



SPECIFICATIONS

SOLICITATION #: 17-22103

BUILDING: M-58
1200 Montreal Road
Ottawa, Ontario

PROJECT: M58- Electrical Vault Upgrade

PROJECT #: M58-5160

Date: November 2017



SPECIFICATION

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Directions to the Ottawa Research Facilities – Montreal Road

1200 Montréal Road
Ottawa, Ontario, Canada K1A 0R6

Tel: 613-993-9101

NRC Institutes/Branch/Program	Buildings
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NRC Institute For Research In Construction (NRC-IRC)	M-20, M-24, M-25, M-27, M-42, M-48, M-59
NRC Strategy and Development Branch (NRC-SDB)	M-58

By Road, from the OTTAWA International Airport

1. From the airport take the AIRPORT PARKWAY to RIVERSIDE DR EAST
2. Follow RIVERSIDE DR EAST to HIGHWAY 417 EAST
3. Take HIGHWAY 417 EAST, past the ST-LAURENT BLVD exit, where HIGHWAY 417 splits, continue LEFT on HIGHWAY 174 (ROCKLAND)
4. Exit HIGHWAY 174 on BLAIR RD NORTH
5. Proceed on BLAIR RD NORTH, cross OGILVIE RD, and continue on to the traffic lights at the intersection of BLAIR and MONTREAL RD
6. Turn left onto MONTREAL RD and take the first immediate right onto the ramp leading down to the traffic circle. Stop at Building M-1 on the north side of the traffic circle. Ask the commissionaires in M-1 for directions to the NRC building, institute or staff member you seek.

By Road, from MONTRÉAL

1. Take MÉTROPOLITAIN 40 WEST and follow signs for OTTAWA and HIGHWAY 417 WEST
2. Follow 417 WEST to reach OTTAWA
3. Exit at HIGHWAY 174 EAST (ROCKLAND) when entering OTTAWA
4. Follow 174 EAST and exit at BLAIR RD NORTH (first exit after entering 174 EAST)
5. Follow BLAIR RD NORTH, cross OGILVIE RD, and continue on to the traffic lights at the intersection of BLAIR and MONTREAL RD
6. Turn left onto MONTREAL RD and take the first immediate right onto the ramp leading down to the traffic circle. Stop at Building M-1 on the north side of the traffic circle. Ask the commissionaires in M-1 for directions to the NRC building, institute or staff member you seek.





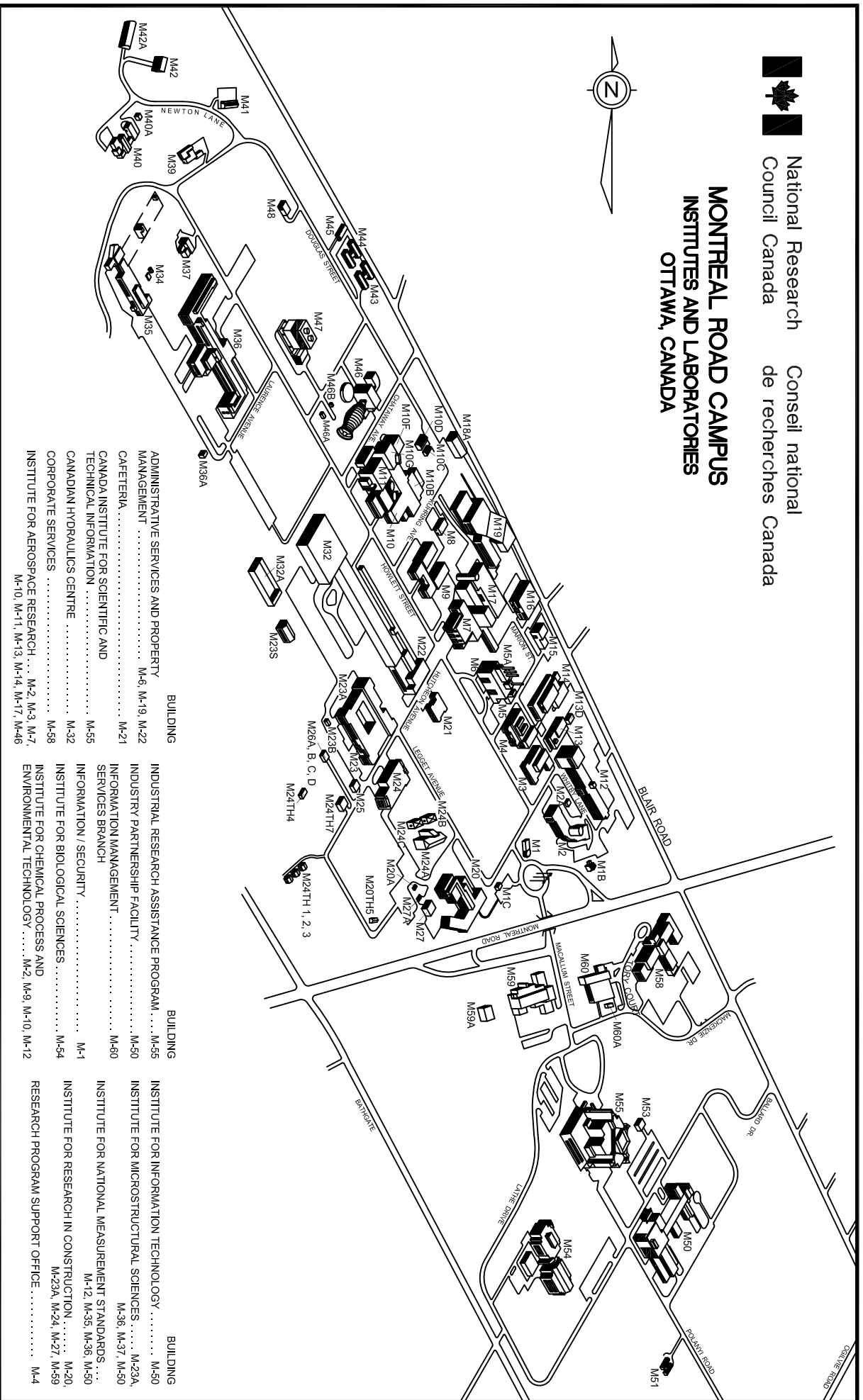
- | | | | | |
|--|---|---|---|---|
|  NRC Institute |  Major HWY |  Airport |  Ferry |  Metro |
|  Trans Canada HWY |  Secondary HWY |  Train Station |  Bus Station | |



National Research Council Canada

Conseil national de recherches Canada

MONTREAL ROAD CAMPUS INSTITUTES AND LABORATORIES OTTAWA, CANADA



- BUILDING**
- ADMINISTRATIVE SERVICES AND PROPERTY MANAGEMENT M-6, M-19, M-22
 - CAFETERIA M-21
 - CANADA INSTITUTE FOR SCIENTIFIC AND TECHNICAL INFORMATION M-55
 - CANADIAN HYDRAULICS CENTRE M-32
 - CORPORATE SERVICES M-58
 - INSTITUTE FOR AEROSPACE RESEARCH M-2, M-3, M-7, M-10, M-11, M-13, M-14, M-17, M-46

- BUILDING**
- INDUSTRIAL RESEARCH ASSISTANCE PROGRAM M-55
 - INDUSTRY PARTNERSHIP FACILITY M-50
 - INFORMATION MANAGEMENT M-60
 - SERVICES BRANCH
 - INFORMATION / SECURITY M-1
 - INSTITUTE FOR BIOLOGICAL SCIENCES M-54
 - INSTITUTE FOR CHEMICAL PROCESS AND ENVIRONMENTAL TECHNOLOGY M-2, M-9, M-10, M-12

- BUILDING**
- INSTITUTE FOR INFORMATION TECHNOLOGY M-50
 - INSTITUTE FOR MICROSTRUCTURAL SCIENCES M-23A, M-36, M-37, M-50
 - INSTITUTE FOR NATIONAL MEASUREMENT STANDARDS M-12, M-35, M-36, M-50
 - INSTITUTE FOR RESEARCH IN CONSTRUCTION M-20, M-23A, M-24, M-27, M-59
 - RESEARCH PROGRAM SUPPORT OFFICE M-4

National Research Council Conseil national de recherches
Canada Canada

Administrative Services Direction des services
& Property management administratif et gestion
Branch (ASPM) de l'immobilier (SAGI)

Construction Tender Form

Project Identification **M58- Electrical Vault Upgrade**

Tender No.: **17-22103**

1.2 Business Name and Address of Tenderer

Name _____

Address _____

Contact Person(Print Name) _____

Telephone (_____) _____ **Fax:** (_____) _____

1.3 Offer

I/We the Tenderer, hereby offer to Her Majesty the Queen in Right of Canada (hereinafter referred to as "Her Majesty") represented by the National Research Council Canada to perform and complete the work for the above named project in accordance with the Plans and Specifications and other Tender Documents, at the place and in the manner set out therein for the Total Tender Amount (to be expressed in numbers only) of: \$_____. _____ **in lawful money of Canada (excluding GST/HST)**

The above amount is inclusive of all applicable (*) Federal, Provincial and Municipal taxes except that in the event of a change in any tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property, that occurs

- .1 after the date this tender was mailed or delivered, or
- .2 if this tender is revised, after the date of the last revision

the amount of this offer shall be decreased or decreased in the manner provided for in GC22 of the General Conditions of the Contract Documents.

National Research Council Canada	Conseil national de recherches Canada
Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)

1.3.1 Offer (continued)

(*) For the purpose of this tender, the Goods and Services Tax (GST) is not to be considered as an applicable tax.

In the province of Quebec, the Quebec Sales Tax is not to be included in the tender amount because the Federal Government is exempt from this tax. Tenderers shall make arrangements directly with the provincial Revenue Department to recover any tax they may pay on good and servives acquired in the performance of this contract. However, tenderers should include in their tender amount Quebec Sales Tax for which an Input Tax Refund is not available.

1.4 Acceptance and Entry into Contract

I/We undertake, within fourteen (14) days of notification of acceptance of my/our offer, to sign a contract for the performance of the work provided I/we are notified, by the Department, of the acceptance of my/our offer within 30 days of the tender closing date.

1.5 Construction Time

I/We Agree to complete the work within the time stipulated in the specification from the date of notification of acceptance of my/our offer.

1.6 Bid Security

I/We herewith enclose tender security in accordance with Article 5 of the General Instruction to Tenderers.

I/We understand that if a security deposit is furnished as tender security and if I/we refuse to enter into a contract when called upon to do so, my/our security deposit shall be forfeited but the Minister may, if it is in the public interest, waive the right of Her Majesty to forfeit the security deposit.

I/We understand that if the security furnished is not in the approved form as described in Article 5 of the General Instructions to Tenderers, my/our tender is subject to disqualification.

National Research Council Canada	Conseil national de recherches Canada
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Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)
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1.7 Contract Security

Within fourteen (14) days after receipt of written notification of the acceptance of my/our offer, I/we will furnish contract security in accordance with the Contract Conditions "F" of the Contract Documents.

I/We understand that the contract security referred to herein, if provided in the form of a bill of exchange, will be deposited into the Consolidated Revenue Fund of Canada.

1.8 Appendices

This Tender Form includes Appendix No. ____N/A_____.

1.9 Addenda

The Total Tender Amount provides for the Work described in the following Addenda:

NUMBER	DATE	NUMBER	DATE

(Tenderers shall enter numbers and dates of addenda)

National Research Council Canada	Conseil national de recherches Canada
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Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)
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1.10 Execution of Tender

The Tenderer shall refer to Article 2 of the General Instructions to Tenderers.

**SIGNED, ATTESTED TO AND DELIVERED on the _____ day of
_____ on behalf of**

(Type or print the business name of the Tenderer)

AUTHORIZED SIGNATORY (IES)

(Signature of Signatory)

(Print name & Title of Signatory)

(Signature of Signatory)

(Print name & Title of Signatory)

SEAL

BUY AND SELL NOTICE

M58- Electrical Vault Upgrade

The National Research Council Canada, 1200 Montreal Road Ottawa, ON has a requirement for a project that includes:

Replace High Voltage and Low Voltage equipment in electrical vault located at building M-58.

1. GENERAL

Questions regarding any aspect of the project are to be addressed to and answered only by the Departmental Representative (or his designate) or the Contracting Authority.

Any information received other than from the Departmental Representative (or his designate) or the Contracting Authority will be disregarded when awarding the contract and during construction.

Firms intending to submit tenders on this project should obtain tender documents through the Buyandsell.gc.ca TMA services provider. Addenda, when issued, will be available from the Buyandsell.gc.ca TMA service provider. Firms that elect to base their bids on tender documents obtained from other sources do so at their own risk and will be solely responsible to inform the tender calling authority of their intention to bid. Tender packages are not available for distribution on the actual day of tender closing.

2. MANDATORY SITE VISIT

It is mandatory that the bidder attends one of the site visits at the designated date and time. At least one representative from proponents that intend to bid must attend.

The site visits will be held on November 29th and December 1st, 2017 at **9:00**. Meet Maurice Richard at Building M58, Main Entrance, 1200 Montreal Road Ottawa, ON. Bidders who, for any reason, cannot attend at the specified date and time will not be given an alternative appointment to view the site and their tenders, therefore, will be considered as non-responsive. **NO EXCEPTIONS WILL BE MADE.**

As proof of attendance, at the site visit, the Contracting Authority will have an Attendance Form which **MUST** be signed by the bidder's representative. It is the responsibility of all bidders to ensure they have signed the Mandatory Site Visit Attendance form prior to leaving the site. Proposals submitted by bidders who have not attended the site visit or failed to sign the Attendance Form will be deemed non-responsive.

3. CLOSING DATE

Closing date is December 21st, 2017 at 14:00.

4. TENDER RESULTS

Following the Tender closing, the tender results will be sent by facsimile to all Contractors who submitted a tender

5. SECURITY REQUIREMENT FOR CANADIAN CONTRACTORS

5.1 MANDATORY SECURITY REQUIREMENT:

This procurement contains a mandatory security requirement as follows:

- 1 The Contractor must, at all times during the performance of the Contract, hold a valid Designated Organization Screening (DOS), issued by the Canadian Industrial Security Director (CISD), Public Works Government Services Canada.
- 2 The Contractor personnel requiring access to sensitive work site(s) must EACH hold a valid RELIABILITY STATUS, granted or approved by CISD/PWGSC.
- 3 The Contractor must comply with the provisions of the:
 - a. Security Requirements Checklist attached at Appendix "D"
 - b. Industrial Security Manual (Latest Edition) available at: <http://ssi-iss.tpsgc-pwgsc.gc.ca/ssi-iss-services/eso-oss-eng.html>

5.2 VERIFICATION OF SECURITY CLEARANCE AT BID CLOSING

- 1 The Bidder must hold a valid Designated Organization Screening (DOS) issued by the Canadian Industrial Security Directorate (CISD), Public Works and Government Services Canada (PWGSC), **TO BE INCLUDED WITH THEIR TENDER OR PROVIDED WITHIN 48 HOURS FROM THE DATE AND TIME OF TENDER CLOSING.** Verifications will be made through CISD to confirm the security clearance status of the Bidder. Failure to comply with this requirement will render the bid non-compliant and no further consideration will be given to the bid.
- 2 Within 72 hours of tender closing, the General Contractor must name all of his sub-contractors, each of whom **must hold a valid RELIABILITY STATUS**, granted or approved by CISD/PWGSC, or any other Federal Department or Agency along with the names and birthdates or security clearance certificate numbers of all personnel who will be assigned to the project.
- 3 It is to be noted that any subcontractor required to perform any part of the work during the performance of the subsequent contract must also adhere to the mandatory security requirement of the contract. As well, no personnel without the required level of security will be allowed on site. It will be the responsibility of the successful bidder to ensure that the security requirement is met throughout the performance of the contract. The Crown will not be held liable or accountable for any delays or additional costs associated with the contractor's non-compliance to the mandatory security requirement. Failure to comply with the mandatory security requirement will be grounds for being declared in default of contract.
- 4 For any enquiries concerning the project security requirement during the bidding period, the Bidder/Tenderer must contact the Security Officer @ 613-993-8956.

6.0 WSIB (WORKPLACE SAFETY AND INSURANCE BOARD)

- 1 All Bidders must provide a valid WSIB certificate with their Tender or prior to contract award.

7.0 OFFICE OF THE PROCUREMENT OMBUDSMAN

1 Dispute Resolution Services

The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will, on request or consent of the parties to participate in an alternative dispute resolution process to resolve any dispute between the parties respecting the interpretation or application of a term and condition of this contract and their consent to bear the cost of such process, provide to the parties a proposal for an alternative dispute resolution process to resolve their dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca.

2 Contract Administration

The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will review a complaint filed by [*the supplier or the contractor or the name of the entity awarded this contract*] respecting administration of this contract if the requirements of Subsection 22.2(1) of the *Department of Public Works and Government Services Act* and Sections 15 and 16 of the *Procurement Ombudsman Regulations* have been met, and the interpretation and application of the terms and conditions and the scope of the work of this contract are not in dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca.

- 3 The Office of the Procurement Ombudsman (OPO) was established by the Government of Canada to provide an independent avenue for suppliers to raise complaints regarding the award of contracts under \$25,000 for goods and under \$100,000 for services. You have the option of raising issues or concerns regarding the solicitation, or the award resulting from it, with the OPO by contacting them by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca. You can also obtain more information on the OPO services available to you at their website at www.opo-boa.gc.ca.

The Departmental Representative or his designate for this project is: **Maurice Richard**
Telephone: **613 993-9299**.

Contracting Authority for this project is: **Alain Leroux** alain.leroux@nrc-cnrc.gc.ca
Telephone: **613 991-9980**.

INSTRUCTIONS TO BIDDERS

Article 1 – Receipt of Tender

- 1a) Tenders must be received not later than the specified tender closing time. Tenders received after this time are invalid and shall not be considered, regardless of any reason for their late arrival.
- 1b) A letter of printed telecommunication from a bidder quoting a price shall not be considered as a valid tender unless a formal tender has been received on the prescribed Tender Form.
- 1c) Bidders may amend their tenders by letter or printed telecommunication provided that such amendments are received not later than the specified tender closing time.
- 1d) Any amendments to the tender which are transmitted by telefax must be signed and must clearly identify the tenderer.

All such amendments are to be addressed to:
National Research Council of Canada
Alain Leroux, Senior Contracting Officer
Building M-22
Montreal Road, Ottawa, Ontario
K1A 0R6

Fax: (613) 991-3297

Article 2 – Tender Form & Qualifications

- 1) All tenders must be submitted on the Construction Tender Form and the tender must be signed in compliance with the following requirements:
 - a) Limited Company: The full names of the Company and the name(s) and status of the authorized signing officer(s) must be printed in the space provided for that purpose. The signature(s) of the authorized officer(s) and the corporate seal must be affixed.
 - b) Partnership: The firm name and the name(s) of the person(s) signing must be printed in the space provided. One or more of the partners must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.
 - c) Sole Proprietorship : The business name and the name of the sole proprietor must be printed in the space provided. The sole proprietor must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.
- 2) Any alterations in the printed part of the Construction Tender Form or failure to provide the information requested therein, may render the tender invalid.
- 3) All space in the Construction Tender Form must be completed and any handwritten or typewritten corrections to the parts so completed must be initialed immediately to the side of the corrections by the person or persons executing the tender on behalf of the the tenderer.
- 4) Tenders must be based on the plans, specifications and tender documents provided.

Article 3 - Contract

- 1) The Contractor will be required to sign a contract similar to the Standard Contract Form for Fixed Price Construction Contracts, a blank specimen of which is enclosed in the package for reference purposes.

Article 4 – Tender Destination

- 1a) Tenders are to be submitted in sealed envelopes to:
National Research Council Canada
Administrative Services and Property Management Branch
1200 Montreal Road
Building M-22
Ottawa, ON
K1A 0R6

Endorsed "Tender for (insert title of work as it appears in the drawings and specifications)" and must bear the name and address of the tenderer.

- 1b) Unless otherwise specified, the only documents required to be submitted with the tender are the Tender form and the Bid Security.

Article 5 - Security

- 1a) Bid Security is required and must be submitted in one of the following forms:
 - i) a certified cheque payable to the Receiver General for Canada and drawn on a member of the Canadian Payments Association or a local cooperative credit society that is a member of a central cooperative credit society having membership in the Canadian Payments Association; **OR**
 - ii) bonds of the Government of Canada, or bonds unconditionally guaranteed as to principal and interest by the Government of Canada; **OR**
 - iii) a bid bond.
- 1b) Regardless of the Bid Security submitted, it should never be more than \$250,000 maximum, calculated at 10% of the first \$250,000 of the tendered price, plus 5% of any amount in excess of \$250,000.
- 2a) Bid Security shall accompany each tender or, if forwarded separately from the tender, shall be provided not later than the specified tender closing time. Bid Security must be in the **ORIGINAL** form. Fax or photocopies and **NOT** acceptable. **FAILURE TO PROVIDE THE REQUIRED BID SECURITY SHALL INVALIDATE THE TENDER.**
- 2b) If the tender is not accepted, the Bid Security submitted pursuant to Article 8 shall be returned to the tenderer.
- 3a) The successful tenderer is required to provide security within 14 days of receiving notice of tender acceptance. The tenderer must furnish **EITHER**:
 - i) a Security Deposit as described in 1(b) above together with a Labour and Material Payment Bond in the amount of at least 50% of the amount payable under the contract, **OR**

- ii) a Performance Bond and a Labour and Material Payment Bond – each in the amount of 50% of the amount payable under the contract.
- 3b) Should it not be possible to obtain a Labour Material Payment Bond as required under 3(a) above, on making application thereof to at least two acceptable Bonding Companies, an additional Security Deposit of a straight 10% of the amount payable under the contract must be furnished.
- 3c) Where a tender has been accompanied by a Security Deposit, as described in 1(b) above, the amount of the Security Deposit required under 3(a) above may be reduced by the amount of the Security Deposit which accompanied the tender.
- 3d) Bonds must be in an approved form and from the companies whose

bonds are acceptable to the Government of Canada. Samples of the approved form of Bid Bond, Performance Bond and Labour and Material Payment Bond and a list of acceptable Bonding Companies may be obtained from the Contracting Officer, National Research Council, Building M-22, Montreal Road, Ottawa, Ontario, K1A 0R6.

