespersons for installation, splicing, termination and testing of high voltage power cables.

.3 Engage an independent testing agent to test high voltage power cable:

.1 Existing high voltage power cables to be non-destructively tested using the very low frequency test method

.2 New high voltage power cables to be tested using hi-pot test.

.4 Submit test result and inspection certificate.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Short circuit and protective device coordination study.

.2 Arc Flash Hazard Analysis Study: to NFPA 70E and CSA Z462.

1.2 RELATED SECTIONS

.1 Section 26 05 15 - Commissioning of Electrical Systems

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA Z462-12 – Workplace Electrical Safety

.2 Institute of Electrical and Electronics Engineers, Inc. (IEEE):

.1 IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

.2 IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis

.3 IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations

.3 The National Fire Protection Association (NFPA)

.1 NFPA 70E-2012 – Standard for Electrical Safety in the Workplace

1.4 SUBMITTALS

.1 The short-circuit, protective device coordination, and arc flash studies of the entire institution – down to and including, branch circuit breakers of secondary distribution centres – shall be submitted to the Departmental Representative prior to receiving final approval of the equipment shop drawings listed in Clause 1.2 Related Sections.

.2 The results of the short-circuit protective device coordination and arc flash hazard analysis studies shall be summarized in a final report and shall be included in the operation and maintenance manual.

.3 Upon substantial completion of the project, provide the electronic project files of the entire institution (i.e. model and library files) for use with ETAP version 16. Files to be included on CD and on USB memory stick, as well as upon request.

.4 Provide three (3) bound copies, one CD, and one USB memory stick in PDF format.

.5 The report shall include, but not be limited to, the following as a minimum:

.1 One-line diagram showing protective device ampere ratings and associated designations, cable size & lengths, transformer kVA & voltage ratings, stand-by generator kVA ratings, and switchgear/switchboard/panelboard designations.

.2 Descriptions, purpose, basis and scope of the study.

.3 Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (circuit breakers, fuses, etc.); the short circuit duties shall be upward-adjusted for X/R ratios that are above the device design ratings.

.4 Protective device time versus current coordination curves with associated one line diagram identifying the plotted devices, tabulations of ANSI protective relay functions and adjustable circuit breaker trip unit settings.

.5 Fault study input data, case descriptions, and current calculations including a definition of terms and guide for interpretation of the computer printout.

.6 Incident energy and flash protection boundary calculations.

.7 Recommendations for PPE based on incident energies.

.8 Comments and recommendations for system improvements, where needed.

.9 Executive Summary including source of information and assumptions.

1.5 QUALIFICATIONS

.1 The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Professional Electrical Engineer registered in the Province of British Columbia and skilled in performing and interpreting the power system studies.

.2 This study report shall bear the stamp of a professional engineer registered in the Province of British Columbia.

Part 2 Products

2.1 STUDIES

.1 The coordination study shall cover the entire institution and begin with the utility company's feeder protective device and include all of the electrical protective devices down to power distribution panelboards.

.2 Calculation results to include all fault point/busses for panelboards and loads as follows:

.1 120/208V and 347/600 V panelboards and loads for 3 phase symmetrical short circuit current.

.3 Allow for two iterations/submissions of the coordination study and arc flash hazard analyses prior to approval of distribution equipment and overcurrent protective devices.

.4 Allow for time to update model at completion of project with final devices as constructed.

2.2 DATA COLLECTION

.1 The Engineer performing the short-circuit protective device coordination and arc flash hazard analysis studies shall furnish Departmental Representative with a listing of required data immediately after award of the contract.

.2 Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Departmental Representative.

.3 Include fault contribution of existing motors in the study, with motors equal to or larger than 50 hp as separate equipments and less than 50 hp as grouped together. The Contractor shall obtain required existing equipment data, to satisfy the study requirements.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

.1 Use actual conductor impedances and lengths if known. If unknown, use typical conductor impedances based on IEEE Standards 141, latest edition and length measured on the Contract drawings.

.2 Transformer design impedances and standard X/R ratios on the manufacturer's technical sheet shall be used when test values are not available.

.3 Provide the following:

.1 Calculation methods and assumptions.

.2 Selected base per unit quantities.

.3 One-line diagram of the system being evaluated with available fault at each bus, and interrupting rating of devices noted.

.4 Source impedance data, including electric utility system and motor fault contribution characteristics.

.5 Typical calculations.

.6 Tabulations of calculated quantities.

.7 Results, conclusions, and recommendations.

.4 Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:

.1 Electric utility's supply termination point.

.2 Incoming switchgear.

.3 Unit substation primary and secondary terminals.

.4 Low voltage switchgear.

.5 Stand-by generator, transfer switches

.6 Branch circuit panelboards.

.7 Other significant locations throughout the system.

.5 Calculate separate short-circuit momentary and interrupting duties for stand-by generator operation for areas as defined for the three-phase bolted fault short-circuit study.