Article 6 – Interest On Security Deposits

- 1) Tenderers are notified that they must make their own arrangements with their bankers as to the interest, if any, on the amount of the certified cheque accompanying their tender. The Council will not pay interest on said cheque pending the awarding of the contract nor be responsible for the payments of interest under any arrangement made by the tenderers.

Article 7 – Sales Tax

- 1) The amount of the tender shall include all taxes as levied under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act or the Customs Tariff, in force or applicable at the time.
- 2) In Quebec, the Provincial Sales Tax should not be included in the Tender Price as the Federal Government is exempt. Tenderers should contact the Provincial Revenue Minister to recover all taxes paid for goods and services rendered under this contract.

Tenderers must include in their Tender Price the amount of Provincial Sales Tax for which the exemption does not apply.

Article 8 – Examination of Site

- 1) All parties tendering shall examine the sites of the proposed work before sending in their tender and make themselves thoroughly acquainted with the same and obtain for themselves any and all information that may be necessary for the proper carrying out of the Contract. No after claim will be allowed or entertained for any work or material that may be requisite and necessary for the proper execution and completion of this Contract with the exception of that provided for under GC 35 in the General Conditions of the General Specification.

Article 9 – Discrepancies, Omissions, Etc.

- 1a) Bidders finding discrepancies in, or omissions from, drawings, specifications or other documents, or having any doubt as to the meaning or intent of any part thereof, should at once notify the Engineer who will send written instructions or explanation to all bidders.
- 1b) Neither the Engineer nor the Council will be responsible for oral instructions.
- 1c) Addenda or corrections issued during the time of the bidding shall be covered in the proposal. However, the contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work and made prior to the date of the contract.

Article 10 – No additional Payments for Increased Costs

- 1) The only other adjustments in the contract price allowed are those specified in the General Conditions of the General Specification. The contract price will not be amended for change in freight rates, exchange rates, wage rates or cost of materials, plant or services.

Article 11 – Awards

- 1a) The Council reserves the power and right to reject tenders received from parties who cannot show a reasonable acquaintance with and preparation for the proper performance of the class of work herein specified and shown on plans. Evidence of such competence must be furnished by the tenderers if required to do so.
- 1b) A tenderer may be required to furnish to the Contracting Office, National Research Council of Canada, Building M-22, 1200 Montreal Road, Ottawa, Ontario, K1A 0R6, Canada, unsigned copies of the insurance requirements as covered by the Insurance Conditions of the General Specification.
- 1c) The Council does not bind itself to accept the lowest or any tender.

Article 12 – Harmonized Sales Tax

- 1) The Harmonized Sales Tax (HST) which is now in effect shall be considered an applicable tax for the purpose of this tender. However, the bidder shall NOT include any amount in the bid price for said HST. The successful contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount certified for payment under the Contract in addition to the amount certified for payment under the Contract and will therefore not affect the Contract Price. The Contractor agrees to remit any HST collected or due to Revenue Canada.

Non-resident contractors

RST guide 804

Published August 2006

ISBN: 1-4249-2007-8 (Print), **1-4249-2009-4 (PDF)**, **1-4249-2008-6 (HTML)**

Publication Archived

Notice to the reader: For Retail Sales Tax (RST) – On July 1, 2010 the 13 per cent Harmonized Sales Tax (HST) took effect in Ontario replacing the existing provincial Retail Sales Tax (RST) and combining it with the federal Goods and Services Tax (GST). As a result, RST provisions described on this page and in other publications ended on June 30, 2010.

Effective July 1, 2010 this publication was archived for RST purposes **only**. Use caution when you refer to it, since it reflects the law in force for RST at the time it was released and may no longer apply.

- The information in this Guide explains the Retail Sales Tax (RST) responsibilities of a non-resident contractor who is awarded a construction contract to perform work in Ontario and their Ontario customers. Please note that this Guide replaces the previous version dated March 2001.

Non-Resident Contractor Defined

A non-resident contractor is a contractor located outside Ontario who has been awarded a construction contract to perform work in Ontario, and who has not maintained a permanent place of business in Ontario continuously for twelve months immediately prior to signing the contract, or which is not a company incorporated under the laws of Ontario. A construction contract is a contract for the erection, remodelling or repair of a building or other structure on land.

A contractor is a person who is in the business of constructing, altering, repairing or improving real property and includes, but is not limited to,

1. a general contractor and subcontractor,
2. a carpenter, bricklayer, stonemason, electrician, plasterer, plumber, painter, decorator, paver, and bridge builder,
3. a sheet metal, tile and terrazzo, heating, air conditioning, insulation, ventilating, papering, road, roofing and cement contractor, who installs or incorporates items into real property. (See RST [Guide 206 - Real Property and Fixtures](#)).

Registration and Guarantee Deposit

Non-resident contractors who are awarded a construction contract in Ontario are required to register with the Ministry of Finance (ministry), Centralized Programs Unit and post a guarantee equal to 4 per cent of the total of each Ontario contract. The guarantee can be paid in cash, by certified cheque (payable to the Minister of Finance), letter of credit or by a guarantee bond.

To register with the ministry and to obtain further information on posting a guarantee, contractors should contact the ministry's Centralized Programs Unit, 33 King Street West, PO Box 623, Oshawa, Ontario, L1H 8H7, toll-free 1 866 ONT-TAXS (1 866 668-8297) or fax to 905 435-3617.

Non-resident contractors who sell taxable goods on a supply only basis to Ontario customers, or provide taxable services in Ontario, may obtain a regular Vendor Permit to collect and remit RST on their sales. Non-resident contractors who have been issued a regular Vendor Permit must still register separately with the ministry and post a guarantee if they are awarded a construction contract in Ontario.

Letter of Compliance

After receiving the guarantee, the ministry mails out two copies of a "letter of compliance" to the contractor certifying the Retail Sales Tax (RST) requirements have been met. Contractors must give a copy of the letter to their customers.

If a copy of the compliance letter is not provided, the customer must withhold 4 per cent of all amounts payable to the non resident contractor and pay the withheld amounts to the Minister of Finance (minister). Details relating to the contract should be sent along with the payments to the Centralized Programs Unit. Customers may give the minister a guarantee bond equal to 4 per cent of the total contract price instead of making the 4 per cent payments.

Note: Customers who do not follow these requirements may be held liable for 4 per cent of all amounts payable to the non resident contractor or any other amount that the Ministry deems to be the RST payable resulting from the performance of the contract.

Calculation of RST

Fair Value

RST is payable on the "fair value" of materials, purchased or brought into Ontario, to be used for work performed in Ontario. "Fair value" includes:

- the purchase price in Canadian funds;
- all charges by the supplier for handling and delivery, and
- any federal customs duties and excise taxes paid (but not the federal Goods and Services Tax (GST)).

Contractors are also required to pay RST to Ontario suppliers on the purchase, rental or lease of taxable services, materials, machinery, or equipment.

Machinery and Equipment - Leased

If machinery or equipment is leased from a supplier outside Ontario and brought into the province, RST is payable on the lease payments for the period the machinery or equipment is in Ontario.

Machinery and Equipment - Owned by Contractor

If machinery or equipment is owned by the contractor, RST may be calculated in one of the following ways:

- a. If a contractor brings machinery and equipment into Ontario for less than 12 months' use, RST is to be calculated using the following formula:

$$1/36 \times \text{net book value at date of import} \times \text{number of months in Ontario} \times \text{tax rate}$$

For the purpose of this formula, RST is payable for each month or part of a month that the goods are in Ontario. A month is considered 31 consecutive days and a part month is considered more than 12 days. The RST payable is based on the number of days the machinery and equipment are located in Ontario and not the number of days the items are actually used.

Example: Equipment is brought into Ontario on March 28 and taken out on May 8. The items were in the province for 41 days. RST is payable on the first 31 days' temporary stay in Ontario vs. use of the equipment. Since the remainder (10 days) is not considered part of a month, no RST is payable on this portion.

- b. If, at the time the goods are brought into Ontario, it is expected that the machinery or equipment will be in Ontario for more than twelve months, contractors must pay Retail Sales Tax (RST) on the following basis:

net book value at date of import × tax rate

If, at the time of import, the length of time is not known, vendors may use the formula under (a). If they later find it necessary to keep the machinery and equipment in Ontario for more than 12 months, the RST paid under (a) may be deducted from the RST payable under (b).

Using formula (a) or (b) above, contractors will calculate and remit the RST payable on the return that is filed when the contract is finished.

(See Completion of Contract section)

M a n u f a c t u r i n g f o r O w n U s e

Contractors may need to manufacture items, such as doors and windows, for their construction contracts. Manufacturing is work done in a factory away from a construction site, or in a mobile unit or workshop that is on or near the construction site. Manufacturing occurs when raw materials are changed into manufactured goods for use in real property contracts.

Contractors are considered to be manufacturing contractors if they produce goods:

1. for their own use in real property contracts, and
2. the manufactured cost of the goods is more than \$50,000 a year.

(See RST Guide 401 - Manufacturing Contractors)

C o n t r a c t s w i t h t h e F e d e r a l G o v e r n m e n t

Where a non-resident contractor enters into a construction contract with the federal government, for the construction of a building and/or the installation of equipment, the nature of the equipment will determine whether the contract should be let on a tax-included or tax excluded basis.

Contracts for the construction of a building and the installation of equipment that directly services that building (i.e., elevators, escalators, light fixtures, central heating and air conditioning, etc.) should be tendered on a tax -included basis. Contractors are the consumers of the materials used in fulfilling these contracts and must pay or account for RST on the materials used to complete the contracts. There is NO exemption just because the contract is with the federal government.

Contracts for the installation of equipment that becomes a fixture and does not directly service a building (i.e., material handling equipment, production machinery, communication equipment, training equipment) may be tendered on a tax-excluded basis. Contractors engaged in contracts of this nature are permitted to make tax exempt purchases of such equipment by issuing a valid Purchase Exemption Certificate (PEC) to their supplier. Only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC.

E x e m p t i o n s

Contractors may supply and install equipment or materials for certain customers that may be entitled to an exemption from RST (e.g., manufacturers, Indian band councils, farmers and diplomatic organizations). The equipment or materials, when installed, becomes real property if it is permanently attached to land, or a fixture if it is permanently attached to a building or real property structure. Since

contractors are liable for RST, they should contact the ministry to find out if the customer qualifies for exemption before tendering the contract on a tax-excluded basis.

Status Indians, Indian Bands and Band Councils

Non-resident contractors may purchase building materials exempt from Retail Sales Tax (RST) for certain buildings and structures situated on reserves. The cost of such projects must be paid by the band council, and the buildings must provide a community service for the reserve. Contracts for the construction of an exempt community building project should be made on an RST-excluded basis. Non-resident contractors may purchase the materials exempt from RST by providing suppliers with a valid Purchase Exemption Certificate (PEC). As noted previously, only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC. (See RST Guide [204 - Purchase Exemption Certificates](#)).

Non-resident contractors must pay RST on items purchased for incorporation into a building or structure built for individual status Indians on a reserve. (See RST [Guide 808 - Status Indians, Indian Bands and Band Councils](#)).

Completion of Contract

When a contract is completed, non-resident contractors who were required to post a guarantee must complete a [Non-Resident Contractor Retail Sales Tax Return \[PDF - 92 KB\]](#) that is provided by the ministry.

If a contractor's guarantee was given in cash or by certified cheque, the amount of the deposit can be deducted from the RST liability owed by the contractor. If the liability is greater than the deposit, the amount remaining must be paid by the contractor. If the deposit is more than the liability, the contractor will receive a refund.

If a guarantee bond was posted instead of cash, the bond will be discharged once the RST liability is paid in full.

All returns are subject to audit.

Legislative References

- Retail Sales Tax Act, Subsections 19(2) and 39(3)(4) and (5)
- Regulation 1012 under the Act, Subsections 15.3(1)(2)(5)(6) and (7)
- Regulation 1013 under the Act, Sections 1 and 3

For More Information

The information contained in this publication is only a guideline. For more information, please contact the Ontario Ministry of Finance at 1 866 ONT-TAXS (1 866 668-8297) or visit our website at ontario.ca/finance.

Acceptable Bonding Companies

Published September 2010

The following is a list of insurance companies whose bonds may be accepted as security by the government.

1. Canadian Companies

- ACE INA Insurance
- Allstate Insurance Company of Canada
- Ascentus Insurance Ltd. (Surety only)
- Aviva Insurance Company of Canada
- AXA Insurance (Canada)
- AXA Pacific Insurance Company
- Canadian Northern Shield Insurance Company
- Certas Direct Insurance Company (Surety only)
- Chartis Insurance Company of Canada (formerly AIG Commercial Insurance Company of Canada)
- Chubb Insurance Company of Canada
- Commonwealth Insurance Company
- Co-operators General Insurance Company
- CUMIS General Insurance Company
- The Dominion of Canada General Insurance Company
- Echelon General Insurance Company (Surety only)
- Economical Mutual Insurance Company
- Elite Insurance Company
- Everest Insurance Company of Canada
- Federated Insurance Company of Canada
- Federation Insurance Company of Canada
- Gore Mutual Insurance Company
- Grain Insurance and Guarantee Company
- The Guarantee Company of North America
- Industrial Alliance Pacific General Insurance Corporation
- Intact Insurance Company
- Jevco Insurance Company (Surety only)
- Lombard General Insurance Company of Canada
- Lombard Insurance Company
- Markel Insurance Company of Canada
- The Missisquoi Insurance Company
- The Nordic Insurance Company of Canada
- The North Waterloo Farmers Mutual Insurance Company (Fidelity only)
- Novex Insurance Company (Fidelity only)
- The Personal Insurance Company
- Pilot Insurance Company
- Quebec Assurance Company
- Royal & Sun Alliance Insurance Company of Canada
- Saskatchewan Mutual Insurance Company
- Scottish & York Insurance Co. Limited
- The Sovereign General Insurance Company
- TD General Insurance Company
- Temple Insurance Company
- Traders General Insurance Company

- Travelers Guarantee Company of Canada
- Trisura Guarantee Insurance Company
- The Wawanesa Mutual Insurance Company
- Waterloo Insurance Company
- Western Assurance Company
- Western Surety Company

2. Provincial Companies

Surety bonds issued by the following companies may be accepted provided that the contract of suretyship was executed in a province in which the company is licensed to do business as indicated in brackets.

- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- ALPHA, Compagnie d'Assurances Inc. (Que.)
- Canada West Insurance Company (Ont., Man., Sask, Alta., B.C., N.W.T.) (Surety only)
- The Canadian Union Assurance Company (Que.)
- La Capitale General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., Que.(Surety only), Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Coachman Insurance Company (Ont.)
- Continental Casualty Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- GCAN Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- The Insurance Company of Prince Edward Island (N.S., P.E.I., N.B.)
- Kingsway General Insurance Company (N.S., N.B., Que., Ont., Man., Sask., Alta., and B.C.)
- Liberty Mutual Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Manitoba Public Insurance Corporation (Man.)
- Norgroupe Assurance Générales Inc.
- Orleans General Insurance Company (N.B., Que., Ont.)
- Saskatchewan Government Insurance Office (Sask.)
- SGI CANADA Insurance Services Ltd. (Ont., Man., Sask., Alta.)
- L'Unique General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., N.B., Que.(Surety only), Ont.(Surety only), Man., Sask., Alta., B.C.(Surety only), Nun., N.W.T., Yuk.)

3. Foreign Companies

- Aspen Insurance UK Limited
- Compagnie Française d'Assurance pour le Commerce Extérieur (Fidelity only)
- Eagle Star Insurance Company Limited
- Ecclesiastical Insurance Office Public Limited Company (Fidelity only)
- Lloyd's Underwriters
- Mitsui Sumitomo Insurance Company, Limited
- NIPPONKOA Insurance Company, Limited
- Sompo Japan Insurance Inc.
- Tokio Marine & Nichido Fire Insurance Co., Ltd.
- XL Insurance Company Limited (Surety only)
- Zurich Insurance Company Ltd

Articles of Agreement

Standard Construction Contract – Articles of Agreement
(23/01/2002)

- A1 Contract Documents
- A2 Date of Completion of Work and Description of Work
- A3 Contract Amount
- A4 Contractor's Address
- A5 Unit Price Table

Articles of Agreement

These Articles of Agreement made in duplicate this day of .

Between

Her Majesty the Queen, in right of Canada (referred to in the contract documents as “ Her Majesty”) represented by the National Research Council Canada (referred to in the contract documents as the “Council”)

and

(referred to in the contract documents as the “Contractor”)

Witness that in consideration for the mutual promises and obligations contained in the contract, Her Majesty and the Contractor covenant and agree as follows:

A1 Contract Documents

(23/01/2002)

1.1 Subject to A1.4 and A1.5, the documents forming the contract between Her Majesty and the Contractor, referred to herein as the contract documents, are

1.1.1 these Articles of Agreement,

1.1.2 the document attached hereto, marked “A” and entitled “Plans and Specifications”, referred to herein as the Plans and Specifications,

1.1.3 the document attached hereto, marked “B” and entitled “Terms of Payment”, referred to herein as the Terms of Payment,

1.1.4 the document attached hereto, marked “C” and entitled “General Conditions”, referred to herein as the General Conditions,

1.1.5 the document attached hereto, marked “D” and entitled “Labour Conditions”, referred to herein as the Labour Conditions,

1.1.6 the document attached hereto, marked “E” and entitled “Insurance Conditions”, referred to herein as the Insurance Conditions,

1.1.7 the document attached hereto, marked “F” and entitled “Contract Security Conditions”, referred to herein as the Contract Security Conditions, and

1.1.8 any amendment or variation of the contract documents that is made in accordance with the General Conditions.

1.1.9 the document entitled Fair Wage Schedules for Federal Construction Contracts referred to herein as Fair Wage Schedules

1.1.10

Articles of Agreement

The Council hereby designates _____ of _____ of the Government of Canada as the Engineer for the purposes of the contract, and for all purposes of or incidental to the contract, the Engineer's address shall be deemed to be:

1.2 In the contract

1.3.1 "Fixed Price Arrangement" means that part of the contract that prescribes a lump sum as payment for performance of the work to which it relates; and

1.3.2 "Unit Price Arrangement" means that part of the contract that prescribes the product of a price multiplied by a number of units of measurement of a class as payment for performance of the work to which it relates.

1.3 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Unit Price Arrangement are not applicable to any part of the work to which a Fixed Price Arrangement is applicable.

1.4 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Fixed Price Arrangement are not applicable to any part of the work to which a Unit Price Arrangement is applicable.

A2 Date of Completion of Work and Description of Work

(23/01/2002)

2.1 The contractor shall, between the date of these Articles of Agreement and the _____, _____, in the careful and workmanlike manner, diligently perform and complete the following work:

which work is more particularly described in the Plans and Specifications.

Articles of Agreement

A3 Contract Amount

(23/01/2002)

- 3.1 Subject to any increase, decrease, deduction, reduction or set-off that may be made under the Contract, Her Majesty shall pay the Contractor at the times and in the manner that is set out or referred to in the Terms of Payment
- 3.1.1 the sum of _____ (GST/HST extra), in consideration for the performance of the work or the part thereof that is subject to Fixed Price Arrangement, and
- 3.1.2 a sum that is equal to the aggregate of the products of the number of units of Measurement of each class of labour, plant and material that is set out in a Final Certificate of Measurement referred to in GC44.8 multiplied in each case by the appropriate unit price that is set out in the Unit Price Table in consideration for the performance of the work or the part thereof that is subject to a Unit Price Arrangement.
- 3.2 For the information and guidance of the Contractor and the persons administering the contract on behalf of Her Majesty, but not so as to constitute a warranty , representation or undertaking of any nature by either party, it is estimated that the total amount payable by Her Majesty to the Contractor for the part of the work to which a Unit Price Arrangement is applicable will be approximately \$N/A
- 3.3 A3.1.1 is applicable only to a Fixed Price Arrangement.
- 3.4 A3.1.2 and A3.2 applicable only to a Unit Price Arrangement.

A4 Contractor's Address

(23/01/2002)

- 4.1 For all purposes of or incidental to the contract, the Contractor's address shall be deemed to be:

Articles of Agreement

Signed on behalf of Her Majesty by

as Senior Contracting Officer

and _____

as _____

of the **National Research Council Canada**

on the _____

day of _____

Signed, sealed and delivered by

as _____ and
Position

by _____

as _____ and
Position

of

on the _____

day of _____

Seal

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1. SCOPE OF WORK

- .1 Work under this contract covers the electrical vault upgrade in the Council's Building M-58 of the National Research Council.

2. DRAWINGS

- .1 The following drawings illustrate the work and form part of the contract documents:

5160-E01 EXISTING SINGLE LINE DIAGRAM
5160-E02 NEW SINGLE LINE DIAGRAM
5160-E03 FLOOR PLAN AND EQUIPMENT LAYOUT

3. COMPLETION

- .1 Complete all work within 36 week(s) after receipt of notification of acceptance of tender.

4. GENERAL

- .1 The word "provide" in this Specification means to supply and install.
.2 Provide items mentioned in either the drawings or the specification.

5. SPECIFIED ACCEPTABLE & ALTERNATIVE EQUIPMENT & MATERIALS

- .1 Materials and equipment scheduled and/or specified on the drawings or in the specifications have been selected to establish a performance and quality standard. In most cases, acceptable manufacturers are stated for any material or equipment specified by manufacturer's name and model number. Contractors may base their tender price on materials and equipment supplied by any of the manufacturers' names as acceptable for the particular material or equipment.
- .2 In addition to the manufacturers specified or named as acceptable, you may propose alternative manufacturers of materials or equipment to the Departmental Representative for acceptance. For a product to be considered as an alternative product substitute, make a written application to the Departmental Representative during the tender period, not later than ten (10) working days before tender closing.
- .3 Certify in writing that the alternative meets all requirements of the specified material or equipment. In addition, it shall be understood that all costs required by or as a result of acceptance or proposed alternatives, will be borne by the contractor.
- .4 Approval of alternatives will be signified by issue of an Addendum to the Tender Documents.
- .5 Any alternative manufacturers or materials submitted which are incomplete and cannot be evaluated, or are later than ten (10) working days before tender closing date or after the tender period, will not be considered.

6. MINIMUM STANDARDS

- .1 Conform to or exceed minimum acceptable standards of the various applicable federal, provincial and municipal codes such as The National Building Code, The National Fire Code, Canadian Plumbing Code, Canadian Electrical Code, Canadian Code for Construction Safety and the Provincial Construction Safety Act.
- .2 Work to conform to referenced standards and codes as reaffirmed or revised to date of specification.

7. WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS)

- .1 The general contractor shall comply with Federal and Provincial legislation regarding the WHMIS. The contractor's responsibilities include, but are not limited to the following:
 - .1 To ensure that any controlled product brought on site by the contractor or sub-contractor is labeled;
 - .2 To make available to the workers and the Departmental Representative, Material Safety Data Sheets (MSDS) for these controlled products;
 - .3 To train own workers about WHMIS, and about the controlled products that they use on site;
 - .4 To inform other contractors, sub-contractors, the Departmental Representative, authorized visitors and outside inspection agency personnel about the presence and use of such products on the site.
 - .5 The site foreman or superintendent must be able to demonstrate, to the satisfaction of the Departmental Representative, that he/she has had WHMIS training and is knowledgeable in its requirements. The Departmental Representative can require replacement of this person if this condition or implementation of WHMIS is not satisfactory.

8. REQUIREMENTS OF BILL 208, SECTION 18(a)

Under the requirements of Bill 208 of the Ontario Ministry of Labour Occupational Health & Safety Act, the following designated substances may be encountered while performing the work described in these contract documents:

- .1 Acrylonitrile, Isocyanates, Arsenic, Lead, Asbestos, Mercury, Benzene, Silica, Coke Oven Emissions, Vinyl Chloride, and Ethylene Oxide
 - .1 It is the responsibility of the general contractor to ensure that each prospective subcontractor for this project has received a copy of the above list.
 - .2 The general contractor is advised to take the following precautions when dealing with the above substances:

9. COST BREAKDOWN

- .1 Submit, for approval by the Departmental Representative, a cost breakdown of tender 72 hours after the contract is awarded.
- .2 Use the approved cost breakdown as the basis for submitting all claims.

- .3 Request Departmental Representative's verbal approval to amount of claim prior to preparing and submitting the claim in its final form.

10. SUB-TRADES

- .1 Submit no later than 72 hours after tender closing, a complete list of sub trades for the Departmental Representative's review.

11. PERSONNEL SECURITY AND IDENTIFICATION

- .1 All persons employed by the contractor, or by any subcontractor and present on the site must be security cleared in accordance with the requirements of the Section entitled Special Instructions to Tenderers.
- .2 All such persons must wear and keep visible identification badges as issued by the Security Office of NRC.

12. WORKING HOURS AND SECURITY

- .1 Normal working hours on the NRC property are from 8:00 a.m. until 4:30 p.m., Monday to Friday inclusive, except statutory holidays.
- .2 At all other times, special written passes are required for access to the building site.
- .3 Before scheduling any work outside normal working hours, obtain permission from the Departmental Representative to perform the specific tasks.
- .4 An escort may be required whenever working outside normal hours. Contractor to bear the associated costs.

13. SCHEDULE

- .1 The contractor shall prepare a detailed schedule, fixing the date for commencement and completion of the various parts of the work and update the said schedule. Such schedule shall be made available to the Departmental Representative not later than two weeks after the award of the contract and prior to commencement of any work on site.
- .2 Notify Departmental Representative in writing of any changes in the schedule.
- .3 14 day(s) before the scheduled completion date, arrange to do an interim inspection with the Departmental Representative.

14. PROJECT MEETINGS

- .1 Hold regular project meetings at times and locations approved by the Departmental Representative.
- .2 Notify all parties concerned of meetings to ensure proper coordination of work.
- .3 Departmental Representative will set times for project meetings and assume responsibility for recording and distributing minutes.

15. SHOP DRAWINGS

- .1 Submit to Departmental Representative for review, shop drawings, product data and samples specified within 8 week(s) after contract award.
- .2 Submit to Departmental Representative for review a complete list of all shop drawings, product data and samples specified and written confirmation of corresponding delivery dates within one (1) week after shop drawings, product data and samples approval date. This list shall be updated on a two week basis and any changes to the list shall be immediately notified in writing to the Departmental Representative.
- .3 Review shop drawings, data sheets and samples prior to submission.
- .4 Submit electronic copy of all shop drawings and product data and samples for review, unless otherwise specified.
- .5 Review of shop drawings and product data by the Departmental Representative does not relieve the contractor of the responsibility for errors and omissions and for the conformity with contract documents.

16. SAMPLES AND MOCK-UPS

- .1 Submit samples in sizes and quantities as specified.
- .2 Where colour, pattern or texture is criterion, submit full range of samples.
- .3 Construct field samples and mock-ups at locations acceptable to Departmental Representative.
- .4 Reviewed samples or mock-ups will become standards of workmanship and material against which installed work will be checked on the project.

17. MATERIALS AND WORKMANSHIP

- .1 Install only new materials on this project unless specifically noted otherwise.
- .2 Only first class workmanship will be accepted, not only with regard to safety, efficiency, durability, but also with regard to neatness of detail and performance.

18. WORK & MATERIALS SUPPLIED BY OWNER

- .1 Work and materials not included in this contract are described on drawings and in this specification.
- .2 Deliver to a storage place, as directed by the Departmental Representative, all materials returned to the Owner.
- .3 Unless otherwise specified, accept owner-supplied materials at their storage location and provide all transportation as required.
- .4 General Contractor's duties:

- .1 Unload at site.
- .2 Promptly inspect products and report damaged or defective items.
- .3 Give written notification to the Departmental Representative for items accepted in good order.
- .4 Handle at site, including uncrating and storage.
- .5 Repair or replace items damaged on site.
- .6 Install, connect finished products as specified.

19. SITE ACCESS

- .1 Make prior arrangements with the Departmental Representative before starting work or moving materials and equipment on site.
- .2 Obtain approval of Departmental Representative for regular means of access during the construction period.
- .3 Obtain approval of Departmental Representative before temporarily suspending operations on site; before returning to the site and before leaving the site at the end of the job.
- .4 Provide and maintain access to site.
- .5 Build and maintain temporary roads and provide snow removal during period of work.
- .6 Make good any damage and clean up dirt, debris, etc., resulting from contractor's use of existing roads.

20. USE OF SITE

- .1 Restrict operations on the site to the areas approved by the Departmental Representative
- .2 Locate all temporary structures, equipment, storage, etc., to the designated areas.
- .3 Restrict parking to the designated areas.

21. ACCEPTANCE OF SITE

- .1 Inspect the site before commencing work, review any unexpected conditions with the Departmental Representative.
- .2 Commencement of work will imply acceptance of existing conditions.

22. SITE OFFICE & TELEPHONE

- .1 Contractor to erect a temporary site office at his own expense.
- .2 Install and maintain a telephone, if necessary.
- .3 Use of NRC phones is not permitted unless in the case of an emergency.

23. SANITARY FACILITIES

- .1 Obtain permission from the Departmental Representative to use the existing washroom facilities in the building.

24. TEMPORARY SERVICES

- .1 A source of temporary power will be made available in the area. Bear all costs to make connections to the power source and perform distribution on site.
- .2 Provide all load centres, breakers, conduit, wiring, disconnects, extension cords, transformers, as required from the source of power.
- .3 Power is to be used only for power tools, lighting, controls, motors, and not for space heating.
- .4 A source of temporary water will be made available if required.
- .5 Bear all costs associated with distributing the water to the required locations.
- .6 Comply with NRC requirements when connecting to existing systems in accordance with the articles entitled "Co-operation" and "Service Interruptions" of this section.

25. DOCUMENTS REQUIRED AT WORK SITE

- .1 The contractor shall keep on the site, one (1) up-to-date copy of all contract documents, including specifications, drawings, addenda, shop drawings, change notices, schedule and any reports or bulletins pertaining to the work, in good order, available to the Departmental Representative and to his / her representatives at all times.
- .2 At least one (1) copy of specifications and drawings shall be marked by the contractor to show all work "As Built" and shall be provided to the Departmental Representative with the Application for Payment and for the Final Certificate of Completion.

26. CO-OPERATION

- .1 Co-operate with NRC staff in order to keep disruption of normal research work to an absolute minimum.
- .2 Work out in advance, a schedule for all work which might disrupt normal work in the building.
- .3 Have schedule approved by the Departmental Representative.
- .4 Notify the Departmental Representative in writing, 72 hours prior to any intended interruption of facilities, areas, corridors, mechanical or electrical services and obtain requisite permission.

27. PROTECTION AND WARNING NOTICES

- .1 Provide all materials required to protect existing equipment.

- .2 Erect dust barriers to prevent dust and debris from spreading through the building.
- .3 Place dust protection in the form of cover sheets over equipment and furniture and tape these sheets to floors, to ensure no dust infiltration.
- .4 Repair or replace any and all damage to Owner's property caused during construction, at no cost to the Owner and to the satisfaction of the Departmental Representative.
- .5 Protect the buildings, roads, lawns, services, etc. from damage which might occur as a result of this work.
- .6 Plan and co-ordinate the work to protect the buildings from the leakage of water, dust, etc.
- .7 Ensure that all doors, windows, etc., that could allow transfer of dust, noise, fumes, etc., to other areas of the building are kept closed.
- .8 Be responsible for security of all areas affected by the work under the Contract until acceptance by NRC. Take all necessary precautions to prevent entry to the work area by unauthorized persons and guard against theft, fire and damage by any cause. Secure working area at the end of each day's work and be responsible for same.
- .9 Provide and maintain adequate safety barricades around the work sites to protect NRC personnel and the public from injury during the construction.
- .10 Post warnings, in all instances where possible injury could occur such as Work Overhead, Hard Hat Areas, etc. or as required by the Departmental Representative.
- .11 Provide temporary protective enclosures over building entrances and exits to protect pedestrians. All enclosures to be structurally sound against weather and falling debris.

28. BILINGUALISM

- .1 Ensure that all signs, notices, etc. are posted in both official languages.
- .2 Ensure that all identification of services called for by under this contract are bilingual.

29. LAYOUT OF WORK

- .1 Location of equipment, fixtures, outlets and openings indicated on drawings or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with the manufacturer's recommendations for safety, access and maintenance.
- .3 Employ competent person to lay out work in accordance with the contract documents.

30. DISCREPANCIES & INTERFERENCES

- .1 Prior to the start of the work, examine drawings and specifications. Report at once to the Departmental Representative, any defects, discrepancies, omissions or interferences affecting the work.
- .2 Contractor to immediately inform the Departmental Representative in writing, of any discrepancies between the plans and the physical conditions so the Departmental Representative may promptly verify same.
- .3 Any work done after such a discovery, until authorized, is at the contractor's risk.
- .4 Where minor interferences as determined by the Departmental Representative are encountered on the job and they have not been pointed out on the original tender or on the plans and specifications, provide offsets, bends or reroute the services to suit job conditions at no extra cost.
- .5 Arrange all work so as not to interfere in any way with other work being carried out.

31. MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 Notify the Departmental Representative in writing of any conflict between these specifications and manufacturer's instruction. Departmental Representative will designate which document is to be followed.

32. TEMPORARY HEATING AND VENTILATING

- .1 Bear the costs of temporary heat and ventilation during construction including costs of installation, fuel, operation, maintenance, and removal of equipment.
- .2 Use of direct-fired heaters discharging waste products into the work areas will not be permitted unless prior approval is given by the Departmental Representative.
- .3 Furnish and install temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of work.
 - .2 Protect work and products against dampness and cold.
 - .3 Reduce moisture condensation on surfaces to an acceptable level.
 - .4 Provide ambient temperature and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for a safe working environment.
- .4 Maintain minimum temperature of 10 °C (50 °F) or higher where specified as soon as finishing work is commenced and maintain until acceptance by the Departmental Representative. Maintain ambient temperature and humidity levels as required for comfort of NRC personnel.

- .5 Prevent hazardous or unhealthy accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction including also, storage areas and sanitary facilities.
 - .1 Dispose of exhaust materials in a manner that will not result in a harmful or unhealthy exposure to persons.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment.
 - .1 Enforce conformance with applicable codes and standards.
 - .2 Comply with instructions of the Departmental Representative including provision of full-time watchman services when directed.
 - .3 Enforce safe practices.
 - .4 Vent direct-fired combustion units to outside.
- .7 Submit tenders assuming existing or new equipment and systems will not be used for temporary heating and ventilating.
- .8 After award of contract, Departmental Representative may permit use of the permanent system providing agreement can be reached on:
 - .1 Conditions of use, special equipment, protection, maintenance, and replacement of filters.
 - .2 Methods of ensuring that heating medium will not be wasted and in the case of steam, agreement on what is to be done with the condensate.
 - .3 Saving on contract price.
 - .4 Provisions relating to guarantees on equipment.

33. CONNECTIONS TO AND INTERRUPTIONS TO EXISTING SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times and in the manner agreed to by the Departmental Representative and by authorities having jurisdiction, with minimum disruption to NRC Personnel and vehicular traffic and minimum service interruption. Do not operate any NRC equipment or plant.
- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit a schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility; allow minimum **4 WEEKS** notice. Adhere to approved schedule and provide notice to the Departmental Representative.
- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Provide detours, bridges, alternate feeds, etc., as required to minimize disruptions.
- .6 Protect existing services as required and immediately make repairs if damage occurs.
- .7 Remove any abandoned service lines as indicated on the contract documents and as approved by the Departmental Representative; cap or otherwise seal lines at cut-off points. Record and provide a copy to the Departmental Representative of locations of maintained, re-routed and abandoned service lines.

34. CUTTING AND PATCHING

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove all items as shown or specified.
- .3 Patch and make good with identical materials, the surfaces that have been disturbed, cut or damaged, to the satisfaction of the Departmental Representative.
- .4 Where new pipes pass through existing construction, core drill an opening. Size openings to leave 12mm (1/2") clearance around the pipes or pipe insulation. Do not drill or cut any surface without the approval of the Departmental Representative.
- .5 Obtain written approval of the Departmental Representative before cutting openings through existing or new structural members.
- .6 Seal all openings where cables, conduits or pipes pass through walls with an acoustic sealant conforming to CAN/CGSB-19.21-M87.
- .7 Where cables, conduits and pipes pass through fire rated walls and floors, pack space between with compressed glass fibres and seal with fire stop caulking in accordance with CAN/CGSB-19.13-M87 AND NBC 3.1.7.

35. FASTENING DEVICES

- .1 Do not use explosive actuated tools, without first obtaining permission from the Departmental Representative.
- .2 Comply with the requirements of CSA A-166 (Safety Code for Explosive Actuated Tools).
- .3 Do not use any kind of impact or percussion tool without first obtaining permission from the Departmental Representative.

36. OVERLOADING

- .1 Ensure that no part of the building or work is subjected to a load which will endanger safety or cause permanent deformation or structural damage.

37. DRAINAGE

- .1 Provide temporary drainage and pumping as required to keep excavations and site free of water.

38. ENCLOSURE OF STRUCTURES

- .1 Construct and maintain all temporary enclosures as required to protect foundations, sub-soil, concrete, masonry, etc., from frost penetration or damage.
- .2 Maintain in place until all chances of damage are over and proper curing has taken place.

- .3 Provide temporary weather tight enclosures for exterior openings until permanent sash and glazing and exterior doors are installed.
- .4 Provide lockable enclosures as required to maintain the security of NRC facilities and be responsible for the same.
- .5 Provide keys to NRC security personnel when required.
- .6 Lay out the work carefully and accurately and verify all dimensions and be responsible for them. Locate and preserve general reference points.
- .7 Throughout the course of construction, keep continuously acquainted with field conditions, and the work being developed by all trades involved in the project. Maintain an awareness of responsibility to avoid space conflict with other trades.
- .8 Conceal all services, piping, wiring, ductwork, etc., in floors, walls or ceilings except where indicated otherwise.

39. STORAGE

- .1 Provide storage as required to protect all tools, materials, etc., from damage or theft and be responsible for the same.
- .2 Do not store flammable or explosive materials on site without the authorization of the Departmental Representative.

40. GENERAL REVIEW

- .1 Periodic review of the contractor's work by the Departmental Representative does not relieve the contractor of the responsibility of making the work in accordance with contract documents. Contractor shall carry out his own quality control to ensure that the construction work is in accordance with contract documents.
- .2 Inform the Departmental Representative of any impediments to the installation and obtain his / her approval for actual location.

41. INSPECTION OF BURIED OR CONCEALED SERVICES

- .1 Prior to concealing any services that are installed, ensure that all inspection bodies concerned, including NRC, have inspected the work and have witnessed all tests. Failure to do so may result in exposing the services again at the contractor's expense.

42. TESTING

- .1 On completion, or as required by local authority inspectors and/or Departmental Representative during progress of work and before any services are covered up and flushing is complete, test all installations in the presence of the Departmental Representative.

- .2 Obtain and hand to the Departmental Representative all acceptance certificates or test reports from authority having jurisdiction. The project will be considered incomplete without the same.

43. PARTIAL OCCUPANCY

- .1 NRC may request partial occupancy of the facility if the contract extends beyond the expected completion date.
- .2 Do not restrict access to the building, routes, and services.
- .3 Do not encumber the site with materials or equipment.

44. DISPOSAL OF WASTES

- .1 Dispose of waste materials including volatiles, safely off NRC property. Refer to the section entitled "General and Fire Safety Requirements" included as part of this specification.

45. CLEAN-UP DURING CONSTRUCTION

- .1 On a daily basis, maintain project site and adjacent area of campus including roofs, free from debris and waste materials.
- .2 Provide on-site dump containers for collection of waste materials and rubbish.

46. FINAL CLEAN-UP

- .1 Upon completion do a final clean-up to the satisfaction of the Departmental Representative.
- .2 Clean all new surfaces, lights, existing surfaces affected by this work, replace filters, etc.
- .3 Clean all resilient flooring and prepare to receive protective finish. Protective finish applied by NRC

47. WARRANTY AND RECTIFICATION OF DEFECTS IN WORK

- .1 Refer to General Conditions "C", section GC32.
- .2 Ensure that all manufacturers' guarantees and warranties are issued in the name of the **General** Contractor and the National Research Council.

48. MAINTENANCE MANUALS

- .1 Provide three (3) bilingual copies of maintenance manuals or two English and two French maintenance manuals immediately upon completion of the work and prior to release of holdbacks.
- .2 Manuals to be neatly bound in hard cover loose leaf binders.

- .3 Manuals to include operating and maintenance instructions, all guarantees and warranties, shop drawings, technical data, etc., for the material and apparatus supplied under this contract.

END OF SECTION

1. GENERAL CONSTRUCTION SAFETY REQUIREMENTS

- .1 The Contractor shall take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property from any harm during the course of the contract.
- .2 The Contractor shall be solely responsible for the construction safety of both its employees and those of its sub-contractors at the work site, and for initiating, maintaining and supervising safety precautions, programs and procedures in connection with the performance of the work.
- .3 The Contractor shall comply with all Federal, Provincial and Municipal safety codes and regulations and the Occupational Health and Safety Act and the Workplace Safety and Insurance Board. In the event of any conflict between any provisions in legislation or codes, the most stringent provisions shall apply.
- .4 Periodic review of the contractor's work by the Departmental Representative, using the criteria of the contract documents, does not relieve the contractor of his safety responsibilities in carrying out the work in accordance with the contract documents. The contractor shall consult with the Departmental Representative to ensure that this responsibility is carried out.
- .5 The Contractor shall ensure that only competent personnel are permitted to work on site. Throughout the term of the contract, any person will be removed from the site who is not observing or complying with the safety requirements.
- .6 All equipment shall be in safe operating condition and appropriate to the task.
- .7 Following a project and site hazard assessment, the Contractor shall develop a Site Specific Safety Plan based on the following minimum requirements:
 - .1 Provide a safety board mounted in a visible location on the project site, with the following information included thereon:
 - .1 Notice of Project
 - .2 Site specific Safety Policy
 - .3 Copy of Ontario Health and Safety Act
 - .4 Building Schematic showing emergency exits
 - .5 Building emergency procedures
 - .6 Contact list for NRC, Contractor and all involved sub-contractors
 - .7 Any related MSDS sheets
 - .8 NRC Emergency phone number
- .8 The Contractor shall provide competent personnel to implement its safety program and those of any Health and Safety Act legislation applicable at this project location, and to ensure they are being complied with.
- .9 The Contractor shall provide safety orientation to all its employees as well as those of any subcontractors under its jurisdiction.

- .10 The Departmental Representative will monitor to ensure that safety requirements are met and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the contract to be cancelled and the Contractor or sub-contractors removed from the site.
- .11 The Contractor will report to the Departmental Representative and jurisdictional authorities, any accident or incident involving Contractor or NRC personnel or the public and/or property arising from the Contractor's execution of the work.
- .12 If entry to a laboratory is required as part of the work of the Contractor, a safety orientation shall be provided to all his employees as well as those of any subcontractors regarding lab safety requirements and procedures, as provided by the Researcher or the Departmental Representative.

2. FIRE SAFETY REQUIREMENTS

.1 Authorities

1. The Fire Commissioner of Canada (FC) is the authority for fire safety at NRC.
2. For the purpose of this document, "Departmental Representative" will be deemed as the NRC person in charge of the project and who will enforce these Fire Safety Requirements.
3. Comply with the following standards as published by the Office of the Fire Commissioner of Canada:
 - a. Standard No. 301 - June 1982 "Standard for Construction Operations";
 - b. Standard No. 302 - June 1982 "Standard for Welding and Cutting".

.2 Smoking

- .1 Smoking is prohibited inside all NRC buildings, as well as roof areas.
- .2 Obey all "NO SMOKING" signs on NRC premises.