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

.7 Protective Device Evaluation:

.1 Evaluate equipment and protective devices and compare to short circuit ratings.

.2 Adequacy of switchgear and panelboard bus bracing to withstand short-circuit stresses.

.3 Adequacy of transformer windings to withstand short-circuit stresses.

.4 Cable and busway sizes for ability to withstand short-circuit heating.

.5 Notify Departmental Representative in writing, of existing circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

.1 Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

.2 Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.

.3 Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

.4 Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

.5 Plot the following characteristics on the TCC curve sheets, where applicable:

.1 Rated current and 3 phase symmetrical short circuit current values for busses of protective devices included.

.2 Electric utility's protective device.

.3 Medium voltage equipment relays.

.4 Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.

.5 Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands.

.6 Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters.

.7 Conductor damage curves.

.8 Ground fault protective devices, as applicable.

.9 Pertinent motor starting characteristics and motor damage points.

.10 Pertinent generator short-circuit decrement curve and generator damage point.

.11 Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.

.6 Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

.1 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E, Annex D.

.2 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

.3 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, panelboards, busway and splitters) where work could be performed on energized parts.

.4 The Arc-Flash Hazard Analysis shall include all 25kV, 15 kV, 600V, 120/208V installations and equipment.

.5 Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering incident energy of 1.2 cal/cm^2.

.6 The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

.7 Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

.8 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2.

2.6 REPORT SECTIONS

.1 Input Data:

.1 Utility three-phase and line-to-ground available contribution with associated X/R ratios.

.2 Short-circuit reactance of rotating machines with associated X/R ratios.

.3 Cable type, construction, size, # per phase, length, impedance and conduit type.

.4 Bus duct type, size, length, and impedance.

.5 Transformer primary & secondary voltages, winding configurations, kVA rating, impedance, and X/R ratio.

.6 Reactor inductance and continuous ampere rating.

.7 Aerial line type, construction, conductor spacing, size, # per phase, and length.

.2 Short-Circuit Data:

.1 Source fault impedance and generator contributions.

.2 X to R ratios.

.3 Asymmetry factors.

.4 Motor contributions.

.5 Short circuit kVA.

.6 Symmetrical and asymmetrical fault currents.

.3 Recommended Protective Device Settings:

.1 Phase and Ground Relays.

.2 Current transformer ratio.

.3 Current setting.
.4 Time setting.
.5 Instantaneous setting.
.6 Specialty non-overcurrent device settings.
.7 Recommendations on improved relaying systems, if applicable.

.4 Circuit Breakers:

.1 Adjustable pickups and time delays (long time, short time, ground).
.2 Adjustable time-current characteristic.
.3 Adjustable instantaneous pickup.
.4 Recommendations on improved trip systems, if applicable.

.5 Incident energy and flash protection boundary calculations.

.1 Arcing fault magnitude.
.2 Device clearing time.
.3 Duration of arc.
.4 Arc flash boundary.
.5 Working distance.
.6 Incident energy.
.7 Hazard Risk Category.
.8 Recommendations for arc flash energy reduction.

Part 3 Execution

3.1 FIELD ADJUSTMENT

.1 Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Notify Departmental Representative about locations where arc flash incident energy can be reduced to below 12 cal/cm^2 at the sacrifice of overcurrent device coordination.

.2 Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

.3 Notify Departmental Representative in writing of any required major equipment modifications including the recommended mitigation measure with supporting calculations.

3.2 ARC FLASH WARNING LABELS

.1 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

.2 Orange header with the wording, “WARNING, ARC FLASH HAZARD”, and with the following information:

.1 Location designation.

.2 Nominal voltage.

.3 Flash protection boundary.

.4 Hazard risk category.

.5 Incident energy.

.6 Working distance.

.7 Engineering report number, revision number and issue date.

.3 Labels shall be machine printed, with no field markings.

.4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

.1 For each 25kV, 15kV, 600V, and applicable 120/208V panelboards, one arc flash label shall be provided.

.2 For each low voltage switchboard, one arc flash label shall be provided.

.3 For medium voltage switches and circuit breakers, one arc flash label shall be provided for each cubicle.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 – Common Work Results for Electrical.

.2 Section 26 05 14 – Power Cable and Terminations (1001V and Over).

.3 Section 26 09 02.b – Metering and Switchboard Instruments.

.4 Section 26 12 19 – Padmounted Liquid Filled Medium Voltage Transformers.

.5 Section 26 40 00.01 – Primary Lightning Arresters

1.2 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C37.121-1989(R2000), Unit Substations - Requirements.

.2 CSA International

.1 CSA C22.2 No.14-10, Industrial Control Equipment.

.2 CSA C22.2 No.31-14, Switchgear Assemblies

.3 CSA C22.2 No.58-M1989(R2015), High-Voltage Isolating Switches.

.4 CSA C22.2 No.193-M1983(R2014), High-Voltage Full-Load Interrupter Switches

.5 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.3 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC G1-1-1958, Indoor and Outdoor Switch and Bus Insulators.