.3 Hot Work

- .1 Prior to commencement of any "Hot Work" involving welding, soldering, burning, heating, use of torches or salamanders or any open flame, obtain a Hot Work Permit from the Departmental Representative.
- .2 Prior to commencement of "Hot Work", review the area of hot work with the Departmental Representative to determine the level of fire safety precautions to be taken.

.4 Reporting Fires

- .1 Know the exact location of the nearest Fire Alarm Pull Station and telephone, including the emergency phone number.
- .2 REPORT immediately, all fire incidents as follows:
 - .1 Activate nearest fire alarm pull station and;

.2 Telephone the following emergency phone number as appropriate:

FROM AN NRC PHONE	333
FROM ANY OTHER PHONE	(613) 993-2411

4. When reporting a fire by phone, give the location of fire, building number and be prepared to verify location.
5. The person activating fire alarm pull station must remain at a safe distance from the scene of the fire but readily available to provide information and direction to the Fire Department personnel.

.5 Interior and Exterior Fire protection & Alarm Systems

- .1 DO NOT OBSTRUCT OR SHUT OFF FIRE PROTECTION EQUIPMENT OR SYSTEMS, INCLUDING BUT NOT LIMITED TO FIRE ALARM SYSTEMS, SMOKE/HEAT DETECTORS, SPRINKLER SYSTEM, PULL STATIONS, EMERGENCY CALL BUTTONS AND PA SYSTEMS, WITHOUT AUTHORIZATION FROM THE DEPARTMENTAL REPRESENTATIVE.
- .2 WHEN ANY FIRE PROTECTION EQUIPMENT IS TEMPORARILY SHUT DOWN, ALTERNATIVE MEASURES AS PRESCRIBED BY THE DEPARTMENTAL REPRESENTATIVE SHALL BE TAKEN TO ENSURE THAT FIRE PROTECTION IS MAINTAINED.
- .3 DO NOT LEAVE FIRE PROTECTION OR ALARM SYSTEMS INACTIVE AT THE END OF A WORKING DAY WITHOUT NOTIFICATION AND AUTHORISATION FROM THE DEPARTMENTAL REPRESENTATIVE. THE DEPARTMENTAL REPRESENTATIVE WILL ADVISE THE (FPO) OF THE DETAILS OF ANY SUCH EVENT.
- .4 DO NOT USE FIRE HYDRANTS, STANDPIPES AND HOSE SYSTEMS FOR OTHER THAN FIRE FIGHTING PURPOSES UNLESS AUTHORISED BY DEPARTMENTAL REPRESENTATIVE.

.6 Fire Extinguishers

- .1 Provide a minimum of 1-20 lb. ABC Dry Chemical Fire Extinguisher at each hot work or open flame location.
- .2 Provide fire extinguishers for hot asphalt and roofing operations as follows:
 - a. Kettle area - 1-20 lb. ABC Dry Chemical;
 - b. Roof - 1-20 lb. ABC Dry Chemical at each open flame location.
- .3 Provide fire extinguishers equipped as below:
 - c. Pinned and sealed;
 - d. With a pressure gauge;
 - e. With an extinguisher tag signed by a fire extinguisher servicing company.

- .4 Carbon Dioxide (CO₂) extinguishers will not be considered as substitutes for the above.

.7 Roofing Operations

.1 Kettles:

- .1 Arrange for the location of asphalt kettles and material storage with the Departmental Representative before moving on site. Do not locate kettles on any roof or structure and keep them at least 10m (30 feet) away from a building.
- .2 Equip kettles with 2 thermometers or gauges in good working order; a hand held and a kettle-mounted model.
- .3 Do not operate kettles at temperatures in excess of 232°C (450 °F).
- .4 Maintain continuous supervision while kettles are in operation and provide metal covers for the kettles to smother any flames in case of fire. Provide fire extinguishers as required in article 2.6.
- .5 Demonstrate container capacities to Departmental Representative prior to start of work.
- .6 Store materials a minimum of 6m (20 feet) from the kettle.

.2 Mops:

- .1 Use only glass fibre roofing mops.
- .2 Remove used mops from the roof site at the end of each working day.

.3 Torch Applied Systems:

- .1 DO NOT USE TORCHES NEXT TO WALLS.
- .2 DO NOT TORCH MEMBRANES TO EXPOSED WOOD OR CAVITY
- .3 Provide a Fire Watch as required by article 2.9 of this section.

- .4 Store all combustible roofing materials at least 3m (10 feet) away from any structure.

- .5 Keep compressed gas cylinders a minimum of 6m (20 feet) away from the kettle, protected from mechanical damage and secured in an upright position.

.8 Welding / Grinding Operations

- .1 Contractor to provide fire blankets, portable fume extraction devices, screens or similar equipment to prevent exposure to welding flash, or sparks from grinding.

.9 Fire Watch

- .1 Provide a fire watch for a minimum of one hour after the termination of any hot work operation.
- .2 For temporary heating, refer to General Instructions Section 00 010 00.
- .3 Equip fire watch personnel with fire extinguishers as required by article 2.6.

.10 Obstruction of access/egress routes-roadways, halls, doors, or elevators

- .1 Advise the Departmental Representative in advance of any work that would impede the response of Fire Department personnel and their apparatus. This includes violation of minimum overhead clearance, erection of barricades and the digging of trenches.
- .2 Building exit routes must not be obstructed in any way without special permission from the Departmental Representative, who will ensure that adequate alternative routes are maintained.
- .3 The Departmental Representative will advise the FPO of any obstruction that may warrant advanced planning and communication to ensure the safety of building occupants and the effectiveness of the Fire Department.

.11 Rubbish and Waste Materials

- .1 Keep rubbish and waste materials to a minimum and a minimum distance of 6m (20 feet) from any kettle or torches.
- .2 Do not burn rubbish on site.
- .3 Rubbish Containers
 - .1 Consult with the Departmental Representative to determine an acceptable safe location for any containers and the arrangement of chutes etc. prior to bringing the containers on site.
 - .2 Do not overfill the containers and keep area around the perimeter free and clear of any debris.
- .4 Storage
 - .1 Exercise extreme care when storing combustible waste materials in work areas. Ensure maximum possible cleanliness, ventilation and that all safety standards are adhered to when storing any combustible materials.
 - .2 Deposit greasy or oily rags or materials subject to spontaneous combustion in CSA or ULC approved receptacles and remove at the end of the work day or shift, or as directed.

.12 Flammable Liquids

- .1 The handling, storage and use of flammable liquids is governed by the current National Fire Code of Canada.
- .2 Flammable Liquids such as gasoline, kerosene and naphtha may be kept for ready use in quantities not exceeding 45 litres (10 imp gal), provided they are stored in approved safety cans bearing the ULC seal of approval and kept away from buildings, stockpiled combustible materials etc. Storage of quantities of flammable liquids exceeding 45 litres (10 imp gal) for work purposes, require the permission of the Departmental Representative.

- .3 Flammable liquids are not to be left on any roof areas after normal working hours.
- .4 Transfer of flammable liquids is prohibited within buildings.
- .5 Do not transfer flammable liquids in the vicinity of open flames or any type of heat producing device.
- .6 Do not use flammable liquids having a flash point below 38 °C (100 °F) such as naphtha or gasoline as solvents or cleaning agents.
- .7 Store flammable waste liquids for disposal in approved container located in a safe, ventilated area. Waste flammable liquids are to be removed from the site on a regular basis.
- .8 Where flammable liquids, such as lacquers or urethane are used, ensure proper ventilation and eliminate all sources of ignition. Inform the Departmental Representative prior to, and at the cessation of such work.

3. Questions and/or clarifications

- .1 Direct any questions or clarification on Fire or General Safety, in addition to the above requirements, to the Departmental Representative.

END OF SECTION

1 REFERENCES

- .1 Perform all work to meet or exceed the requirements of the Canadian Electrical Code, CSA Standard C22.1 - (latest edition).
- .2 Consider CSA Electrical Bulletins in force at time of tender submission, while not identified and specified by number in this Division, to be forming part of related CSA Part II standard.
- .3 Do overhead and underground systems in accordance with CSA C22.3 except where specified otherwise.
- .4 Where requirements of this specification exceed those of above mentioned standards, this specification shall govern.
- .5 Notify the NRC Departmental Representative as soon as possible when requested to connect equipment supplied by NRC which is not CSA approved.
- .6 Refer to Sections 00 10 00 & 0015 45.

2 PERMITS AND FEES

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay all fees required for the performance of the work.

3 START-UP

- .1 Instruct the NRC Departmental Representative and operating personnel in the operation, care and maintenance of equipment supplied under this contract.

4 INSPECTION AND FEES

- .1 Furnish a Certificate of Acceptance from the Authorized Electrical Inspection Department on completion of work.
- .2 Request and obtain Special Inspection approval from the Authorized Electrical Inspection Department for any non-CSA approved control panels or other equipment fabricated by the contractor as part of this contract.
- .3 Pay all fees required for inspections.

5 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
 - .2 Indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

6 ACOUSTICAL PERFORMANCE

- .1 In general provide equipment producing minimal sound levels in accordance with the best and latest practices established by the electrical industry.
- .2 Do not install any device or equipment containing a magnetic flux path metallic core, such as gas discharge lamp ballasts, dimmers, solenoids, etc., which are found to produce a noise level exceeding that of comparable available equipment.

7 EQUIPMENT IDENTIFICATION

- .1 Identify with 3mm (1/8") Brother, P-Touch non-smearing tape, or an alternate approved by the NRC Departmental Representative, all electrical outlets shown on drawings and/or mentioned in the specifications. These are the lighting switches, recessed and surface mounted receptacles such as those in offices and service rooms and used to plug in office equipment, telecommunication equipment or small portable tools. Indicate only the source of power (Ex. for a receptacle fed from panel L32 circuit #1: "L32-1").
- .2 Light fixtures are the only exceptions for electrical equipment identification (except as noted in 7.13 below). They are not to be identified.
- .3 Identify with lamicoïd nameplates all electrical equipment shown on the drawings and/or mentioned in the specification such as motor control centers, switchgear, splitters, fused switches, isolation switches, motor starting switches, starters, panelboards, transformers, high voltage cables, industrial type receptacles, junction boxes, control panels, etc., regardless of whether or not the electrical equipment was furnished under this section of the specification.
- .4 Coordinate names of equipment and systems with other Divisions to ensure that names and numbers match.
- .5 Wording on lamicoïd nameplates to be approved by the NRC Departmental Representative prior to fabrication.
- .6 Provide two sets of lamicoïd nameplates for each piece of equipment; one in English and one in French.
- .7 Lamicoïd nameplates shall identify the equipment, the voltage characteristics and the power source for the equipment. Example: A new 120/240 volt single phase circuit breaker panelboard, L16, is fed from panelboard LD1 circuit 10.

"PANEL L16
120/240 V
FED FROM LD1-10"

PANNEAU L16
120/240 V
ALIMENTE PAR LD1-10

- .8 Provide warning labels for equipment fed from two or more sources - "DANGER MULTIPLE POWER FEED" black letters on a yellow background. These labels are available from NRC's Facilities Maintenance group in building M-19.
- .9 Lamicaid nameplates shall be rigid lamicaid, minimum 1.5 mm (1/16") thick with:
 - .1 Black letters engraved on a white background for normal power circuits.
 - .2 Black letters engraved on a yellow background for emergency power circuits.
 - .3 White letters engraved on a red background for fire alarm equipment.
- .10 For all interior lamicaid nameplates, mount nameplates using two-sided tape.
- .11 For all exterior lamicaid nameplates, mount nameplates using self-tapping 2.3 mm (3/32") dia. slot head screws - two per nameplate for nameplates under 75 mm (3") in height and a minimum of 4 for larger nameplates. Holes in lamicaid nameplates to be 3.7 mm (3/16") diameter to allow for expansion of lamicaid due to exterior conditions.
 - .1 No drilling is to be done on live equipment.
 - .2 Metal filings from drilling are to be vacuumed from the enclosure interiors.
- .12 All lamicaid nameplates shall have a minimum border of 3 mm (1/8"). Characters shall be 9 mm (3/8") in size unless otherwise specified.
- .13 Identify lighting fixtures which are connected to emergency power with a label "EMERGENCY LIGHTING/ÉCLAIRAGE D'URGENCE", black letters on a yellow background. These labels are available from NRC's Facilities Maintenance group in building M-19.
- .14 Provide neatly typed updated circuit directories in a plastic holder on the inside door of new panelboards.
- .15 Carefully update panelboard circuit directories whenever adding, deleting, or modifying existing circuitry.
- .16 Identify molded case breaker with lamicaid nameplate.

8 WIRING IDENTIFICATION

- .1 Unless otherwise specified, identify wiring with permanent indelible identifying markings, using either numbered or coloured plastic tapes on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.

9 CONDUIT AND CABLE IDENTIFICATION

- .1 All new conduits to be colour-coded EMT, type as follows:
 - .1 Fire alarm – red conduit
 - .2 Emergency power circuits – yellow conduit
 - .3 Voice/data – blue conduit
 - .4 Gas detection system – purple conduit
 - .5 Building Automation system – orange conduit

- .6 Security system – green conduit
- .7 Control system – black conduit
- .2 Apply paint to the covers of junction boxes and condulets of existing conduits as follows:
 - .1 Fire alarm – red
 - .2 Emergency power circuits – yellow
 - .3 Voice/data – blue
 - .4 Gas detection system – purple
 - .5 Building Automation system – orange
 - .6 Security system – green
 - .7 Control system - black
- .3 For system running with cable, half-lap wrap with dedicated coloured PVC tape to 100 mm width, tape every 5 m and both sides where cable penetrates a wall.
- .4 All other systems need not be coloured.

10 MANUFACTURER'S & APPROVALS LABELS

- .1 Ensure that manufacturer's registration plates are properly affixed to all apparatus showing the size, name of equipment, serial number, and all information usually provided, including voltage, cycle, phase and the name and address of the manufacturer.
- .2 Do not paint over registration plates or approval labels. Leave openings through insulation for viewing the plates. Contractor's or sub-contractor's nameplate not acceptable.

11 WARNING SIGNS AND PROTECTION

- .1 Provide warning signs, as specified or to meet requirements of Authorized Electrical Inspection Department and NRC Departmental Representative.
- .2 Accept the responsibility to protect those working on the project from any physical danger due to exposed live equipment such as panel mains, outlet wiring, etc. Shield and mark all live parts with the appropriate voltage. Caution notices shall be worded in both English and French.

12 LOAD BALANCE

- .1 Measure phase current to new panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes, and revise panelboard schedules.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

13 MOTOR ROTATION

- .1 For new motors, ensure that motor rotation matches the requirements of the driven equipment.

- .2 For existing motors, check rotation before making wiring changes in order to ensure correct rotation upon completion of the job.

14 GROUNDING

- .1 Thoroughly ground all electrical equipment, cabinets, metal supporting frames, ventilating ducts and other apparatus where grounding is required in accordance with the requirements of the latest edition of the Canadian Electrical Code Part 1, C.S.A. C22.1 and corresponding Provincial and Municipal regulations. Do not depend upon conduits to provide the ground circuits.
- .2 Run separate green insulated stranded copper grounding conductors in all electrical conduits including those feeding toggle switches and receptacles.

15 TESTS

- .1 Provide any materials, equipment and labour required and make such tests deemed necessary to show proper execution of this work, in the presence of the NRC Departmental Representative.
- .2 Correct any defects or deficiencies discovered in the work in an approved manner at no additional expense to the Owner.
- .3 Megger all branch circuits and feeders using a 600V tester for 240V circuits and a 1000V tester for 600V circuits. If the resistance to ground is less than permitted by Table 24 of the Code, consider such circuits defective and do not energize.
- .4 The final approval of insulation between conductors and ground, and the efficiency of the grounding system is left to the discretion of the local Electrical Inspection Department.

16 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, fuses, are installed to values and settings as indicated on the Drawings.

17 WORK ON LIVE EQUIPMENT & PANELS

- .1 NRC requires that work be performed on non-energized equipment, installation, conductors and power panels. For purposes of quotation assume that all work is to be done after normal working hours and that equipment, installation, conductors and power panels are to be de-energized when worked upon.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

- .1 The work listed in these specifications involves hazardous voltages, materials, operations, and equipment. These specifications do not claim to address all of the safety problems associated with their use. It is the responsibility of the user to review all applicable regulatory limitations prior to the use of these specifications.
- .2 The contractor shall provide qualified services, or shall engage the services of a specialized, qualified testing firm, for the purpose of performing inspections and tests as herein specified.
- .3 The contractor, or specialized testing firm, shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
- .4 The contractor will arrange and pay for all required ESA maintenance and inspection certificates for their scope of work.

1.2 REFERENCES

- .1 NETA, MTS-2007, Maintenance Testing Specification for Electrical Power Distribution Equipment and Systems.
- .2 IEEE – Standard Collection C57 – 1998.
- .3 IEEE – Standards Collection C37 – 1998.
- .4 CSA Z462 ‘Workplace Electrical Safety’

1.3 QUALIFICATIONS OF TESTING FIRM

- .1 The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- .2 All employees of the testing firm shall be qualified as per CSA Z462 requirements.
- .3 The testing firm shall have at least one person on site with the following qualifications to provide technical supervision and/or guidance as required for the remainder of the testing personnel:
 - .1 An employee certified by the InterNational Electrical Testing Association (NETA)
 - .2 A Professional Engineer (P. Eng) licensed in the Province of Ontario with specialized training and experience in the testing and inspection of electrical power distribution equipment
 - .3 A member of the Ontario Association of Certified Engineering Technicians and Technologists (OACETT) with specialized training and experience in the testing and inspection of electrical power distribution equipment

- .4 The contractor is to supply the Client, within 10 business days of awarding of contract, the name and qualifications of the proposed on-site supervisor. Approval, in writing from the Client, is required if the contractor needs to change the on-site supervisor for any reason. The Client will have the right to reject candidates not meeting the above qualifications.
- .4 All work designated 'Specialist Testing' shall be performed by employees of the specialist testing firm and all personnel must be qualified to operate, test, and commission high and low voltage electrical equipment.
- .5 All work designated 'Generalist Testing' may be completed by qualified electricians, technicians, technologists, or engineers employed or subcontracted by the specialist testing firm or electrical contractor.
- .6 The contractor to supply the Client with a list of people proposed for site work with their qualifications at least 5 business days before the shutdown, or as early as required to receive appropriate clearances. The Client will have the right to reject candidates not meeting the above qualifications.
- .7 The agency must have the necessary wiring, materials, equipment, tools, instruments, measuring devices and all other tools necessary to carry out the work.
- .8 The testing firm shall submit interim proof of all the above qualifications when responding to the Request for Proposals.
- .9 Various specialized testing firm have been pre-qualified to provide the client with the inspections and tests herein specified:
 - .1 Eaton Engineering Services
 - .2 Schneider Engineering Services

1.4 DIVISION OF RESPONSIBILITY

- .1 The testing firm shall supply a suitable and stable source of electrical power to each test site unless notified by the client in writing that sufficient local power will be available for operating test equipment. All portable alternating current (AC) power sources shall operate at 60 Hz +/- 0.1 Hz.
- .2 The testing firm shall supply adequate portable lighting for each test site unless notified by the client in writing that sufficient local lighting will be available for operating test equipment. Ensure adequate lighting is available both with and without normal and/or emergency power.
- .3 The owner, or owner's representative, will supply an up to date short circuit analysis and coordination study, a protective device setting sheet, a complete set of electrical plans, specifications, and any pertinent change orders to the testing firm prior to commencement of testing.
- .4 The owner, or owner's representative, shall notify the testing firm when equipment becomes available for maintenance tests. Work shall be coordinated to expedite project scheduling. Note: various pieces of equipment are required to maintain each buildings environmental condition. It is imperative that the communication between each building's operations personnel and the testing firm be established prior to the isolation

of any equipment. Sufficient time shall be given for the shutdown and startup of equipment such as chillers, pumps, and other essential equipment.

- .5 The testing firm shall notify the owner, or owner's representative, prior to commencement of any testing.
- .6 Deviation from the planned schedule of work for each stage of the work must be approved by the owner or owner's representative prior to the isolation of any additional equipment.
- .7 Once the supporting guarantee is received, the testing firm shall be fully responsible for their own safety, including all switching procedures, equipment isolation, and grounding procedures. At the end of each stage of the work, the testing firm shall ensure that all temporary grounds are removed from the equipment and all equipment is placed into its normal operation position prior to releasing the 'Station Guarantee'. It is the testing firm's responsibility to record the position of all circuit breakers and switches under the scope of the contract and to ensure that the 'As found' position is maintained after the work is completed.

1.5 SAFETY AND PRECAUTIONS

- .1 Safety practices shall include, but are not limited to, the following requirements:
 - .1 The current Occupational Health and Safety Act
 - .2 CSA Z462 'Workplace Electrical Safety'
 - .3 Workplace Hazardous Materials Information System (WHMIS). Submit to owner, or owner's representative, pertinent MSDS information.
 - .4 Applicable Provincial, local, and client safety operating procedures
 - .5 National Fire Protection Association – NFPA, and the National Fire Code of Canada 1995
 - .6 OSHA 29 CFR 1910.147. Control of Hazardous Energy Sources (Lockout/Tagout)
- .2 All tests shall be performed with apparatus de-energized except where otherwise specifically required. Lock out and tag procedures shall be in effect. All testing firm representatives shall lock and tag all equipment tested under the scope of work. The testing agency shall provide a 'lock box' for any equipment requiring more than 3 locks. All equipment to be tested under the scope of work shall be isolated from all sources of power, locked and tagged, tested for voltage potential with an approved potential tester rated for the voltage application, and grounded from all sources of power using approved temporary grounds.
- .3 As per CSA Z462, all testing firm representatives shall wear the appropriate Personal Protective Equipment (PPE) including approved safety boots, side impact hard hats, safety glasses and/or safety shields, arc flash coveralls, and rubber gloves with protectors during switching operations. All PPE shall be rated for the appropriate voltage class application.
- .4 The contractor shall review and supervise all operations with respect to safety, and notify any sub-contractors and/or the client of any known or found hazards or information about the client's installation that needs to be transmitted to sub-contractors.