.4 Underwriters' Laboratories (UL)

.1 UL 1062-97, Standard for Unit Substations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 01 50 – General Instructions.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.

.2 Indicate:

.1 Single line diagram.

.2 Equipment layout.

.3 Equipment dimensions including door openings, draw-out equipment positions and workspace requirements.

.4 Dimensioned foundation template.

.5 Dimensioned cable entrance and exit locations.

.6 Dimensioned cable termination and pothead heights.

.7 Details of entry plate.

.3 Submit preliminary coordination study with shop drawings.

.1 Study to show co-ordination curves for protective devices from utility fuse cutouts, recloser, or upstream protective device to secondary breakers.

.2 Study to show protective devices and transformer damage curves are properly coordinated.

.3 Recommend breaker settings and main secondary breaker setting.

.4 Shop drawings will not be accepted or reviewed without co-ordination study.

.3 Test Reports:

.1 Submit production test results.

.1 Do not ship equipment until test results have been accepted by Departmental Representative.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Operation and Maintenance Data: submit operation and maintenance data for unit substation for incorporation into manual.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Include:

.1 Fuses:

.1 6 fuse refills for each type up to and including 600 A.

.2 6 of each type of indicator light bulbs installed.

Part 2 Products

2.1 MATERIALS

.1 Unit substation: ANSI C37.121 and UL 1062.

.2 Steel for cubicles: to CSA G40.21.

.3 Insulators: to CSA C22.2 No.58.

2.2 DESIGN TO INCLUDE THE FOLLOWING:

.1 Designed to **trip overcurrent protective devices and assemblies within 25ms** utilizing feeder protection relay c/w protective relays as noted on drawings. Provide letter, calculation and TCC characteristics to confirm compliance with the design criteria (signed and sealed by a Professional Engineer registered in the Province of British Columbia).

.2 Lightning and surge arrestors.

.3 External shunt trip ability.

.4 CT compartment for supply authority primary meter as required.

.5 Digital meter compatible with existing digital metering system at Building 106 (Eaton Power Xprt Meter 2000) and to section 26 09 02.b – Metering and Switchboard Instruments.

.6 Gauge auxiliary contacts.

.7 Environmentally friendly, liquid-filled transformer.

.8 Low voltage terminal lugs to suit conductor size (note reducers may be required)

.9 Transformer overload/over temperature shunt trip.

.10 Single phase protection

.11 Secondary ground fault detection and annunciation

.12 Marine grade steel front end enclosure

2.3 PRIMARY SWITCHGEAR

.1 Primary switchgear: 25kV, 600A, 3 phase, 4 wire, interrupting capacity 12kA, BIL 125kV, live front cable termination assemblies to BC Hydro standards.

.2 Primary switchgear: 15kV, 600A, 3 phase, 4 wire, interrupting capacity 16kA, BIL 95kV, dead break cable terminations for unit substations US-103 and US-105.

2.4 ENCLOSURE

.1 Enclosure: metal clad free standing, pad mounted, dead front, outdoor, tamperproof, non-walk in CSA enclosure 3R cubicle unit.

.1 Constructed from rolled flat steel sheets to UL 1062.

.2 Ventilating louvres: vermin, insect, rain proof with easily replaceable fiberglass filters.

.3 Use non-corrodible bolts and hardware.

.4 Access from front and back.

.5 100 mm steel channel sills for base mounting in single length common to multi-cubicle switch board.

.6 Full height outer door reinforced with stiffeners, gasketted, hinges, provision for multiple padlocking. Three-point latch, stops, to open at least 135 degrees with viewing windows of transparent shatterproof material for inspection of disconnecting switch position.

.7 Inner doors to open at least 90 degrees.

.8 Hinge doors of multi-cubicle switchboard on same side.

.9 Gaskets on removable covers.

.10 Removable cover bolts not accessible from outside of cubicle.

.11 Interior hinged and bolted mesh steel screens to prevent inadvertent contact with exposed

live parts.

.12 Storage container on inside surface of compartment to accommodate 3 spare fuse refills.

.13 Metal pocket on inside surface of door to accommodate drawing and diagram prints.

.14 Space heaters: self-powered, 120 V, 250 W, 60 Hz, single phase, in each cubicle complete with thermostat, overcurrent protective device, and disconnect switch.

2.5 TERMINATIONS

.1 In accordance with Section 26 05 14 – Power Cable and Terminations (1001V and over).

2.6 PRIMARY BUS BARS AND CONNECTIONS

.1 Three phase and full capacity neutral bus bars, continuous current rating 600A extending full width of cubicle suitably supported on insulators.

.2 Main connections between bus bars and major switching components to match major switching components.

.3 Copper for bus bars and main connections.

.4 Provision for future extension of bus on both sides of unit without need for further drilling or preparation in field.

.5 Brace bus-bar system to withstand stresses resulting from short circuit currents specified.