1.6 TEST EQUIPMENT

- .1 All test equipment shall be in good mechanical and electrical condition.
- .2 Metering or monitoring equipment shall be true RMS sensing only. (Peak sensing equipment shall not be permitted).
- .3 Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked. Field Test Equipment shall meet the following criteria;
 - .1 1000 volt DC Insulation Resistance test equipment shall have a meter scale of at least 500 Gig Ohms.
 - .2 5000 volt DC Insulation Resistance test equipment shall have a meter scale of at least 500 Meg Ohms
 - .3 Low Resistance test equipment shall have a minimum of 5 ampere DC output and the ability to measure down to a 5 micro Ohms.
 - .4 Transformer turns ratio test equipment shall have a minimum of 130 to 1 ratio and scaled operate to three (3) significant digits. Test equipment shall have excitation current measurement capability to at least 5 amperes.
 - .5 Winding Resistance test equipment shall have a minimum of 5 ampere DC output and the ability to measure to a 100 milli-Ohms scale.
 - .6 Relay test equipment shall have a minimum of 100 amperes AC output in order to test standard mechanical overcurrent relays.
 - .7 Accuracy of metering in test equipment shall be appropriate for the test being performed but not in excess of 2% of the scale used.
 - .8 Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment. Test equipment shall not exceed 2.0 percent Total Harmonic Distortion THD output on voltage waveforms and 2.0 percent THD output on current waveforms.
- .4 Test Instrument Calibration
 - .1 The testing firm shall have a calibration program, which assures that all applicable test instruments are maintained within rated accuracy.
 - .2 Calibration shall be done by a calibration agency compliant with International Standards Organization ISO 17025 and Standard Council of Canada CAN-P-4D.
 - .3 Dated calibration labels shall be visible on all test equipment.
 - .4 Records must be available and up to date for the owner, or owner's representative, to inspect calibration of each piece of equipment.

1.7 TEST REPORT

- .1 The testing firm shall maintain a written or typed record of all field tests, and then shall assemble and certify a final completely typed test report.
- .2 The test report shall include the following:

- .1 Summary of project, complete with a detailed deficiency list, comments, results, analysis, and recommendations.
- .2 Description of all equipment tested which shall include complete equipment nameplate values and/or installation information (e.g. Manufacturer, Date, Model Number, Serial Number, Voltage, Ampacity, Phases, kW, Power Factor, Horsepower, RPM, Torque, Type, Size, Insulation Type, Insulation Rating (100%, 133%, etc.), Shield if present, Number of conductors, Free air or Raceway rating, Configuration, etc.). Please note, the above list is not a complete and comprehensive list. Each device test sheet should have enough data to clearly identify the device, its location within the distribution system, a unique identifier, and all parameters which define its ratings and application. As a minimum, each device test sheet should usually include all parameters defined by the device's ruling Industry Standard.
- .3 Include results from all tests above with starting conditions noted.
- .4 Include any items found out of specified tolerances.
- .5 Include any relevant comments about the condition of the switchgear.
- .3 A blank copy of all applicable test sheets on the project shall be submitted to the Client for approval within five (5) business days of the contract issuance. The Client has the right to reject test sheets that do not include all required information or test results.
- .4 Each item within the Specialist's testing listed under item 4.1.2 shall be detailed with all item information, ratings, and test results on one or more pages per unit (unless units are in sets like fuses).
- .5 Group all devices by substation, type, ID number, and area.
- .6 Furnish .pdf electronic copy, with high resolution of the complete report to NRC departmental representative.
- .7 Any system, material, or workmanship, which is found defective on the basis of maintenance test, shall be reported verbally during the shutdown, and in writing in the final report.

PART 2 - INSPECTION AND TEST PROCEDURES

2.1 WORK COMMON TO MOST ELECTRICAL ASSEMBLIES

- .1 Inspection
 - .1 Compare equipment nameplate information with latest single line diagram to ensure agreement.
 - .2 Inspect for evidence of corrosion, the presence of corona or insulation breakdown, and/or for environmental contamination, especially on insulators or insulating surfaces.
 - .3 Verify acceptable anchorage, required area clearances, and proper alignment.
 - .4 Verify presence of required warning signs.
 - .5 Verify that protective devices and settings, instrument transformers and ratios, and all other electrical elements correspond to single line drawings, coordination study, and/or relevant documentation.

- .6 Verify that ventilation filters are present and in good condition, and/or that ventilation openings or vents are clear.
- .7 Verify that there are no inadvertent connections of the ground bus to the neutral bus on any electrical systems containing a neutral. Ensure that a ground to neutral bond(s) is in the correct location.
- .2 Mechanical/Functional Verification
 - .1 For commissioning, verify tightness of accessible bolted electrical connections by calibrated torque-wrench in accordance with manufacture's published data or, if not available, use NETA Table 10.12. For maintenance, verify general tightness of accessible bolted electrical connections.
 - .2 Test operation, alignment, and penetration of instrument and control power transformer withdrawal disconnects, current-carrying and grounding.
 - .3 Exercise all active components, and verify the operation of all mechanical indicating devices.
 - .4 Test all electrical and mechanical interlock systems for proper operation and sequencing:
 - .5 Attempt to close locked-open devices. Attempt to open locked-closed devices.
 - .6 Make Kirk Key exchanges with devices operated in off-normal positions.
 - .7 Verify that Kirk Key numbers match with the single line diagram and record them on the approved test sheet.
- .3 Cleaning
 - .1 Thoroughly clean switchgear cells or electrical equipment prior to testing. Clean equipment using cleaning agents that have high dielectric properties, repel moisture, prevent corona tracking, and are not harmful to the electrical equipment insulation, such as Banwet manufactured by Brodi.
 - .2 Vacuum all loose elements from electrical switchgear, junction boxes, and other areas within or without electrical equipment. Blowers shall not be used unless no other methods to remove contaminants are possible.
- .4 Lubrication
 - .1 Verify appropriate contact lubricant on moving current carrying parts. Refer to manufacturer's recommendations on lubrication of components.
 - .2 Verify appropriate lubrication on moving and sliding surfaces. Refer to manufacturer's recommendations on lubrication of components.

2.2 SWITCHGEAR ASSEMBLIES, GREATER THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning.
- .2 Electrical Tests
 - .1 Disconnect all equipment and conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B –Black, Phase C – Blue). After testing re-connect equipment and conductors in the original phasing order. Perform field taping if required in accordance to Section 3.
 - .2 Perform tests on all instrument and control power transformers in accordance with relevant Section.

- .3 Perform insulation resistance tests on each bus section. Energize each phase with the correct test voltage ensuring the opposing two phases and neutral (4 wire only) are grounded. Each test shall occur for a duration of one (1) minute. Electrical equipment rated from 600 volts AC to 2,600 volts AC shall be tested at 1,000 volts DC. Electrical equipment rated from 2,601 volts AC to 69,000 volts DC shall be tested at 5,000 volts DC.
 - .4 Perform an overpotential (hi-pot) test on each bus section. Energize each phase with the correct DC test voltage ensuring the opposing two phases and neutral (4 wire only) are grounded. Each test shall occur for a duration of one (1) minute. The step voltage method shall be used to achieve the full test voltage, whereby the test voltage is raised to final value in 10 equal steps (increments of 1/10 the final test voltage). There will be a 30 second delay between incremental steps where the micro-Amp leakage current will be recorded for each step. After 6 step intervals a linear rate of change leakage current versus test voltage shall be established. During the final 4 step changes if the predicted rate of change is greater than 5 to 1 leakage current versus test voltage the test shall be terminated and all test results up to that point will be documented. All tests shall be performed as per manufacturers published data. If manufacturer's data is not available this test shall be performed in accordance to the NETA standard Table 10.2.
 - .5 Perform a system function test. Use the elementary diagrams of the switchgear to identify each remote control and protective device. Energize control circuits with the correct designed tripping and closing circuit voltages.
 - .6 Operate all circuit breakers and switches manually and electrically in local and remote modes of operation to ensure correct closing and tripping.
 - .7 Verify that all indication and alarm lights and audible devices operate correctly.
 - .1 General Industrial/Commercial Application: red signifies device closed and green signifies device open.
 - .2 General Utility Application: green signifies device closed and red signifies device open.
 - .8 Verify the operation of switchgear cell heaters.
- .3 Test Values
- .1 Compare bus connection resistances to values of similar connections.
 - .2 Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values, which deviate from similar bus by more than 25 percent of the lowest value. Microhm value should not exceed the following:
 - .1
$$\frac{0.050 \text{volts}}{\text{Equipment Continuous Current Rating}} \times 1,000,000$$
 - .3 Insulation resistance values for bus, control wiring, and instrument & control power transformers shall be in accordance with manufacturers published data. In the absence of manufacturers published data, use NETA Standard Table 10.1. (Note: Do not use test voltage levels in NETA Table 10.1) Values of insulation resistance less than this table or manufacturers minimum should be investigated. Overpotential tests should not proceed until insulation resistance levels are raised above minimum values.

- .4 The insulation shall withstand the overpotential test voltage applied. Flag any values greater than 10 Micro Amperes.

2.3 LOAD BREAK SWITCHES, GREATER THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Switch
 - .1 Blade and Jaw - verify correct blade alignment, blade penetration, travel stops, and mechanical operation.
 - .2 Arc Blade – verify correct alignment, erosion, ensure arc blade operates properly on opening with arc chute
 - .3 Arc Chute – verify correct alignment, absence of cracks
 - .4 Operating Arm – free movement, break over
 - .5 Operating Mechanism – sprockets, chain, pushrod arms, lubrication.
 - .6 Door interlock – verify door unable to open when switch closed.
 - .7 Latch Spring and Latch – verify switch unable to close when door open.
 - .8 Interrupter Head – Verify correct alignment of contacts.
 - .2 Electrical Tests
 - .1 Disconnect all conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black, Phase C – Blue, Neutral – White). After testing re-connect equipment and conductors in the original phasing order
 - .2 Perform insulation resistance tests on each pole, phase to phase and phase to ground with switch closed and across each open pole for one minute. Electrical equipment rated from 600 volts AC to 2600 volts AC shall be tested at 1000 volts DC. Electrical equipment rated from 2601 volts AC to 15,000 volts AC shall be tested at 5000 volts DC.
 - .3 Perform resistance measurements through all switch contacts with a low resistance ohmmeter.
 - .3 Test Values
 - .1 Compare bolted connection resistances to values of similar connections.
 - .2 Bolt torque levels shall be in accordance with NETA Standard Table 10.12 unless otherwise specified by manufacturer.
 - .3 Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from adjacent poles or similar switches by more than 25 percent of the lowest value. Microhm value should not exceed the following:
 - .1
$$\frac{0.050 \text{volts}}{\text{Equipment Continuous Current Rating}} \times 1,000,000$$
 - .4 If switch contact resistance exceeds above formula, burnish main contacts and apply lubrication as per manufacturer's specification until correct contact resistance is achieved.

- .5 Insulation resistance shall be in accordance with NETA Standard Table 10. 1.
(Note: Do not use DC test voltage levels in NETA Standard Table 10.1.)

2.4 FUSES, GREATER THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Disassemble fuse units to inspect link conditions and record link nameplate data.
 - .1 Measure fuse resistance before and after this operation to ensure proper re-assembly
 - .2 Fuse Holder – Inspect for cracks, corona and erosion, especially where fuse link seats into holder
 - .3 Fuse Mounting – Record fixed or drawout, verify that each fuse holder has adequate mechanical support.
 - .4 Fuse Alignment – verify latch on drawout mounts
 - .5 Muffler – Verify that expulsion limiting devices are in place on all holders having expulsion type elements, verify arc stop material in good condition
- .2 Electrical Tests
 - .1 Measure fuse resistance with a Low Resistance Test Set. (Ensure that Low Resistance test set current output does not exceed rated fuse current.)
- .3 Test Values
 - .1 Investigate fuse resistance values that deviate from each other by more than 15 percent. Fuse links may have crystallized.

2.5 CIRCUIT BREAKERS, VACUUM, GREATER THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Ground Contact – verify breaker moving contact fingers with ground bus
 - .2 Floor Trip/Close Tripper – Verify circuit breaker trips and removes potential kinetic energy for closing (spring charge type mechanism) or inhibits close coil operation (electrical coil type mechanism) while racking in and out of cell.
 - .3 Position Indicator – verify fully connected, test, and fully disconnected indicators.
 - .4 Secondary Contact Blocks - verify alignment, engagement, and correct contact
 - .5 Padlock/Key Lock Operator – ensure breaker can be locked in the fully disconnected position
 - .6 Racking Mechanism - verify unobstructed operation with breaker.
 - .7 Verify that all maintenance devices are available for servicing and operating the breaker. (umbilical cord, racking handle, drawout rails, lifting mechanism)
 - .8 Circuit Breaker
 - .1 Operation Counter – record number of as found and as left operations
 - .2 Auxiliary Switches – ensure that breaker properly engages and toggles ‘a’, ‘b’, and position contacts
 - .3 Cut Off Switch – ensure electrical motor cutoff operates consistently.

- .4 Electrical Interlocks – Ensure anti-pumping (Y) relay operates correctly. Ensure (52 X) relay operates correctly (electrical coil close only).
- .9 Vacuum Bottles
 - .1 Verify that all vacuum bottles are sealed and without dents or other mechanical indications of problems.
 - .2 Verify that vacuum bottle contact wear indicator is not indicating
- .2 Electrical Tests
 - .1 Perform a contact resistance test with a low resistance ohmmeter. Test should be performed through the entire breaker from line side primary drawout contact to load side primary drawout contact.
 - .2 Perform insulation-resistance tests on each pole, phase-to-phase and phase-to-ground with switch closed and across each open pole for one minute. Test voltage shall be in accordance with manufacturer's published data or Table 10.1.
 - .3 Perform vacuum bottle integrity (overpotential) test across each vacuum bottle with the switch in the open position in strict accordance with manufacturer's published data. Do not exceed maximum voltage stipulated for this test. Provide adequate barriers and protection against x radiation during this test. Do not perform this test unless the contact displacement of each interrupter is within manufacturer's tolerance. (Be aware that some dc high-potential test sets are half wave rectified and may produce peak voltages in excess of the switch manufacturer's recommended maximum.)
 - .4 Perform resistance measurements through all bolted connections with a low resistance ohmmeter.
 - .5 Perform insulation resistance test at 250 volts DC on all control wiring. Do not perform insulation resistance tests on solid state or electronic control devices.
 - .6 Measure the following coil resistances with a DC ohmmeter;
 - .1 Closing Coil
 - .2 Tripping Coil
 - .3 52 X Coil
 - .7 With breaker in the test position, make the following tests:
 - .1 Trip and close breaker with the control switch.
 - .2 Trip breaker by operating each of its protective relays.
 - .3 Verify trip free and antipump (Y relay) function.
 - .4 Perform minimum pickup voltage tests on trip coil and record value.
- .3 Test Values
 - .1 Compare bolted connection resistances to values of similar connections.
 - .2 Bolt torque levels shall be in accordance with NETA Standard Table 10.12 unless otherwise specified by manufacturer.
 - .3 Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from adjacent poles or similar breakers by more than 25 percent of the lowest value. Microhm value should not exceed the following:

$$.1 \quad \frac{0.050 \text{ volts}}{\text{Equipment Continuous Current Rating}} \times 1,000,000$$

- .4 If breaker contact resistance exceeds above formula, burnish main contacts and apply lubrication as per manufacturer specification until correct contact resistance is achieved.
- .5 Circuit breaker insulation resistance shall be in accordance with NETA Standard Table 10.1. (Note: Do not use DC test voltage levels in NETA Standard Table 10.1)
- .6 Control wiring insulation resistance shall be a minimum of two megohms.
- .7 Insulation resistance values should be in accordance with manufacturer's published data or Table 10.1.
- .8 Critical distances of operating mechanism should be in accordance with manufacturer's published data.
- .9 The vacuum bottles shall withstand the overpotential voltage applied.
- .10 Coil resistances should be consistent with previous year's results.
- .11 Minimum pickup for trip coil shall conform to manufacturers published data. If data is not available trip coil should operate at 25 percent below rated voltage.

2.6 DISCRETE PROTECTIVE RELAYS

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Prior to cleaning the relay, record as-found settings.
 - .2 Tighten case connections. Inspect cover for correct gasket seal. Clean cover glass. Inspect shorting hardware, connection paddles, and/or knife switches. Remove any foreign material from the case. Verify target reset.
 - .3 Inspect relay for foreign material, particularly in disc slots of the damping and electromagnets. Verify disk clearance. Verify contact clearance and spring bias. Inspect spiral spring convolutions. Inspect disk and contacts for freedom of movement and correct travel. Verify tightness of mounting hardware and connections. Burnish contacts. Inspect bearings and/or pivots.
 - .4 Verify that all settings are in accordance with coordination study or setting sheet supplied by owner.
- .2 Electrical Tests
 - .1 Perform insulation resistance test at 250 volts DC on each circuit to frame. Do not perform insulation resistance test on solid state and microprocessor based relays.
 - .2 Inspect targets and indicators.
 - .3 Ensure correct magnitude and polarity of power supply to relay including the verification of any external power supply voltage drop resistors inherent to the relay (solid state and microprocessor based relays only)
 - .4 Determine pickup and dropout of electromechanical targets.
 - .5 Verify operation of all light emitting diode indicators.
 - .6 Set contrast for liquid crystal display readouts.

- .3 Functional Operation
 - .1 50/50G Instantaneous Overcurrent Relay
 - .1 Record the relays setting and operating range.
 - .2 Determine pickup current.
 - .3 Determine dropout current.
 - .4 Determine time delay at rated current.
 - .2 51/51N/51G Time Overcurrent Relay
 - .1 Record the relays tap setting, time dial setting, tap range, time dial range, seal in coil setting, seal in coil range, and time current curve type.
 - .2 Verify and/or calibrate timed contact zero adjustment.
 - .3 Perform secondary current injection test
 - .4 Determine minimum pickup current value.
 - .5 Determine time delays at two points on the manufacturers published time current curve or published formula. Time values shall be selected at 2 and 5 times the relay tap setting from the published time current curve with respect to the time dial setting.
 - .6 Verify the operation of the seal in target.
 - .3 Control Verification
 - .1 Perform primary injection test:
 - .2 Utilizing a high output relay test set, wrap window type current transformers individually with the appropriate number of turns to functionally operate the corresponding phase and ground overcurrent relay. If the current transformers are bar type remove the CT secondary conductors and perform a secondary injection test at the secondary conductors to functionally operate the corresponding phase and ground overcurrent relays
 - .3 Verify that each of the relay contacts performs its intended function in the control scheme including breaker trip tests, close inhibit tests, 86 lockout tests, and alarm functions.
 - .4 Verify control wiring from the instrument transformers to each protective relay.
 - .4 Test Values
 - .1 When not otherwise specified, use manufacturer's recommended tolerances.
 - .2 When critical test points are specified, the relay should be calibrated to those points even though other test points may be out of tolerance.
 - .3 If the 51-timed overcurrent relay is found to be out of manufacturer's tolerances for the two point test, a combination of dampening magnet and core flux set screw shall be adjusted to properly calibrate the relay at 2 and 5 times the tap setting.

2.7 INSTRUMENT TRANSFORMERS, BOTH CTS AND PTS, APPLIED TO CIRCUITS GREATER THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Verify that all required grounding and shorting connections are correct. Ensure that after tests are completed all functioning Current Transformer (CT) shorting connections are not made and that all non-functioning CTs shorting connections are made. Ensure that after tests are completed all CTs have a completed permanent secondary circuit through the correct corresponding device.
 - .2 Ensure that donut type CTs rated for 0.6 kV systems have sufficient insulation and clearance from the primary switchgear bus when being applied to medium voltage systems. Ensure that bar type CTs do not exhibit any signs of corona discharge at the CT mounting base.
 - .3 Verify correct operation of transformer withdrawal mechanism and grounding operation. Ensure that shutters operate properly on Potential Transformer (PT) cabinets. Verify that hinged type, drawout PT cabinets are mechanically interlocked so that entry cannot be gained while the PTs are energized.
 - .4 Ensure that all PTs are correctly installed so that the PT primary circuit is connected through current limiting fuses and not directly connected to the switchgear phase bus.
 - .5 Ensure that all PT primary circuit cable conductors are properly installed and mechanically braced. Verify that all jumper type cable conductor sizes are at least 2 AWG or greater. Verify that all shielded conductors have proper stress cones.
- .2 Electrical Tests, Current Transformers
 - .1 Perform insulation resistance test of the current transformer and wiring to ground at 1000 volts DC. Do not perform insulation resistance test on solid state and microprocessor based relays.
 - .2 Perform a polarity test of each current transformer using the DC injection bumping method, or any automated method within an approved test set.
 - .3 Perform a ratio verification test by injecting a large enough amount of current through the primary circuit of the CT to be able get a measurable amount of current from the secondary circuit of the CT, note the amount and calculate the measured ratio.
 - .4 Perform an excitation test on transformers used for relaying applications in accordance with ANSI/IEEE C57.13.1.
 - .1 Before the excitation test is made, the current transformer should be demagnetized. To perform the test, an ac test voltage is applied to the secondary winding with the primary open circuited. The voltage applied to the secondary of the current transformer is varied, and the current drawn by the winding at each selected value of voltage is recorded. Readings near the knee of the excitation curve are especially important in plotting a comparison curve. For current transformers with taps, the secondary tap should be selected to assure that the current transformer can be saturated with the test equipment available. The highest tap which can accommodate that requirement should be used. The selection of instruments is especially important for this test. The ammeter should be an RMS instrument.