.6 Tin surfaced joints, secured with non-corrosive bolts and washers, tightened with torque wrench in accordance with manufacturer's recommended load.

.7 Identify phases of bus bars by suitable marking and/or coloured paint.

.8 Busbar connectors when switchgear shipped in more than one section.

2.7 GROUNDING

.1 Copper ground bus not smaller than 50 x 6 mm extending full width of cubicle and situated at bottom. Lugs at each end for size 4/0 AWG grounding cable.

.2 Bond non current carrying metal parts, including switchgear framework, enclosure and bases to ground bus.

2.8 LOAD INTERRUPTER SWITCH

.1 Load Interrupter Switch: to CSA C22.2 No.193.

.2 3 pole, quick-make, quick-break assembly, stored energy operating mechanism manual operated, assembled on welded steel base.

.3 Continuous full load rating: 600A, interrupting rating: 16kA, symmetrical at primary voltage.

.4 Voltage rating: as indicated.

.5 95kV BIL for 15kV primary voltage; 125 kV BIL for 25kV primary voltage.

.6 Interphase barriers.

.7 Non-removable operating handle c/w provision for pad locking and/or key interlock as

shown.

.8 Enclosure: CSA Enclosure 3R.

.9 Include viewing windows that permits full view of the position of all three switch blades.

.10 Interlocks with features as follow:

.1 Mechanically interlocked door to prevent opening when handle in ON position.

.2 Switch can be closed only after fuse access door is closed.

2.9 CIRCUIT BREAKER

.1 Design: outdoor SF-6 circuit breaker or vacuum circuit breaker, 3 pole, single break, power operated, draw out breaker element, sized as indicated.

.2 Breaker operating mechanism:

.1 48V DC solenoid closing and 48V DC shunt trip.

.2 Stored energy closing.

.3 Breaker interrupting capacity: 500 MVA at primary voltage.

.4 Breaker tripping devices, solid state as indicated.

.1 Instantaneous overcurrent relays.

.2 Reverse power relay.

.3 Overvoltage relay.

.4 Undervoltage relay.

.5 Frequency relay.

.6 Time overcurrent relay.

.7 Locking-out relay.

.8 Time-delay relay.

.9 Ground fault relay.

.10 Negative sequence relay.

.5 Trip setting devices: switches.

.6 Auxiliary contacts: 2 - N.O., 2 - N.C.

.7 Auxiliaries:

.1 Status light: open-green, close-red.

.2 Status flags: open-green, close-red.

2.10 LIGHTNING ARRESTERS

.1 Lightning arresters to 26 40 00.01 – Primary Lightning Arresters

2.11 INTERLOCKS

.1 Electrical interlock between normal power circuit breaker and standby power circuit breaker to prevent:

.1 Standby power breaker closing unless normal power breaker is open.

.2 Normal power breaker closing unless standby power breaker is open.

.2 Kirk key interlocks, Type F for load interrupter switch and Type D for switchgear cubicle door to prevent:

.1 Opening cubicle door for access to fuses while load interrupter is in closed position.

.2 Closing load interrupter while cubicle door is open.

.3 Kirk key interlocks Type F for normal power breaker and standby power breaker to prevent:

.1 Standby power breaker closing unless normal power breaker is open.

.2 Normal power breaker closing unless standby breaker is open.

.4 Key interlocks mounted in switchgear so that interlocks can not be removed when operating mechanism is in closed position.

2.12 INSTRUMENT TRANSFORMERS

.1 Potential transformers: to CSA C13, compound filled for outdoor use as required.

.2 Potential transformers fused with separate fuse block. Fuses: as required.

.3 Current transformers: to CSA C13, compound filled for outdoor use as required.

.4 Current transformers to have positive action automatic short-circuiting device in secondary terminals.

2.13 MOUNTING BRACKETS

.1 Potential transformers with channel type mounting brackets.

.2 Fabricate brackets and channels from electrogalvanized code gauge painted steel.

2.14 INDICATOR LIGHTS

.1 Include 30 mm long life LED indicator lights rated for appropriate control voltage to CSA C22.2 No.14.

.2 Include push to test lights with transparent plastic cover.

2.15 TRANSFORMERS

.1 Refer to Section 26 12 19 – Padmounted Liquid Filled Medium Voltage Transformers.

2.16 SECONDARY DISTRIBUTION CENTRE

.1 Refer to Section 26 24 13, unless otherwise noted below.

.2 Secondary distribution centre: outdoor non-walk in type. Voltage, current, and phase rating as indicated on drawings. Minimum short circuit current withstand capability 35 kA.

.3 Enclosure:

.1 Match primary switchgear enclosure construction.

.2 Distribution cubicle to contain:

.1 Molded case circuit breakers with LSIG electronic tripping units feature, sized as indicated.

.2 Tinned copper bus from main cubicle to distribution cubicles, including vertical bussing

.3 50% blanked off spaces for future devices.