- .2 CAUTION: If voltage is applied to a portion of the secondary winding, the voltage across the full winding will be proportionately higher because of autotransformer action. Current transformers should not remain energized at voltages above the knee of the excitation curve any longer than is necessary to take readings. Any substantial deviation of the excitation curve for the current transformer under test from curves of similar transformers or manufacturer's data should be investigated.
- .3 Electrical Tests, Voltage Transformers
 - .1 Perform insulation resistance tests primary winding to ground with the secondary winding grounded. Test voltages shall be applied for one minute at 1000 volts DC. Do not perform this test with solid state devices connected.
 - .2 Perform a polarity test on each transformer to verify the polarity marks or H1 X1 relationship.
 - .3 Perform a turns ratio test on all tap positions.
- .4 Test Values
 - .1 Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 25 percent of the lowest value.
 - .2 Insulation resistance measurement on any instrument transformer shall be not less than that shown in NETA Standard Table 10.1.
 - .3 Polarity results shall agree with transformer markings.
 - .4 Ratio accuracy shall be within 0.5 percent of nameplate or manufacturer's published data.
 - .5 Deviation from the excitation test manufacturers expected results may indicate a turn to turn short circuit, distortion of test supply voltage waveform, or the presence of a completed conducting path around the current transformer core.

2.8 LIGHTNING ARRESTORS, GREATER THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.
 - .2 Verify that stroke counter, if present, is correctly mounted and electrically connected.
- .2 Electrical Tests
 - .1 Disconnect all conductors prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black, Phase C – Blue, Neutral – White). After testing, re-connect equipment and conductors in the original phasing order. For equipment rated over 750 volts AC ensure that the connections are covered with “air seal” and high voltage rubber tape correctly applied as per the system rated voltage levels. “Duct seal” shall not be permitted.
 - .2 Perform resistance measurements of ground connection with a low resistance ohmmeter.
 - .3 Perform an insulation resistance test at voltage levels in NETA Standard Table 10.1.

- .3 Test Values
 - .1 Compare bolted connection resistances to values of similar connections.
 - .2 Resistance between the arrester ground terminal and the ground system shall be less than 0.5 ohm.
 - .3 Insulation resistance values should be in accordance with NETA Standard Table 10. 1.

2.9 CABLES, GREATER THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Inspect exposed sections of cables for physical damage and evidence of overheating and corona.
 - .2 Inspect terminations and splices for evidence of overheating and corona.
 - .3 Inspect for proper shield grounding or isolation as required, cable support, and termination.
 - .4 Verify that visible cable bends meet or exceed ICEA and/or manufacturers minimum allowable bending radius.
 - .5 If cables are terminated through window type current transformers, make an inspection to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.
- .2 Electrical Tests
 - .1 Disconnect all conductors prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black, Phase C – Blue, Neutral – White). After testing, re-connect equipment and conductors in the original phasing order. Retape as per section 3.
 - .2 Perform a shield continuity test on each power cable by ohmmeter method.
 - .3 Perform an insulation resistance test utilizing a megohmmeter with a voltage output of at least 5000 volts DC for cables rated greater than 750 volts AC. Individually test each conductor with all other conductors and shields grounded. Test duration shall be one minute.
 - .4 Provide DC Hi-Pot testing for all PILC cables to NETA standards.
 - .5 Provide VLF testing for all shielded power cables containing extruded dielectric insulation to IEEE 400.2 "Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)".
 - Acceptance test for new cable, maintenance test for in-service cable.
- .3 Test Values
 - .1 Shielding must exhibit continuity. Investigate resistance values in excess of ten ohms per 1000 feet of cable.

2.10 TRANSFORMERS, MEDIUM VOLTAGE, LIQUID FILLED

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning
 - .1 Inspect primary and secondary bushings, tank wall, gaskets, and radiators for insulating fluid leaks and cracks.
 - .2 Inspect pressure relief diaphragm for damage.

- .3 Verify that alarm, control, and trip settings on temperature indicators are as specified.
 - .4 Verify that cooling fans and/or pumps operate correctly.
 - .5 Verify operation of all alarm, control, and trip circuits from temperature and level indicators, pressure relief device, and fault pressure relay.
 - .6 Verify correct liquid level in all tanks and bushings. Ensure temperature correction is applied when reading gauges.
 - .7 Verify “silica gel” or equivalent breathing apparatus is present on all conservator type transformers and that the “silica gel” colour indication is at least 70% blue or orange. (Conservator type only)
 - .8 Verify that the valve between the main tank and conservator tank is in the fully open position and that there are no obstructions in the breathing pipe. (Conservator type only)
- .2 Electrical Tests
- .1 Disconnect all equipment and conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black, Phase C – Blue, Neutral – White). After testing, re-connect equipment and conductors in the original phasing order. Make field connects as per Section 3.
 - .2 Perform insulation resistance tests (two winding transformers). With all primary side (High) electrical connections shorted together and all secondary side (Low) electrical connections shorted together test the following:
 - .1 High to Low with Low Grounded
 - .2 Low to High with High Grounded
 - .3 High and Low connected together to Ground
 - .4 Test voltage shall be 1000 volts DC with resistances tabulated and graphed at 10 seconds, 20 seconds, 30 seconds, one minute, five minutes, and 10 minutes. Test duration shall be for ten minutes. Calculate polarization index and dielectric absorption values. Correct the ten minute value to 20°C in accordance with test equipment manufacturer's published data.
 - .1
$$D.A. = \frac{1 \text{ Min. Re sult}}{30 \text{ Sec. Re sult}}$$
 - .2
$$P.I. = \frac{10 \text{ Min. Re sult}}{1 \text{ Min. Re sult}}$$
 - .3 Perform turns ratio tests on all tap positions for all phases to ensure proper exercising of the off load tap changer. Return the tap changer to the designated “as found” tap position, lock tap changer in place, and perform turns-ratio test on all phases after all other electrical tests have been completed.
 - .4 On all liquid transformers larger than 1500kVA, perform insulation power factor/dissipation factor test (two winding transformers). With all primary side (High) electrical connections shorted together and all secondary side (Low) electrical connections shorted together perform the following test:
 - .1 Energize High
 - .1 Ground Low (GST), (CH + CHL)

- .2 Guard Low (GST), (CH)
 - .3 Unground Low (UST), (CHL) (UST)
 - .2 Energize Low
 - .1 Ground High (GST), (CL + CHL)
 - .2 Guard High (GST), (CL)
 - .3 Unground High (UST), (CHL) (UST)
 - .3 AC test voltages shall be equivalent to but not exceed equipment nameplate nominal ratings and never exceed 10 kVAC. Capacitance values for each test shall be recorded. Accepted insulation power factor/dissipation test sets are Doble MH2 or equivalent.
- .5 On all top mounted exposed bushings, perform the following power factor/dissipation factor tests for all bushings rated above 2601 volt AC:
 - .1 Hot collar watts loss tests.
 - .2 C1 capacitance test. (applicable for bushings with C1 tap only)
 - .3 C2 capacitance test. (applicable for bushings with C1 tap only)
 - .4 Hot Collar test shall be performed at 10 kVdc. Capacitance test voltage shall be performed as per bushing manufacturer's published data. Correct for 20°C in accordance with test equipment manufacturer's published data.
- .6 Perform excitation current tests in accordance with test equipment manufacturer's published data.
- .7 Measure the resistance of each winding with an approved winding resistance tester, on all primary windings in each tap changer positions and on each secondary winding.
- .8 If core ground strap is accessible, measure core insulation resistance at 500 volts DC.
- .9 Remove a sample of insulating liquid in accordance with ASTM D923. Sample shall be tested in accordance with the referenced standard.
 - .1 Dielectric breakdown voltage: ASTM D877 and/or ASTM D1816
 - .2 Acid neutralization number: ANSI/ASTM D974
 - .3 Interfacial tension: ANSI/ASTM D971 or ANSI/ASTM D2285
 - .4 Color: ANSI/ASTM D1500
 - .5 Visual Condition: ASTM D1 524
 - .6 Parts per million water: ASTM D1 533. Required on 25 kV or higher voltages and on all silicone filled units.
 - .7 Measure dissipation factor or power factor in accordance with ASTM D924.
 - .8 Part per million of PCB (Perform only if values are not known)
- .10 Remove a sample of insulating liquid in accordance with ASTM D3613 and perform dissolved gas analysis (DGA) in accordance with ANSI/IEEE C57.104 or ASTM D3612. (Atmospheric air shall not enter the test sample) Test should include dissolved water and total dissolved gas concentration complete with the following gas concentrations:
 - .1 Hydrogen (H2)
 - .2 Methane (CH4)

- .3 Carbon Monoxide (CO)
- .4 Acetylene (C₂H₂)
- .5 Ethylene (C₂H₄)
- .6 Ethane (C₂H₆)
- .7 Carbon Dioxide (CO₂)
- .8 Oxygen (O₂)
- .9 (N₂)
- .10 Evaluation of gas concentrations with recommendations shall be submitted within chemical analysis report.

.3 Test Values

- .1 Insulation resistance test values at one minute should not be less than values recommended by the manufacturer. Resistance values to be temperature corrected in accordance with the manufacturer.
- .2 The polarization index should be compared to previously obtained results. Polarization Index calculations range from 2 to 5. Investigate any values which deviate from range.
- .3 Turns ratio test results shall not deviate more than one half percent from either the adjacent coils or the calculated ratio.
- .4 Maximum power factor of liquid filled transformers corrected to 20°C shall be in accordance with transformer manufacturer's published data. Representative values are indicated in NETA Standard Table 10.3. Compare with test equipment manufacturer's published data. To ensure test results are valid the Grounded Specimen Tests must equal the summation of the Guarded Specimen Test and the Ungrounded Specimen Test. Measured capacitance values have the same relationship.
- .5 Investigate bushing power factors and capacitances that vary from nameplate values by more than ten percent. Investigate any bushing hot collar watts loss results that exceed the test equipment manufacturers published data. Investigate hot collar results, which deviate from similar results by more than 15 percent. In the case of hermetically sealed liquid filled bushings perform the hot collar test on every bushing skirt in order to detect bushing oil levels.
- .6 Typical excitation current test data pattern for three legged core transformer is two similar current readings and one lower current reading.
- .7 Winding resistance measurements should compare within one percent of previously obtained results after factoring in temperature correction. Investigate any values which deviate from similar connections by more than 15 percent of the lowest value.
- .8 Core insulation values should be comparable to previously obtained results but not less than one megohm at 500 volts dc. If the core insulation is breached a circulating current in the transformer core will be established that will tend to cause adverse heating of the unit. Monitor transformer running temperature.
- .9 Insulating liquid shall be in accordance with NETA Standard Table 10.4. Make observations on acceptability.
- .10 Evaluate results of dissolved gas analysis in accordance with ANSI/IEEE Standard C57.104 and make observations on acceptability.

2.11 TRANSFORMERS, MEDIUM VOLTAGE, AIR COOLED

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning
 - .1 Verify that control and alarm settings on temperature indicators are as specified.
 - .2 Verify that cooling fans operate if present.
 - .3 Perform specific inspections and mechanical tests as recommended by manufacturer.
 - .4 Verify that as-found tap connections are recorded before changing tap position, and as-left tap connections are as specified.
 - .5 Verify if surge arresters, neutral ground resistors, current transformers, or other non-transformer devices are present within the transformer enclosure.
- .2 Electrical Tests
 - .1 Disconnect all equipment and conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black, Phase C – Blue, Neutral – White). After testing, re-connect equipment and conductors in the original phasing order. Make field connections as per Section 3.
 - .2 Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
 - .3 Perform insulation resistance tests (two winding transformers). With all primary side (High) electrical connections shorted together and all secondary side (Low) electrical connections shorted together test the following:
 - .1 High to Low with Low Grounded
 - .2 Low to High with High Grounded
 - .3 High and Low connected together to Ground
 - .4 Test voltage shall be 1000 volts DC with resistances tabulated and graphed at 10 seconds, 20 seconds, 30 seconds, one minute, five minutes, and 10 minutes. Test duration shall be for ten minutes. Calculate polarization index and dielectric absorption values. Correct the ten minute value to 20°C in accordance with test equipment manufacturer's published data.
 - .1
$$D.A. = \frac{1 \text{ Min. Re sult}}{30 \text{ Sec. Re sult}}$$
 - .2
$$P.I. = \frac{10 \text{ Min. Re sult}}{1 \text{ Min. Re sult}}$$
 - .4 Perform insulation power factor/dissipation factor test (two winding transformers). With all primary side (High) electrical connections shorted together and all secondary side (Low) electrical connections shorted together perform the following test:
 - .1 Energize High
 - .1 Ground Low (GST), (CH + CHL)
 - .2 Guard Low (GST), (CH)
 - .3 Unground Low (UST), (CHL) (UST)

- .2 Energize Low
 - .1 Ground High (GST), (CL + CHL)
 - .2 Guard High (GST), (CL)
 - .3 Unground High (UST), (CHL) (UST)
- .3 AC test voltages shall be equivalent to but not exceed equipment nameplate nominal ratings and never exceed 10 kVac. Capacitance values for each test shall be recorded. Accepted insulation power factor/dissipation test sets are Doble M2-H units.
- .5 Perform a power-factor or dissipation-factor tip-up test. Perform test at 2000 VAC for 8 to 15 kV rated equipment.
- .6 Perform turns-ratio tests at each designated tap position.
- .7 Perform an excitation-current test on each phase.
- .8 Measure the resistance of each winding with an approved winding resistance tester, on all primary windings in each tap changer positions and on each secondary winding.
- .9 Measure core insulation-resistance at 500 volts dc if the core ground strap is removable.
- .3 Test Values
 - .1 Compare bolted connection resistances to values of similar connections.
 - .2 Bolt-torque levels should be in accordance with NETA Standard Table 10.12 unless otherwise specified by manufacturer.
 - .3 Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
 - .4 Insulation-resistance test values at one minute should be in accordance with NETA Standard Table 10.5.
 - .5 The polarization index should be compared to previously obtained results. Polarization Index calculations range from 2 to 5. Investigate any values which deviate from range.
 - .6 Turns-ratio test results should not deviate more than one half percent from either the adjacent coils or the calculated ratio.
 - .7 CH and CL power-factor or dissipation-factor values will vary due to support insulators and bus work utilized on dry transformers. The following should be expected on CHL power factors:
 - .1 Power transformers: 2.0 percent or less
 - .2 Distribution transformers: 5.0 percent or less
 - .3 Consult transformer manufacturer's or test equipment manufacturer's data for additional information.
 - .8 Tip-up test watts loss values should indicate no significant increase in power factor.
 - .9 Temperature corrected winding-resistance test results should compare within one percent of previously obtained results.
 - .10 Typical excitation current test data pattern for three-legged core transformer is two similar current readings and one lower current reading.

- .11 Core insulation-resistance values should be comparable to previously obtained results but not less than one megohm at 500 volts dc.

2.12 GROUNDING RESISTORS, AIR COOLED

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning
 - .1 Perform specific inspections and mechanical tests as recommended by manufacturer.
 - .2 Verify if current transformers or other non-resistor devices are present within the resistor enclosure.
- .2 Electrical Tests
 - .1 Disconnect all equipment and conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black , Phase C – Blue, Neutral –White). After testing, reconnect equipment and conductors in the original phasing order. Make field connections as per Section 3 if required.
 - .2 Perform insulation resistance measurements per NETA
 - .3 Perform resistance measurements through resistor or inductor and bolted connections with a low-resistance ohmmeter, either DC or AC as required.
- .3 Test Values
 - .1 Compare bolted connection resistances to values of similar connections.
 - .2 Bolt-torque levels should be in accordance with NETA Standard Table 10.12 unless otherwise specified by manufacturer.
 - .3 Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer’s published data. If manufacturer’s data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
 - .4 Insulation-resistance test values at one minute should be in accordance with NETA Standard Table 10.5

2.13 CABLES, LESS THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Inspect exposed sections of cables for physical damage and evidence of overheating and corona.
 - .2 Inspect terminations and splices for evidence of overheating and corona.
 - .3 Verify tightness of accessible bolted electrical connections by calibrated torque-wrench in accordance with NETA standard Table 10.12.
 - .4 Inspect for shield grounding, cable support, and termination.
 - .5 Verify that visible cable bends meet or exceed ICEA and/or manufacturers minimum allowable bending radius.
 - .6 If cables are terminated through window type current transformers, make an inspection to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.

- .2 Electrical Tests
 - .1 If required by electrical tests, disconnect all conductors prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black, Phase C – Blue, Neutral – White). After testing, re-connect equipment and conductors in the original phasing order.
 - .2 Perform an insulation resistance test utilizing a megohmmeter with a voltage output of at least 500 volts DC for cables up to 250 volts, and at 1000 volts DC for cables rated from 250 to 600 volts AC. Individually test each conductor with all other conductors and shields grounded. Test duration shall be one minute.
- .3 Test Values
 - .1 Minimum insulation resistance values should be comparable to previously obtained results, but not less than two megohms. Investigate values that differ from other phases by more than 50%.

2.14 CIRCUIT BREAKER TRIP UNITS, THERMAL MAGNETIC

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Record as-found settings.
- .2 Electrical Tests
 - .1 Verify functionality of trip unit by tripping using the trip button of the trip unit, if present.
 - .2 If requested by contract documents, provide primary injection of the circuit breaker trip unit.
- .3 Test Values
 - .1 When not otherwise specified, use manufacturer's recommended tolerances.
 - .2 When critical test points are specified, the relay should be calibrated to those points.

2.15 PANELBOARDS AND MCCS, EITHER BREAKER OR FUSIBLE DISCONNECT (DISTRIBUTION, LIGHTING, EMERGENCY, ETC.)

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Note the position of all circuit breakers or disconnects. Operate all circuit breakers or disconnects to ensure proper mechanical operation. Ensure that all devices are left in the original position.
 - .2 Inspect all wires for evidence of damage, chafing, or pinching in the panel board covers.
 - .3 Check tightness of all connections.
- .2 Electrical Tests
 - .1 Perform insulation resistance tests on the main bus with all breakers open and control wiring disconnected. Energize each phase with the correct test voltage ensuring the opposing two phases and neutral (4 wire only) are grounded. Each test shall occur for a duration of one (1) minute. Electrical equipment rated from 120 volts AC to 250 volts AC shall be tested at 500 volts DC. Electrical

equipment rated above 250 volts AC to 600 volts DC shall be tested at 1000 volts DC.

- .2 If required for electrical testing, disconnect all equipment and conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B –Black, Phase C – Blue, Neutral – White). After testing re-connect equipment and conductors in the original phasing order.
- .3 Test Values
 - .1 Insulation resistance values for bus shall be in accordance with manufacturers published data. In the absence of manufacturers published data, use NETA Standard Table 10.1. (Note: Do not use test voltage levels in NETA Table 10.1) Values of insulation resistance less than this table or manufacturers minimum should be investigated.

2.16 SPLITTER TROUGHS

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Inspect all wires for evidence of damage, chafing, or pinching in the panel board covers.
 - .2 Check tightness of all connections.
- .2 Electrical Tests
 - .1 Perform insulation resistance tests on the main bus. Energize each phase with the correct test voltage ensuring the opposing two phases and neutral (4 wire only) are grounded. Each test shall occur for a duration of one (1) minute. Electrical equipment rated from 120 volts AC to 250 volts AC shall be tested at 500 volts DC. Electrical equipment rated above 250 volts AC to 600 volts DC shall be tested at 1000 volts DC.
 - .2 If required by electrical testing, disconnect all equipment and conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B –Black, Phase C – Blue, Neutral – White). After testing re-connect equipment and conductors in the original phasing order.
- .3 Test Values
 - .1 Insulation resistance values for bus shall be in accordance with manufacturers published data. In the absence of manufacturers published data, use NETA Standard Table 10.1. (Note: Do not use test voltage levels in NETA Table 10.1) Values of insulation resistance less than this table or manufacturers minimum should be investigated.

2.17 TRANSFORMERS, AIR COOLED, SMALL (LESS THAN 167 KVA SINGLE PHASE OR 500 KVA THREE PHASE)

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Inspect core and coil for evidence of insulation breakdown due to excessive heating.
 - .2 Check tightness of all connections.
- .2 Electrical Tests

- .1 Verify correct secondary voltage phase to phase and phase to neutral after energization and loading.
- .2 If testing requires cable disconnection, disconnect all equipment and conductors that are not part of the equipment assembly prior to testing and ensure that all phases are properly identified (Phase A – Red, Phase B – Black, Phase C – Blue, Neutral – White). After testing, re-connect equipment and conductors in the original phasing order.

2.18 DISCONNECTS (FUSED AND UNFUSED), LESS THAN 750V

- .1 Visual and Mechanical Inspection, provide all typical inspections and cleaning, plus:
 - .1 Inspect physical and mechanical condition, including:
 - .1 Blade and Jaw - verify correct blade alignment, blade penetration, travel stops, and mechanical operation.
 - .2 Operating Arm – free movement, break over
 - .3 Operating Mechanism – sprockets, chain, pushrod arms, lubrication.
 - .4 Door interlock – verify door unable to open when switch closed.
 - .2 Inspect fuses if present.
 - .3 Check tightness of all connections.
 - .4 Note position and exercise switch, returning switch to original position.

2.19 DC BATTERY SYSTEMS

- .1 Ensure adequate protective equipment is used during all following tests, which shall include at least the following:
 - .1 Goggles and face shields
 - .2 Acid-resistant gloves
 - .3 Protective aprons
 - .4 Portable or stationary water facilities for rinsing eyes and skin in case of contact with electrolyte
 - .5 Bicarbonate of soda solution, mixed 100 grams bicarbonate of soda to 1 litre of water, to neutralize acid spillage. NOTE - the removal and/or neutralization of an acid spill may result in production of hazardous waste. The user should comply with appropriate governmental regulations.
 - .6 Class C fire extinguisher
 - .7 Adequately insulated tools
- .2 The following protective procedures shall be observed during maintenance:
 - .1 Use caution when working on batteries since they represent a shock hazard.
 - .2 Prohibit smoking and open flames, and avoid activities that increase the chances of arcing in the immediate vicinity of the battery.
 - .3 Ensure that the load test leads are clean, in good condition, and connected with sufficient length of cable to prevent accidental arcing in the vicinity of the battery.
 - .4 Ensure that all connections to load test equipment include appropriate short-circuit protection.
 - .5 Ensure that battery area ventilation is operating per its design.

- .6 Ensure unobstructed egress from the battery area.
- .7 Avoid the wearing of metallic objects such as jewellery.
- .8 Neutralize static build up just before working on the battery by contacting the nearest effectively grounded surface.
- .9 If installed, ensure that the battery monitoring system is operational.
- .3 Provide the following visual, mechanical, and electrical inspections, noting that all inspections should be made under normal float conditions.
 - .1 Inspect the battery rack/cabinet and anchors for rusting, corrosion, and other deterioration that could affect the battery rack structural or seismic integrity and strength and inspect approximately 10% of the battery rack fasteners for tightness.
 - .2 Perform the following steps for seismic installations.
 - .1 Inspect the battery to ensure an intercell spacer is present between each battery jar.
 - .2 Inspect the intercell spacers in place for deterioration (broken, warped, crumbling, etc.).
 - .3 Verify that the space between each of the end-rails and the end battery jars is less than or equal to 3/16" or a value specified by the manufacturer.
 - .3 Verify that the rail insulators are in place and in good condition.
 - .4 Verify that the electrolyte level of each cell is between the high- and low-level marks imprinted on the cell case. When any cell electrolyte reaches the low-level line, distilled or other approved-quality water should be added to bring the cells to the manufacturer's recommended full level line. Water quality should be in accordance with the manufacturer's instructions.
 - .5 Inspect each battery cell jar, cell jar cover, and seals (jar to cover seal, post to cover seal) for deterioration (acid leakage, cracking, crazing-spider web effect, distortion, etc.).
 - .6 Examine the plates in each cell for sulfation. NOTE - sulfation can sometimes be detected on the plate edges by shining a light source on the plates, which will reflect off the yellowish sulfate crystals.
 - .7 Examine the plates in each cell for the proper color that indicates a fully charged battery based on the manufacturer's information. NOTE - normally, fully-charged, positive plates are coloured a deep chocolate-brown color. Negative plates are normally a medium grey. A horizontal ring of white deposits around the plates and on the inside of the jar indicates hydration. This is a result of the lead sulfate precipitating out of solution after the recharge of an over discharged cell or the recharge of a discharged cell that has not been promptly recharged. Consult your manufacturer's maintenance instructions for further guidelines in this area. If any negative plates are reddish in color, this indicates copper contamination, and the cell should be replaced as soon as practical.
 - .8 Examine through the clear battery jar case, the plates, bus bar connection to each plate, and bus bar connection to the post of each battery cell for corrosion and other abnormalities. Inspect the lower part of the post seals and the underside of the cover for cracking or distortion.
 - .9 Examine the cell plates, spacers, and sediment space of each cell to determine if any deterioration (warped plates and spacers, lifted cell posts, pieces of plate material that have fallen off, shorted plates, excessive sediment in the bottom of

- the cell, plates that have dropped lower than the other plates, etc.) has occurred that could affect a cell relative to the rest of the cells in the battery.
- .10 Examine the cell posts of each cell to determine if any of them have grown or lifted to a larger degree than the rest of the posts of the battery. NOTE - the positive plates of lead-acid batteries normally swell or grow with age and use. Most manufacturers claim that 5% growth is the expected maximum limit during the life of the battery.
 - .11 Inspect each electrical cell-to-cell and terminal connection to ensure they are clean (no significant corrosion or foreign matter) and the connection surfaces remain coated with a thin layer of anti-corrosion material. If corrosion is noted, remove the visible corrosion and check the resistance of the connection as per item 2.19.3.25 below. NOTE - unless corrosion is cleaned off of battery terminals periodically, it will spread into the area between the posts and the connectors.
 - .12 Verify that all cells of the battery remain properly numbered.
 - .13 Verify that each battery cell vent, flame arrestors, and dust caps are present and inspect each for damage.
 - .14 Examine the general condition of the battery, battery rack and/or cabinet, and the battery room to determine if they are clean and in good order. When excessive dirt is noted on cells or connectors, remove it with a water-moistened clean wipe. Remove electrolyte spillage on cell covers and containers with a solution of bicarbonate of soda mixed with 100 grams of soda to 1 liter of water. Avoid the use of hydrocarbon-type cleaning agents (oil distillates) and strong alkaline cleaning agents, which may cause containers and covers to crack or craze. Do not allow the cleaning compound to enter the cell.
 - .15 Inspect for unintentional battery grounds
 - .16 Record float voltage measured at battery terminals. When the float voltage measured at the battery terminals is outside of its recommended operating range, it should be adjusted. Nominal float voltage should be as recommended by manufacturer. Maximum float voltage or Nominal Equalize voltage should be as recommended by manufacturer.
 - .17 Record charger output current and voltage. Maximum provided voltage from the charger should be as recommended by manufacturer.
 - .18 Record ambient temperature and ventilation
 - .19 Check approximately 10% of the battery rack fasteners for tightness.
 - .20 Measure and record the voltage of each cell
 - .21 Measure and record specific gravity of 10% of the cells of the battery if battery float charging current is not used to monitor state of charge.
 - .22 Measure and record electrolyte temperature of 10% or more of the battery cells. When cell temperatures deviate more than 3°C from each other during a single inspection, determine the cause and correct the problem. If sufficient correction cannot be made, contact the manufacturer for allowances that must be taken. NOTE - when working with large multi-tier installations, the 3°C allowable deviation may not be achievable, especially when relating the bottom to top tier temperature measurements. Typically, the deviation limit should be maintained within tiers.
 - .23 Measure and record specific gravity and temperature of each cell. Please note, specific gravity values are based on a temperature of 25°C, and should be corrected for the actual electrolyte temperature and level. For each 1.67°C above

25°C add 1 point (0.001) to the value. Subtract 1 point for each 1.67°C below 25°C.

- .24 Check all battery rack connection fasteners for tightness.
 - .25 Cell-to-cell and terminal connection resistance. (NOTE – do not take measurements across the cell. This improper action could cause personal injury, damage to the test equipment, and damage the cell.) If resistance measurements obtained are more than 20% above the installation value, or the greater of 20% or 5 micro-ohms above the average value, or if loose connections are noted, torque and re-test. If retested resistance value remains unacceptable, the connection should be disassembled, cleaned, reassembled, and retested. Typically, this will involve the following steps:
 - .1 Clean posts and connectors and apply a thin coat of heated (between 71 and 85°C) no-oxide grease.
 - .2 Re-Install existing inter-cell and inter-tier connectors, and hand tighten nuts in accordance with manufacturer's instructions.
 - .3 Using torque wrenches, tighten nuts in accordance with manufacturer's recommended value.
 - .4 Refer to IEEE Std. 484-1996 for detailed procedures and IEEE Std. 450-2002 D.2 and Annex F for further discussions.
 - .26 Structural integrity of the battery rack and/or cabinet.
- .4 Equalizing Charge
- .1 An equalizing charge should be given in any of the following conditions:
 - .1 If the voltages measured under item 2.19.3.19 above are deviating from the average value by an amount greater than that recommended by the manufacturer, typically +/- 0.05V for lead calcium batteries.
 - .2 If the specific gravity, corrected for temperature, of an individual cell falls below the manufacturer's lower limit.
 - .3 If any cell voltage is below the manufacturer's recommended minimum cell voltage.

2.20 GROUND ELECTRODE

- .1 Visual and Mechanical Inspection
 - .1 Inspect expose ground conductor and connections.
 - .2 Inspect ground rod viewport.
 - .3 Dig to expose to underground ground rods and connections, review condition
 - .4 Ensure proper connections are made to all exposed switchgear, structures, transformers, fences, gates, and other items per OESC section 36.
- .2 Electrical Tests
 - .1 Perform fall of potential or alternative test in accordance with IEEE Standard 81 on the main grounding electrode or system.
 - .2 Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
- .3 Test Values

- .1 The resistance between the main grounding electrode and ground should be no greater than five ohms for commercial or industrial systems and one ohm or less for generating or transmission station grounds unless otherwise specified by the owner. (Reference ANSI/IEEE Standard 142)
- .2 Investigate point-to-point resistance values which exceed 0.5 ohm.

PART 3 - FIELD TAPING PROCEDURE

3.1 MATERIALS FOR TAPING

- .1 Use acceptable high voltage acceptable filler such as Kearney Air Seal or 3M Scotchfil Electrical Insulation Putty. Standard duct seal is not acceptable.
- .2 Use an acceptable high voltage insulating tape such as Scotch 130C.

3.2 APPLICATION

- .1 Elongate insulating tape 10 to 25 percent during application to ensure a smooth, tight fit. On pads elongate corners only.
- .2 Should a tape roll expire, start the new role by overlapping the previous end by 1/2 turn.
- .3 Apply one layer of insulating tape, lapping as specified in the taping chart; overlap any pre-insulation by 1-1/2 inches.

3.3 APPLICATION ON JOINTS WITH HARDWARE

- .1 Clean area of dirt and foreign matter.
- .2 Apply filler over bare conductor and hardware to cover and smooth out the surface. Blend contour into pre-insulation surfaces. Cover conductors and hardware with at least 1/8 inch of filler.
- .3 Apply pad(s) of insulating tape of sufficient width to overlap pre-insulation by one inch or more.
- .4 Apply one layer of insulating tape, lapping as specified in the chart, overlapping any pre-insulation or pads by 1-1/2 inches.

3.4 TAPING CHART

Rated kV of Equipment	Taping Chart			
	Pre-insulation or Pad Overlap Min. Inches	Lap of Tape	Insulating Tape Min. Layers	No. of Pads
Up to 5	1-1/2	1/2	1	1
Up to 15	1-1/2	2/3	2	2
Up to 27	1-1/4	2/3	3	3
Up to 46	1-1/4	2/3	4	4

3.5 DEFINITIONS

- .1 Joint: Area to be covered with tape which consists of bare conductor and 1-1/2 inches of any pre-insulation next to the bare conductor.

- .2 Pre-Insulation: Any insulating tape applied which is wider than one inch, which includes a band of tape consisting of one or more turns wrapped directly on top of each other.
- .3 Layer: Insulating tape, 1 inch wide, wrapped from one end of the joint to the other (or to a pad) so each succeeding turn laps the previous turn by the amount specified in the chart.
- .4 Overlap: A specified distance measured along the pre-insulation starting from where the pre-insulation ends and the exposed conductor begins.

PART 4 - EXECUTION

4.1 GENERAL REQUIREMENTS

- .1 Testing to be completed on all equipment supplied under this contract.
- .2 Keep working area clean and safe, all testing and maintenance areas are to be cleaned after usage.

4.2 EQUIPMENT TO BE TESTED BY SPECIALIST TESTING AGENCY

- .1 Switchgear Assemblies, Greater Than 750V
- .2 Load break switch, Greater Than 750V
- .3 Fuses, Greater Than 750V
- .4 Circuit Breakers, Vacuum, Greater Than 750V
- .5 Circuit Breakers, Low-Voltage Molded-Case Circuit Breakers
- .6 Discrete Protective Relays
- .7 Instrument Transformers, Both Cts And Pts, applied to circuits greater than 750V
- .8 Lightning Arrestors, Greater Than 750V
- .9 Cables, Greater Than 750V
- .10 Transformers, Medium Voltage, Liquid Filled
- .11 Transformers, Medium Voltage, Dry Type
- .12 Cables, Less Than 750V
- .13 Circuit Breaker Trip Units
- .14 Panelboards and MCCs, either breaker or fusible disconnect (distribution, lighting, emergency, etc.)
- .15 Splitter troughs or junction boxes
- .16 Transformers, air cooled, small (less than 167kva single phase or 500kva three phase)
- .17 Disconnects (fused and unfused), less than 750v

- .18 Grounding resistor or inductors
- .19 Grounding Electrodes
- .20 Battery chargers and battery banks

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No. 131-07, Type TECK 90 Cable.
- .2 National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)
 - .1 ICEA S-93-639/NEMA WC74-06, 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.

PART 2 - PRODUCTS

2.1 RUBBER INSULATED CABLES (1001 - 5000 V)

- .1 Conductors: copper size as indicated.
- .2 Insulation: cross-linked polyethylene compound rated RWU90.
- .3 Insulation shielding: semi-conducting non-metallic tape over insulation, and served wire shield over tape.
- .4 Cable jacket: thermosetting with separator tape between shield and jacket.

2.2 COPPER TAPE SHIELDED POWER CABLE 15,000 V

- .1 Single copper conductor, Class B stranded, size as indicated.
- .2 Semi-conducting crosslinked polyolefin conductor shield .
- .3 Manufactured to CSA C68.5
- .4 Insulation: 133% tree retardant crosslinked polyethylene (TRXLPE) rated for 90°C, for 15,000V.
- .5 Semi-conducting crosslinked polyolefin conductor insulation shield.
- .6 Metallic Shield: 0.06mm annealed copper shield tape applied helically with 20% overlap over insulation shield.
- .7 Jacket: Low friction, lead free, flame-retardant, moisture and sunlight-resistant, PVC jacket rated minus 35°C.

2.3 TECK POWER CABLE (1001 - 15000 V)

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Ground: Annealed bare copper Class B stranding.
- .3 Copper circuit conductors, size and number as indicated.
- .4 Extruded Strand Shield: Thermoset semi-conducting extruded stress control layer over conductor.
- .5 Insulation: Cross-linked polyethylene (XLPE).
- .6 Extruded Insulation shield: Thermoset semi-conducting polymeric layer free stripping from insulation.
- .7 Shield: 5mil annealed copper tape with a minimum 25% overlap.
- .8 Armor: Aluminum Interlocked Armor (AIA)
- .9 Jacket: Flame-retardant, moisture and sunlight-resistant, PVC, colored red.
- .10 Acceptable manufacturers: General Cable, Nexans, Prysmian, or equivalent

2.4 AIRGUARD POWER CABLE (1001 – 15000 V)

- .1 Cable: to CAN/CSA-C68.10, CSA C22.2 No.230, CSA-C96.1
- .2 Conductor: Class B compact concentric stranded soft drawn annealed copper, sized as indicated on drawings.
- .3 Insulation: Natural high dielectric strength EPR-based insulation, 133% rated.
- .4 Conductor Shield: Extruded thermosetting semi-conducting shield which is free stripping from the conductor and bonded to the insulation.
- .5 Insulation Shield: Extruded thermosetting semi-conducting shield with controlled adhesion to the insulation.
- .6 Metallic Shield: Helically applied non-magnetic copper tape over the insulation shield with a minimum overlap of 15%. A Mylar ribbon must be longitudinally applied under the copper tape shield for phase identification.
- .7 Grounding Conductors: Bare stranded copper conductor, one in each interstice.
- .8 Assembly: Phase identified shielded conductors cabled with fillers and grounding conductors, forming a firm and cylindrical cable core. Binder tape to be applied to maintain core symmetry and mechanical stability.
- .9 Mechanical protection: High strength and high crush resistant Airbag Layer extruded over the core assembly.
- .10 Chemical protection: A layer of Drylam which consists of aluminum tape and a chemical resistant extruded polymer layer must be applied.
- .11 Jacket: Sunlight-resistant, PVC, colored red.
- .12 Acceptable manufacturers: Prysmian, or approved equivalent.

2.5 NON-SHIELDED JUMPER CABLE 15,000V

- .1 Cable: to ICEA S-96-659.
- .2 Copper circuit conductors, size and number as indicated.
 - .1 Conductor to be flexible, rope stranded, annealed, uncoated copper.
- .3 Copper Shield: Nylon semi-conducting tape.
- .4 Insulation: Heat, moisture, and ozone resistant ethylene propylene rubber (EPR) 90°C per ICEA S-96-659(NEMA WC 71), part 4
- .5 Acceptable manufacturers: BICC, Phillips, Pirelli, or equivalent.
- .6 Note: this cable is only to be installed from ceiling IPS through free air down to transformer primary bushings. Cable must not be near any grounded metal or other installations at other than rated voltage.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Obtain detailed cable pull design from cable manufacture prior to installation of cables. Cable pull design to be submitted to engineer for review prior to installation of cable.
- .2 Install power cable in ducts and manholes as indicated and in accordance with manufacturer's cable pull design.
- .3 Provide supports and accessories for installation of high voltage power cable.
- .4 Install stress cones, terminations and splices in accordance with manufacturer's instructions
- .5 Install grounding in accordance with local inspection authority having jurisdiction.
- .6 Provide cable identification tags and identify each phase conductor of power cable every 15 meters where the cable is not installed in duct.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 10.
- .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. Submit test result and inspection certificate.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

1.2 MATERIALS

- .1 Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2 After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

Part 2 Products

2.1 BUILDING WIRES AND GENERAL REQUIREMENTS

- .1 Conductor material for branch circuit wiring and grounding:
 - .1 Stranded copper.
 - .2 Neutral wire: continuous throughout its length without breaks.
 - .3 Separate insulated green grounding conductors in all electrical conduits.
 - .4 All wire and cable insulation shall meet the C.S.A. Standards for the types and services hereinafter specified. Colours as per section 4-036 of Electrical Code.
 - .5 Where otherwise specified, use wire and cable types as follows:
 - .1 Type R90 XLPE cross-link polyethylene stranded for applications using wires sized No. 8 and larger.
 - .2 Type T90 stranded for applications using wires sized No. 10 and smaller.
 - .3 For fire alarm wiring refer to Section 283100.
 - .4 Approved heat resistant wire for wiring through and at lighting and heating fixtures. Where insulation types are shown on the drawings other types shall not be used unless the specification is more restrictive.
 - .6 Use stranded BX cable only under the following conditions:
 - .1 Wiring from a junction box to a recessed lighting fixture in suspended ceilings. Cable length not to exceed 1.5 m (5'), or
 - .2 Wiring or switches or 15 amp receptacles in partitions having removable wall panels, or
 - .3 When specifically called for on drawings.
 - .7 Use stranded wire no smaller than No. 12 AWG for lighting and power and no smaller than No. 16 AWG for control wiring.
 - .8 Conductors shall be soft copper properly refined and tinned having a minimum conductivity of 98%.

Part 3 Execution

3.1 BUILDING WIRES

- .1 Install building wires as follows:
 - .1 Make joints, taps and splices in approved boxes with solderless connectors. Joints and/or splices are not acceptable inside a panelboard.
 - .2 Ensure the lugs accommodate all the strands of the conductor.
 - .3 Replace any wire or cable showing evidence of mechanical injury.
 - .4 Use No. 10 AWG for branch circuit wiring extending more than 30 m (100 ft.) to farthest outlet from panel.
 - .5 Circuit numbers indicated on the drawing are intended as a guide for the proper connection of multi-wire circuits at the panel.
 - .6 Take care to keep the conductors free from twisting.
 - .7 Use an approved lubricant for pulling in conduit.
 - .8 Leave sufficient slack on all runs to permit proper splicing and connection of electrical devices.
 - .9 Branch circuit wiring of 120 volt applications to be multi-wire utilizing common neutrals. Under no condition shall any switch break a neutral conductor.
 - .10 Provide and install an approved fire- retardant wrap or coating for PVC jacketed cables installed in a grouped configuration of two or more.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

1.2 MATERIALS

- .1 Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2 After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

Part 2 Products

2.1 WIRE AND BOX CONNECTORS

- .1 Pressure type wire connectors sized to fit conductors.

2.2 WIRING TERMINATIONS

- .1 Provide first grade wire and cable connectors suitable for the service on which they are used and install them in accordance with the latest trade practice.
- .2 Provide high quality extruded copper-free aluminium (0.4% or less) connectors for single and multi conductor cable. Steel and then zinc plated connectors for multi conductor cables.
- .3 When used in hazardous area, connectors should be certified for such location in Class, Division and Group.
- .4 For large conductor sizes, use bolted or compression solderless type connectors.
- .5 Use high temperature connectors and insulation on all connections of high temperature conductors.
- .6 Where connector types are called for on the drawings or in the specification, do not use other types.
- .7 Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.
- .8 For fire alarm wiring refer to Section 28 31 00.

Part 3 Execution

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required [to CSA C22.2No.41].

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-09, Canadian Electrical Code, Part 1, 21st Edition

PART 2 - PRODUCTS

2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Surface Mounted: screw-on flat, turned edge covers

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Install terminal block as indicated in Type T cabinets.
- .3 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1

3.3 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00].
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

1.2 MATERIALS

- .1 Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2 After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

Part 2 Products

2.1 FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Steel coupling for EMT.
- .3 Fittings for liquid-tight flexible conduits shall be liquid-tight connectors.
- .4 Provide expansion couplings for all conduits running in slabs through expansion joints. These shall be the type approved for use in concrete with a bonding conductor.
- .5 Factory bends are not permitted to be modified. Ensure conduit bends other than factory bends are made with an approved bender. Making offsets and other bends by cutting and rejoining factory bends are not permitted.

2.2 OUTLET BOXES

- .1 Size boxes in accordance with CSA-C22.
- .2 Unless otherwise specified, provide galvanized steel outlet boxes at least 40mm (1-1/2") deep, single or ganged style, of proper size to accommodate devices used and shall be equipped with covers as necessary of the type designed for the specified fittings. Pull boxes shall be steel and shall be galvanized or painted to prevent rusting. For lighting fixture outlets, use 100mm (4") octagon boxes.
- .3 Equip with plaster rings for flush mounting devices in finished walls.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Equip with centre fixture studs for light fixtures.
- .6 Use cast boxes where indicated and for surface mounted wiring. In areas above hung ceilings where appearance is not significant, pressed steel surface boxes may be used.

- .7 Supply all outlet boxes and pull boxes sized according to code requirements unless specified otherwise on the drawings.

2.3 SUPPORT HARDWARE

- .1 Use 10mm (3/8") threaded rod for suspended unistrut and conduit.
- .2 Unless otherwise specified, use 41mm x 41mm (1-5/8" x 1-5/8") galvanized steel unistrut for conduit support systems.