.4 Busbars and connections:

.1 Three phase insulated bus bars, continuous current rating as shown on drawings, self-cooled, extending from main cubicle to distribution cubicles including vertical bus

.5 Neutral: solidly grounded

2.17 SECONDARY CIRCUIT BREAKERS

.1 For 208V or 600V distribution: circuit breakers shall have a minimum symmetrical interrupting capacity of 35,000 amperes. To ensure a selectively coordinated system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings, regardless of whether equipped with instantaneous trip protection or not.

.2 All circuit breakers suitable for protection devices specified below.

.1 Molded case circuit breakers, with electronic tripping units, LSIG

.2 Breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-centre switching mechanism that is mechanically trip-free.

.3 Padlocking mechanism for all breakers

.4 Automatic tripping of the breaker shall be clearly indicated by the handle position.

.5 Contacts shall be no welding silver alloy and arc extinction shall be accomplished by means of arc chutes.

.6 A push-to-trip button to provide a local manual means to exercise the trip mechanism.

.7 Minimum symmetrical interrupting rating as shown on the drawings.

.8 Where indicated provide CSA listed circuit breakers for applications at 100% of their continuous ampere rating in their intended enclosure.

2.18 SECONDARY CIRCUIT BREAKER TRIP UNITS

.1 Microprocessor based, with three (3) current sensors, a trip unit and a flux-transfer shunt trip.

.2 True rms sensing.

.3 Shunt trip capability to receive tripping signals from auxiliary protective relay devices.

.4 Continuous trip ratings established by interchangeable rating plugs, interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.

.5 System coordination shall be provided by the following microprocessor-based

programmable time/current curve shaping adjustments:

.1 Programmable long-time pickup settings in 1% increments, with +/- 5% band tolerance.

.2 Programmable long-time delay with selectable I^2t or I^4t curve shaping.

.3 Programmable short-time settings (dependent on long-time setting) in 1% increments, with +/- 5% band tolerance.

.4 Programmable short-time delay with selectable flat or I^2t curve shaping.

.5 Programmable instantaneous pickup settings in 1% increments.

.6 Programmable ground fault pickup settings trip or alarm in 1% increments.

.7 Programmable ground fault delay with selectable flat or I^2t curve shaping.

.6 Powered/unpowered selectable thermal memory to provide protection against cumulative overheating.

.7 Selectable discriminator circuit prevent the breaker being closed and latched on to a faulted circuit.

.8 Internal ground fault.

.9 Battery backed-up LEDs to indicate mode of trip following an automatic trip operation, retained after trip complemented by trip event information stored in non-volatile memory after a trip event. A trip reset button shall be provided to turn off the LED indication and reset the memory after an automatic trip. A test pushbutton shall energize an LED to indicate battery status.

.10 A red LED shall be provided on the face of the trip unit and pre-set to flash on and off when an adjustable high-load level is exceeded. A time-delay shall be provided to avoid nuisance alarms. The microprocessor-based trip units shall be capable of monitoring the following data:

.1 Instantaneous value of phase, neutral and ground current

.2 Minimum and maximum current values

.3 Average demand current

.4 System diagnostic information such as alarms and cause of trip

.5 Approximate level of fault current that initiated an automatic trip operation

.11 A hand-held programming unit to set/change the network communication breaker address for each device, set the system baud rate, distribution frequency, display breaker information, and display monitored values. The programmer shall be self-powered by an internal battery. Provide as a minimum one (1) hand-held programming unit per assembly.

.12 The trip unit shall be capable of two-way communication via a network twisted pair for remote monitoring and control. All monitored values shall be transmittable over the network.

.13 Zone interlocking capability for the short-time delay and ground fault delay trip functions for improved system coordination.

.14 Built-in metering system to monitor following parameters:

.1 Peak demand (kW)

.2 Present demand (kW)

.3 Total energy (kWh)

.4 Power factor

.5 Percentage harmonic content

.6 Total Harmonic Distortion (THD)

2.19 SUPPLY AUTHORITY METERING

.1 Arrange with authority having jurisdiction for supply of mounting and wiring for items as follows:

.1 Potential transformers.

.2 Current transformers.

.3 Watthour meter.

.4 Demand meter with kWh register.

.5 Ammeter.

.6 Voltmeter.

.7 Ammeter phase selector switch.

.8 Voltmeter phase selector switch.

.2 Separate compartment and metal raceway for exclusive use of supply authority having jurisdiction metering.

2.20 SHOP FABRICATION

.1 Shop assemble and test components of substation.

.2 After completion of factory assembly and high potential test, prepare for shipment to site, complete with hardware for re-assembly and re-connecting.

2.21 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Cubicle exteriors: green.

.3 Cubicle interiors: white.

.4 Supply 2 spray cans touch up paint.

2.22 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplates: submit nameplates to Departmental Representative for approval

.1 Primary switchgear-white plate, black letters, size 7:

.1 Engraved: "Primary Cubicle".

.2 Engraved: "Main Breakers Switch”

.3 Engraved: “[enter Primary Voltage] fed from [closest upstream

switch/service]"

.2 Transformer Section: white plate, black letters, size 7:

.1 Engraved: "Transformer" "[as indicated on drawings] kVA, [as indicated on drawings] V to [as indicated on drawings] V, 3 phase, 60 Hz".

.2 Winding temperature device engraved: "Winding Temperature".

.3 Oil thermometer engraved: "Oil Temperature".

.3 Secondary switchgear: white plate, black letters, size 7:

.1 Engraved: "Low Voltage Cubicle".

.2 Engraved: "Main Breaker".

.3 Engraved: "Feeder [No. 1]", "Feeder [No. 2]", "Feeder [No. 3]", as required.

2.23 WARNING SIGNS

.1 Include warning signs in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.24 MIMIC BUS

.1 Single line mimic diagrams on the front of the cubicle for the complete assembly.

.2 Integrates the position indicators to give a clear visual display of the circuit breaker's status: open, closed, isolated, in service.

.3 Positive indication of the status of the grounding switch.

.4 Mimic diagrams shall be visible in the event of a power failure.

2.25 COORDINATION STUDY AND COMMISSIONING

.1 Refer to Section 26 05 73, in addition include the following:

.1 Submission for approval to BC Hydro to include coordination study from utility source to largest downstream device, including phase and ground overcurrent plots.

.2 BC Hydro statement of primary voltage stamped and sealed by a professional engineer registered with APEGBC

.3 Equipment commissioning in accordance with CEC Rules – All testing performed to NETA ATS and applicable IEEE/ANSI Standards

.1 Unit substation Tests:

.1 Transformer turn ratio

.2 Insulation test – HV- ground, LV-Ground, HV-LV

.3 Resistance Test (Switch and Transformer)

.4 Equipment inspection

.5 Ground resistance test

.2 Secondary Equipment

.1 Secondary cable insulation test

.2 Secondary breaker set up and calibration

.3 Secondary breaker test as applicable

.3 Station grounding, ground grid step/touch potential calculation per IEEE Standard 80, as required by CEC Table 52, site testing and sealed by a professional engineer registered in BC.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit substation installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Set and secure cubicles and transformers in place, rigid, plumb and square, on channel bases.

.2 Interconnect cubicles and transformer with bus bar connections supplied by manufacturer.

.3 Check factory-made connections for mechanical security and electrical continuity.

.4 Run 1 grounding conductor 4/0 AWG bare copper in 25 mm conduit from substation ground bus to electrical room ground bus.

.5 After finishing Work, remove foreign material, including dust, before energizing substation.

.6 Set transformer taps for secondary voltage of 120 and 208V at no load.

.7 Check relay settings against shop drawings to ensure proper working of components and that co-ordinated sequence of action is established.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Check insulation of switchgear assembly with 1000V megger. If values not satisfactory, clean, and dry and heat switchgear and repeat tests until readings acceptable to the Engineer.

.3 Operate load interrupter and circuit breaker closing and tripping mechanisms, to verify correct functioning.

.4 Check phase rotation of each feeder.

.5 Place primary switchgear in service and check ammeter, voltmeter, wattmeter, power factor meter readings to ensure proper functioning of instruments and satisfactory phase balance and power factor of loads.

.6 Test for 24 consecutive hours, to include:

.1 Primary and secondary voltage at no load.

.2 Primary and secondary voltages at normal load once per hour.

.3 Primary and secondary current in each phase once per hour.

.4 kW and kVA once per hour.

.5 Transformer and ambient temperature once per hour.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by unit substation installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 02 50 13 – Management of Toxic Waste

.2 Section 26 05 00 - Common Work Results for Electrical

.3 Section 26 40 00.01 - Primary Lightning Arrestors

.4 Section 26 05 14 – Power Cable and Terminations (1001V and Over)

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers, Inc. (IEEE)

.1 ANSI/IEEE 386-95(R2001), Separable Insulated Connector Systems for Power Distribution Systems Above 600 V.

.2 ANSI/IEEE C62.11, Metal-Oxide Surge Arresters for AC Power Circuits (>1kV)

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-C2.1-06, Single-phase and three-phase liquid-filled distribution transformers.

.2 CAN/CSA-C227.4-06, Three-Phase Pad-Mounted Distribution Transformers with Separable Insulated High-Voltage Connectors.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, and limitations.

.3 Submit shop drawings and indicate:

.1 Anchoring method and dimensioned foundation template.

.2 Dimensioned cable entry locations.

.4 Identified internal and external component layout on assembly drawing.

.5 Insulating liquid capacity.

.6 Submit primary fuse and secondary breaker time-current characteristics.

.7 Quality Assurance Submittals: submit following in accordance with Section 01 01 50 – General Instructions.

.1 Certificates: submit production certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.8 Closeout Submittals:

.1 Provide operation and maintenance data for pad mounted distribution transformers for incorporation into manual specified in Section 01 01 50 – General Instructions.

.2 Include insulating liquid maintenance data.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 02 50 13 – Management of Toxic Waste.

1.5 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 01 01 50 – General Instructions.

Part 2 Products

2.1 EQUIPMENT

.1 Constructed for outdoor installation NEMA 3R, metal-clad single phase, or three phase, dead front pad mounted distribution transformers: to CSA C2.1 or C227.4, respectively. Separable insulated connectors for power distribution systems above 600 V: to ANSI/IEEE 386.

.2 Liquid filled distribution transformer complete with primary and secondary cable compartments and accessories to form complete factory assembled, self contained, steel fabricated unit low profile unit for mounting on concrete pad. The dielectric liquid shall be seed breed environmental friendly type.

.3 High voltage bushings or high voltage bushing wells for connection to distribution system through separable insulated connectors for dead front operation.

.4 Spade type low voltage terminals.

.5 Connectors for primary and secondary cables.

.6 Designed and constructed for loop feed operation.

.7 Two fuse system as defined in CAN/CSA C2.1 and C227.04-06 to be provided and complete with 3 spare BAYONET fuses.

.8 Mechanical interlock systems to prevent access to primary compartment unless primary supply is isolated at source. Separate padlocking for primary compartment door.

.9 Under-oil lightning arresters, 15kV, to ANSI C62.11.

.10 Load break inserts for elbow connectors.

.11 Stays to hold compartment doors in 110 degrees open position.

.12 Barrier shall be provided between secondary voltage and primary voltage compartment.

.13 Single-phase transformers to be complete with hinged cabinet doors and secondary switchboard c/w overcurrent protective devices as shown.

2.2 TRANSFORMER CHARACTERISTICS

.1 Primary voltage: 12.5 kV, 60 Hz, delta connected, three phase, neutral and grounded.

.2 Primary voltage: 7.2 kV, 60 Hz, delta connected, single phase, neutral and grounded.

.3 Secondary voltage: voltage as indicated on drawing, wye connected, three phase, four wire, neutral grounded.

.4 Capacity: kVA rating as indicated on drawing.

.5 Copper winding.

.6 Type: ONAN.

.7 Temperature Rise: 65 degree C.

.8 Basic impulse level: 95 kV.

.9 Impedance: 4%.

.10 No load losses: standard.

.11 Full load losses: standard.

.12 Average sound level: 55dB.

2.3 VOLTAGE TAPS

.1 Four-2.5% taps, 2-FCAN, 2-FCBN.

2.4 TAP CHANGER

.1 Externally operated off-load tap changer, with provision for padlocking on 3 phase units.

2.5 ACCESSORIES

.1 Liquid temperature thermometer with two sets of contacts.

.2 Liquid level gauge with two sets of contacts.

.3 Pressure relief device.

.4 Internal current limiting primary fuse

.5 Secondary circuit breaker as per drawings.

.6 25 mm drain valve.

.7 25 mm filler plug.

.8 Voltage selector switch.

2.6 GROUNDING

.1 Copper grounding bus.

.2 Connectors for grounding conductor size 4/0 or as indicated.

2.7 FINISH

.1 Two coats of enamel over one coat of rust resistant primer. Finish exterior of unit in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate information label to match existing Institution standard.

2.9 WARNING SIGNS

.1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.10 SOURCE QUALITY CONTROL

.1 Submit to Departmental Representative standard factory test certificates of each transformer and type test of each transformer with high voltage accessories in accordance with CSA-C227.4.

2.11 ACCEPTABLE MANUFACTURERS

.1 Carte International, Pioneer, Cam Tran, Cooper Power, PTI

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Transformer to be filled with insulating oil by manufacturer prior to shipment.

3.2 INSPECTION

.1 Check factory made connections of transformer unit for mechanical security and electrical continuity.

.2 Check transformer insulating liquid for correct quantity and specification per manufacturer's instructions.

.3 Check for leakage of insulating liquid.

3.3 INSTALLATION

.1 Provide a structural engineer (registered in APEGBC) to design a pre-cast reinforced concrete pad or cast-in-place reinforced concrete pad, with seismic restraint anchoring. Size the concrete pad to suit transformer shop drawings for physical footprint and cable entries. Submit detailed shop drawings (signed and sealed by a Professional Engineer registered in the Province of British Columbia) for review.

.2 Ensure concrete pad is fully cured before transformer is installed.

.3 Set and secure transformer unit in place, rigid, plumb and square. Bolt down transformer in accordance with manufacturer’s shop drawings.

.4 Make connections.

.5 Connect transformer unit ground bus to system ground.

.6 When field filling of transformer is necessary, the filling shall be done by transformer manufacturer’s representative.

.7 Set taps to produce the rated secondary voltage at no load.

.8 Wire one set of contacts on liquid temperature thermometer, liquid level gauge, to sound alarm when unsafe condition reached, wire second set of contacts to trip transformer circuit interrupter.

.9 Ensure care is taken to prevent contamination of liquid and components when field filling transformer.

.10 Use only metal hose when field-filling transformer with oil: do not use rubber hose.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Contractor to include and allow for equipment manufacturer or separate independent testing company to perform on site testing of units and equipments.

.3 Carry out following insulation tests using megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20 degrees C.

.1 High voltage to ground with secondary grounded for duration of test.

.2 Low voltage to ground with primary grounded for duration of test.

.3 High to low voltage.

.4 Inspect primary and secondary connections for tightness and for signs of overheating.

.5 Inspect and clean bushings and insulators.

.6 Check oil level and temperature indicators.

.7 Set transformer taps to rated voltage as specified.

.8 Inspect for oil leaks and excessive rusting.

.9 Inspect oil level.

.10 Check fuses for correctness of type and size.

.11 Check circuit breakers for size and settings.

.12 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

.13 Record phase and neutral voltages and currents under normal load.

.14 Record tap setting and adjust as directed. Record phase voltage and current with new tap setting.

.15 Record circuit breaker settings.

.16 Failed transformer is to be replaced at no cost and shall be expedite for delivery as soon as possible. Implement temporary solution at no cost.

.17 Obtain inspection certificate of compliance covering field quality control mentioned above from inspection authority and include it with as-built drawings and maintenance manuals.

3.5 CLEANING

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 09 02.b – Metering and Switchboard Instruments

.2 Section 26 28 21 – Moulded Case Circuit Breakers

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.31-04, Switchgear Assemblies

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC G8-3.3, Metal-Enclosed Interrupter Switchgear Assemblies

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for switchboards and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit maintenance materials in accordance with Section 01 01 50 – General Instructions.

.2 Provide spare parts as recommended by manufacturer for maintenance period of 2 years minimum.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 01 50 – General Instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect switchboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Rating: 120/208V, 3 phase, 4 wire, amperage as indicated, 65kA short circuit current (rms symmetrical) or as indicated; 347/600V, 3 phase, 4 wire, amperage as indicated, 25kA short circuit current (rms symmetrical) or as indicated.

.2 Cubicles: free-standing, dead front, size as indicated.

.3 Distribution section.

.4 Hinged access panels with captive knurled thumb screws.

.5 Bus bars and main connections: 99.3% tinned copper.

.6 Identify phases with colour coding.

.7 Complete with drip shields.

2.2 ENCLOSURE

.1 Main incoming section to contain:

.1 Top or side/rear entry pull boxes, sized as required, to permit feeder drip loop

.2 Distribution sections to contain:

.1 Moulded case circuit breakers sized as indicated

.2 Tinned copper bus, from main section to distribution sections including vertical bussing.

.3 Blanked off spaces for future units.

.4 Metal enclosed, free standing, floor mounted, dead front, indoor, CSA enclosure 1 cubicle unit with sprinkler shield.

.5 Ventilating louvres: vermin, inspect proof with easily replaceable fibreglass filters.

.6 Access from front.

.7 Steel channel sills for base mounting in single length common to multi-cubicle switchboard.

.8 Provision for future extension as indicated on drawing.

.9 Provide barrier/isolation for main breaker compartment to prevent arc flash from escalating from branch breakers to main breaker compartment.

2.3 BUS BARS

.1 Three phase and full capacity neutral, bare busbars, continuous current rating as indicated on drawing. A self-cooled, extending full width of multi-cubicle switchboard, suitably supported on insulators.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: 99.30% conductivity.

.4 Provision for extension of bus without need for further drilling or preparation in field.

.5 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one Section.

2.4 GROUNDING

.1 Copper ground bus not smaller than 50 x 6 mm extending full width of multi-cubicle switchboard and situated at bottom.

.2 Lugs at each end for size 4/0 AWG grounding cable.

2.5 MOULDED CASE CIRCUIT BREAKERS

.1 Refer to Section 26 28 21 – Molded Case Circuit Breakers

2.6 INSTRUMENTS

.1 Instruments and digital information meter in accordance with Section 26 09 02b – Metering and Switchboard Instruments

2.7 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 – Common Work Results for Electrical

.1 Cubicle exteriors: grey

2.8 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for Electrical.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Locate switchgear assembly as indicated and bolt to floor.

.2 Connect main secondary power supply to main breaker, or as indicated on drawing.

.3 Connect load side of breakers in distribution cubicles to distribution feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run one grounding conductor 4/0 AWG bare copper in 25 mm conduit from ground bus to ground.

.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Include all associated costs to have manufacturer’s representative visit the site for 8 hours

to aid in commissioning equipment. Forward all commissioning documentation to the Consultant for review.

.3 Coordinate field control performance and testing with designated commission agent.

END OF SECTION