Part 3 Execution

3.1 INSTALLATION

- .1 Install outlet boxes as follows:
 - .1 Support boxes independently of connecting conduits.
 - .2 Make necessary mounting adjustments to the outlet to match interior finish.
 - .3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.
 - .4 Where more than one conduit enters a switch or receptacle box on the same side, provide a 100mm (4") minimum square box with a suitable plaster ring.
 - .5 Location and appearance to be to the NRC Departmental Representative's approval.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

1.2 MATERIALS

- .1 Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2 After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

Part 2 Products

2.1 RACEWAYS

- .1 Conduit:
 - .1 Each length of conduit to be new and bear the CSA Stamp of Approval.
 - .2 Conduit, unless otherwise noted, to be EMT, no smaller than 12mm (1/2").
 - .3 Conduit to be coloured as required for systems described in section 260500.9.
- .2 Bushings and Connectors:
 - .1 Insulated type, with the insulation an integral part of the fitting.
- .3 Conduit Fastening:
 - .1 One hole malleable iron straps to secure surface conduits. Two hole straps for conduits larger than 50mm (2").
 - .2 Beam clamps to secure conduits to exposed steel work.
 - .3 Channel type supports for two or more conduits.
- .4 Pull Cord:
 - .1 Polypropylene cord in empty conduit.
- .5 Unless specifically called for on the drawings, do not use flexible conduits but it is recognized that there may be applications where this material will be useful, such as equipment connections, etc. In such cases, obtain permission for its use from the NRC Departmental Representative. For tender purposes, assume that flexible conduits will not be permitted unless specifically called for on the drawings or equipment specifications. All flexible conduits for vapour-tight applications shall be liquid-tight flexible conduits (seal-tight).
- .6 Provide expansion couplings for all conduits running in slabs through expansion joints. These shall be the type approved for use in concrete with a bonding conductor.

2.2 SUPPORT HARDWARE

- .1 Use 10mm (3/8") threaded rod for suspended unistrut and conduit.
- .2 Unless otherwise specified, use 41mm x 41mm (1-5/8" x 1-5/8") galvanized steel unistrut channel for conduit and cable support systems, on center spacing at 1.5m.

Part 3 Execution

3.1 RACEWAYS

- .1 Install raceways as follows:
 - .1 Rigidly supported.
 - .2 Workmanlike manner.
 - .3 Maintain maximum headroom.
 - .4 Concealed in finished area.
 - .5 Surface-mounted in open area.
 - .6 Do not pass conduits through structural members except as indicated.
 - .7 Parallel to or at right angles to the building lines.
 - .8 Thoroughly ream all conduits at ends and terminate with appropriate locknuts and bushings.
 - .9 Cause minimum interference in spaces through which they pass.
 - .10 Plug or cap conduit during construction to protect from dust, dirt or water.
 - .11 Unless specifically indicated on drawings or with the permission of the NRC Departmental Representative, do not cast conduits in concrete.
 - .12 Dry conduits out before installing wire.
 - .13 Mechanically bend conduit of any size. Bend conduit cold.
 - .14 Do not cut or modify prefabricated bends.
 - .15 PVC conduit as indicated.
 - .16 Function and appearance to be to the NRC Departmental Representative's approval.
 - .17 Seal conduit and cable openings in fire- rated walls and floors with an approved fire stop material.
 - .18 Seal conduit and cable openings in exterior walls with a weatherproof silicone sealant.
 - .19 Paint exposed conduits and boxes to match existing wall / ceiling.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.126-M91(R1997), Cable Tray Systems.
- .2 National Electrical Manufacturers Association (NEMA) standards
 - .1 NEMA FG 1-1993, Fiberglass Cable Tray Systems.
 - .2 NEMA VE 1-2002, Metal Cable Tray Systems

PART 2 - PRODUCTS

2.1 CABLETROUGH

- .1 Cabletroughs and fittings: to NEMA VE 1.
- .2 Ladder type, Class C1 to CAN/CSA C22.2 No.126.
- .3 Trays: aluminum, width and depth as indicated.
- .4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.
 - .1 Radii on fittings: 900mm minimum.
- .5 Barriers where different voltage systems are in same cabletrough.

2.2 SUPPORTS

- .1 Provide supports as required.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install complete cabletrough system.
- .2 Support cabletrough on both sides.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

- .1 Install cables individually.
- .2 Lay cables into cabletrough. Use rollers when necessary to pull cables.
- .3 Secure cables in cabletrough at 6m centres, with nylon ties.
- .4 Identify cables every 15m with size 2 nameplates in accordance with Section 260500.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 260500 - Common Work Results – Electrical
- .2 Section 261323.00 – Shielded Solid Insulated Switchgear
- .3 Section 262400 – Low Voltage Service Entrance Switchboard

1.2 WORK OUTLINE

- .1 The work in this section includes fabrication, assembly, delivery, installation, field assembly, connection, supervision of related trades, on-site testing, commissioning and warranty of the systems components, as outlined in this specification and as indicated on the drawings.
- .2 Installation, assembly, and field connections include all interconnecting power, control and instrumentation wiring to terminals within the system.
- .3 Programming and commissioning of Control Systems, HMI and Power Monitoring System.
- .4 Manufacturer certified service representative to provide start up, commissioning and training for each system.

1.3 OPERATIONS AND MAINTENANCE DATA

- .1 Provide separately bound operation and maintenance manual for the HMI system.
- .2 Include:
 - .1 Complete set of approved shop drawings.
 - .2 Parts list with catalogue numbers for all components.
 - .3 Operation and maintenance instructions for each component and for the complete system.
 - .4 Schematic diagrams, indicating all interconnections between equipment.
 - .5 Detailed wiring diagrams for all wiring within the control system, including power, control, instrumentation, and communications. Ensure all wiring numbers are unique and logically assigned.
 - .6 Narrative overview of the complete systems sequence of operation, including all interrelationships with other systems, devices and controls.
 - .7 Certified copy of set up, testing, and commissioning results.
 - .8 Complete set of as-built drawings in both paper and electronic form (.PDF and .DWG).
 - .9 Complete set of control and programming files for all digital devices in both paper and electronic form (.PDF and the file's native formats).
 - .10 All software, licensing and source code required for PLC controller and HMI.
- .3 Two copies of the manuals listed above shall be submitted prior to Demonstration and Training.

1.4 INSTRUCTION

- .1 Instructions shall only take place after testing and commissioning of the systems is completed, and all operation and maintenance data is submitted to the satisfaction of the Engineer. The Contractor shall provide the services of qualified service representatives for the following training:
 - .1 A minimum period of 2 hours to instruct the owner's operating personnel in the correct operation and maintenance of the HMI system.

1.5 SITE TESTING AND COMMISSIONING

- .1 Bench test before equipment arrived on site.
- .2 Engineer must be notified two weeks prior to any testing.
- .3 Prepare testing procedure and schedule indicating all tests to be performed. Submit to Engineer for review three weeks before testing.
- .4 Test and commission system components and submit to the Engineer a detailed list of sequence of operation indicating test had been verified. At completion of testing and commissioning, duplicate all procedures in the presence of the Engineer. Correct all noted deficiencies to the satisfaction of the Engineer.
- .5 Test and commission the control and instrumentation equipment and demonstrate the overall performance of the complete system in the presence of the Engineer.
- .6 As a minimum, the following steps are required during the testing and commissioning period.
 - .1 Submit typed testing and commissioning forms customized for every typical type of device applied within the system for review by the Engineer. Forms to be modified to the satisfaction of the Engineer.
 - .2 Testing and commissioning shall not commence until all systems are fully operational.
 - .3 Test and commission the system components and complete all forms noted above, and submit to the Engineer for review. All forms shall be included in the final submission of the operation and maintenance manuals.
 - .4 After all of the systems have been satisfactorily commissioned, repeat all testing and commissioning procedures in the presence of the Engineer.

1.6 SHOP DRAWINGS

- .1 Shop drawings to include, but not limited to:
 - .1 Control and instrumentation equipment
 - .2 Enclosure type and dimensions
 - .3 Description of alarm functions
 - .4 Description of control functions

- .5 Set-point description
 - .6 System schematic showing interconnection of all components
 - .7 Installation drawings and diagrams indicating all interconnections between equipment. Drawing shall include identification numbers for all terminal blocks in all equipment. This shall also be submitted in electronic form.
 - .8 All electronic files for the PLC including ladder logic, annotation files, and any other files required for communication with the HMI system shall be supplied.
- .2 Each shop drawing submission shall include a cover letter identifying all changes and deviations from contract drawings and specifications.
- .1 If shop drawings comply fully with contract documents, Contractor shall state “This shop drawing submission complies fully with contract drawings and specifications”.

1.7 CO-ORDINATION

- .1 Installation of instrumentation and control equipment to be coordinated with the work of other trades to ensure proper installation and wiring.

1.8 TENDER DRAWINGS

- .1 The purpose of the drawings is to show the general requirements for the control system and general overview of the method of implementing the specified sequence of operation. It should be used only as a general guide for the design of the control systems. The contractor may use any other method for implementing the specified sequence of operation, subject to the requirements of this specification and shop drawing review. The Contractor is responsible to provide a control system that will execute the specified sequence of operation.

1.9 HMI SYSTEM DESCRIPTION

- .1 HMI system must be capable of performing the following monitoring, and actions via Ethernet communication:
 - .1 The HMI will communicate with the following devices:
 - .1 All 600V breakers on service entrance switchboard status
 - .2 All 600V breakers on service entrance switchboard open and close command
 - .3 All 2.4KV breakers and switches status
 - .4 All 2.4KV breakers and switches open and close command
 - .2 The HMI will display a complete single line drawing of all 2.4kV breakers and switches in the contract and all 600V breakers on the service entrance switchboard.
 - .3 HMI must show the current status of the 2.4kV breakers, switches and all breakers on main service entrance switchboard either “open”, “closed”, or “grounded”. Status should be conveyed to the reader of the HMI by way of a text description and diagrammatically by showing breaker or switch with an appropriate colour (red for closed, green for open, white for grounded).
 - .4 HMI must display the real time current, for each breaker in the 2.4kV breakers and 600V breakers on service entrance switchboard on the single line page(s).
 - .5 HMI system must be capable of opening and closing the 2.4kV breakers, 2.4kv switches and 600V breakers on service entrance switchboard through the HMI’s touch screen display. The HMI must be programmed such that the operation of the breakers can only be performed after the appropriate password

is inputted into the HMI, and after a clear query from the system and confirmation from the user that the specific breaker is to be operated or not.

- .6 HMI system must maintain a time stamped alarm log of all breaker, switch, and relay operations from operator and relay/trip units.
- .7 The system must include all required interfacing and auxiliaries, such as wiring, conduit, I/O interfacing, etc.
- .8 Commutation between PLC controller and field devices such as PLC I/O module, Ethernet interface or trip unit shall via Modbus TCP/IP.

Part 2 Products

2.1 HUMAN MACHINE INTERFACE (HMI)

- .1 The HMI interface may either be an integrated minimum 10” touchscreen display with built-in controls or a minimum 10” touchscreen display with separately DIN-rail mounted PLC controller.
- .2 Equipped with 8-port industrial grade Ethernet switch interconnected with HMI/ PLC.
- .3 The system is powered by external 120VAC, provide power supply as required by system.
- .4 The HMI system shall be housed in fan powered filter-vented NEMA 1 enclosure.
- .5 Approved manufacturers:
 - .1 Siemens
 - .2 Schneider
 - .3 Rockwell/Allan Bradley
 - .4 GE

Part 3 Execution

3.1 WIRING AND TERMINATION

- .1 Switchgear and switchboard network to HMI and PLC controller communication must be through Ethernet communication.

3.2 INSTALLATION AND VERIFICATION

- .1 Install, calibrate, and connect equipment in accordance with manufacturer’s instructions.
- .2 Provide and install all interconnecting wiring.
- .3 All equipment shall be factory assembled and tested prior to shipping.
- .4 Perform on-site system verification and final calibration.
- .5 The contractor shall certify that the installation has been completed in accordance with their instructions.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 001000
- .2 Section 260500 - Electrical General Requirements.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 47-M90 (R2012), 'Dry-Type Transformers'
 - .2 CSA C9-M1981(R2001), 'Dry-Type Transformers'
 - .3 CSA C802.2-00, 'Minimum Efficiency Values for Dry-Type Transformers'
- .2 National Electrical Manufacturers Association (NEMA)

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 00 10 00.
- .2 Include:
 - .1 Dimensioned drawing showing enclosure, mounting devices, terminals, taps, internal and external component layout.
 - .2 Technical data:
 - .1 kVA rating.
 - .2 Primary and secondary voltages.
 - .3 Frequency.
 - .4 Three phase.
 - .5 Polarity or angular displacement.
 - .6 Full load efficiency.
 - .7 Regulation at unity pf.
 - .8 BIL.
 - .9 Insulation type.
 - .10 Sound rating.

1.4 CONTROL SUBMITTALS

- .1 Submit to Engineer 6 copies of standard factory test certificates of each transformer and type test of each transformer in accordance with CSA C9 or C22.2 No. 47.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for dry type transformers for incorporation into manual specified in Section 00 10 00.
- .2 Operation and maintenance instructions to include:
 - .1 Tap changing.
 - .2 Recommended environmental conditions.
 - .3 Recommended periodic inspection and maintenance.
 - .4 Bushing replacement.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Store transformers indoors in dry location.
- .2 Transformers to be shipped fully plywood crated complete with shrink-wrap and desiccant packs. Ensure that the transformers are properly packaged prior to shipping.
- .3 Include all shipping and storage charges required to send equipment to the site. Include charges for on and off loading of the equipment into storage areas designated by the client.

1.7 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 00 10 00 .

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Dry-type transformers: to CSA C22.2 No. 47 and CSA C802.2.

2.2 TRANSFORMER CHARACTERISTICS > 500 kVA 3 PHASE

- .1 Type: ANN/(Provisional ANF).
- .2 Rating: as indicated, 3 phase, provisions only for fan forced air cooling, 60 Hz.
- .3 220 insulation system class, 115 degrees C temperature rise.
- .4 Impedance (STD): 5.5% to 7.5%
- .5 Primary winding: 24,000V delta, BIL 60 kV.
- .6 Secondary winding: 600V, wye, BIL 10 kV, four wire with neutral brought out for solidly grounded or impedance grounding.

- .7 No load and Full load losses to meet CSA standard C802.2.
- .8 Sound rating: 66dB.
- .9 ENCLOSURE
 - .1 NEMA 1 enclosure
 - .2 Fabricated from sheet steel.
 - .3 Bolted removable panels for access to tap connections, enclosed terminals.
 - .4 Conductor entry:
 - .1 Side entry for primary cables.
 - .2 Exit for secondary conductors through side of transformer enclosure such that cables do not need to be de-rated.
 - .3 Transformer manufacturer to provide flexible connectors for primary connections and coordinate with primary switchgear manufacturer to insure location of primary switchgear bus and transformer primary bus allows for close coupling of transformer to primary switchgear.
 - .5 Designed for floor mounting.
 - .6 Indoor, ventilated, self cooled type. Temperature of exposed metal parts not to exceed 65 degrees C rise.
 - .7 The transformer enclosure must be knock down type to allow for transformer disassembly to insert into room through access hatch. Contractor to ensure size of core and coil is acceptable for insertion into vault through the ventilation airway and vault door.
 - .8 Enclosure height must not exceed 2750mm in height.
- .10 VOLTAGE TAPS
 - .1 5 taps, one at nominal voltage, 2 at 2.5% intervals above nominal, 2 at 2.5% intervals below nominal.
- .11 TAP CHANGER
 - .1 Bolted-link type.
- .12 WINDINGS
 - .1 Primary and secondary coils:
 - .1 Copper.
 - .2 Mechanical Coil Supports
 - .3 Epoxy Vacuum Impregnation (E.V.I.).
 - .4 Primary Winding Construction – Self supporting disk wound with insulation dielectric impulse surge capacity rated at 4000 volts turn to turn equivalent to Nomex.
 - .5 Secondary Winding Construction – Self supporting barrel wound with insulation dielectric impulse surge capacity rated at 4000 volts turn to turn equivalent to Nomex.
 - .2 Coil and core assembly:
 - .1 Taps located at front of coils for accessibility.

.13 ACCESSORIES TO BE INCLUDED

- .1 Winding temperature detector relay and sensing elements with two sets of SPDT contacts to allow for future fan control and high temperature alarming.
- .2 Wiring and terminal box for protective devices.
- .3 Grounding terminal: inside of enclosure.
- .4 Enclosed RC snubber terminated at transformer primary side: NTSA PROTEC Z 3-PHASE HV, cat: PZ-MM3-5KV SSW

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 260500 - Electrical General Requirements.
- .2 Equipment labels: nameplate size 7.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate, install and ground transformers in accordance with manufacturer's instructions.
- .2 Set and secure transformers in place, rigid plumb and square.
- .3 Connect primary terminals to high voltage circuit.
- .4 Connect secondary terminals to secondary circuit.
- .5 Use flexible conduit to make connections to transformer.
- .6 Energize transformers and check secondary no-load voltage.
- .7 Adjust primary taps as necessary to produce rated secondary voltage at no-load.
- .8 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.
- .9 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.
- .10 Provided dedicated system ground to transformer neutral point if present.
- .11 Contractor to provide control power to transformer temperature detector.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 260510 – Electrical Testing.
- .2 Energize transformers and apply incremental loads:
 - .1 0% for 4 hours.

- .2 10% for next 1 hour.
- .3 25% for next 2 hours.
- .4 50% for next 3 hours.
- .5 Full load.
- .6 At each load change, check ambient and winding temperatures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- 1.1.1 Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for electrical controls and relays as required for the complete performance of the Work, as shown on the Drawings, as specified herein, and as specified elsewhere for the assemblies or systems comprised of the components specified herein.
- 1.1.2 Related Sections: Related sections include, but shall not be limited to, the following:
- 1.1.3 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.1.4 Applicable general requirements for electrical Work specified within Division 26 Specification Sections apply to this Section.

1.2 REFERENCES

- 1.2.1 General, Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- 1.2.2 Institute of Electrical and Electronic Engineers (IEEE)
 - 1.2.2.1 ANSI/IEEE C37.20.3 – IEEE Standard for Metal-Enclosed Interrupter Switchgear
 - 1.2.2.2 ANSI/IEEE C37.04 – Standard Rating Structure for AC High-Voltage Circuit Breakers
 - 1.2.2.3 ANSI/IEEE C37.06 – Standard AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
 - 1.2.2.4 ANSI/IEEE C37.09 – Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
 - 1.2.2.5 ANSI/IEEE C37.11 – Standard Requirements for Electrical Control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
 - 1.2.2.6 ANSI/IEEE 386 – Standard for Separable Insulated Connector System for Power Distribution System above 600V

1.2.3 National Fire Protection Agency (NFPA)

1.2.3.1 NFPA 70 - National Electrical Code® (NEC)

1.2.4 International Electrotechnical Commission (IEC)

1.2.4.1 IEC 60044-1 – Instrument Transformers – Part 1: Current Transformers

1.2.4.2 IEC 60044-2 – Instrument Transformers – Part 2: Voltage Transformers

1.2.4.3 IEC 60044-8 – Instrument Transformers – Part 8: Low Power Current Transducers

1.2.4.4 IEC 62271 - High-voltage switchgear and control gear

1.2.4.1.1 Part 201: AC solid-insulation enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV

1.2.4.1.2 IEC 60255 – Electrical Relays

1.2.5 NEMA

1.2.5.1 NEMA SG4 - Alternating Current High Voltage Circuit Breakers.

1.2.5.1.1 NEMA SG5 - Power Switchgear Assemblies.

1.2.5.1.2 NEMA SG6 – Power Switching Equipment

1.2.5.1.3 ASTM B-117 – Standard Practice for Operating Salt Spray (Fog) Apparatus

1.3 SUBMITTALS

1.3.1 General: Submittals shall be in accordance with the requirements of Section 001000, in addition to those specified herein.

1.3.1.1 Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.

1.3.1.2 Deviations from the Contract Documents shall be indicated within the submittal. Each deviation shall reference the corresponding drawing or specification number, show the Contract Document requirement text and/or illustration, and shall be accompanied by a detailed written justification for the deviation.

- 1.3.1.3 The manufacturer shall furnish a detailed Bill of Material and complete set of drawings as follows:
 - 1.3.1.3.1 Detailed front elevation
 - 1.3.1.3.2 Single Line
 - 1.3.1.3.3 Base Plan
 - 1.3.1.3.4 Schematics
 - 1.3.1.3.5 Wiring Diagrams
- 1.3.2 The manufacturer shall furnish comprehensive instruction manuals covering the installation of the switchgear and the operation of its various components.
- 1.3.3 Submit shop drawings indicating outline dimensions, enclosure construction, shipping splits, lifting and supporting points, electrical single line diagram, and equipment electrical ratings.

1.4 QUALITY ASSURANCE

- 1.4.1 **Manufacturer Qualifications:** Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
 - 1.4.1.1 The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.
 - 1.4.1.2 The manufacturer shall have the ISO 14001 Environment Certification and shall supply the Product Environmental Profile (P.E.P) upon request of the Engineer.
 - 1.4.1.3 The manufacturer or their representative shall have office within 100km distance of job site to provide service, repair, and technical support services available 24 hours 7 days a week basis.
- 1.4.2 All work performed and all materials used shall be in accordance with the local Electrical Code, And with applicable local regulations and ordinances. Process controllers, assemblies, materials, and equipment shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- 1.4.3 Provide manufacturer's type test certificates indicating switchgear cubicles and components tested as integrated assembly.
 - 1.4.3.1 Factory test switchgear assembly to IEEE C37.20.2 Production Tests
- 1.4.4 Factory test main components (if applicable) to Section 260510 – Electrical Testing, including:
 - 1.4.4.1 Current Transformers
 - 1.4.4.2 Potential Transformers
 - 1.4.4.3 Circuit Breakers
 - 1.4.4.4 Trip units – functional test only
 - 1.4.4.5 Control Assemblies – functional test only
 - 1.4.4.6 Digital Metering System – functional test only
- 1.4.5 Optional Factory Acceptance Test (not included in the bid):
 - 1.4.5.1 The contractor will pay for travel, accommodation, and meal expenses for one client and one engineering representative to witness all factory acceptance tests of the switchgear. Assume travel from Ottawa to the location of the factory where switchgear is being tested. Assume local travel expenses, accommodations, and meals for one full day before tests begin until, and including, one full day after tests complete.
 - 1.4.5.2 Contractor to liaise with factory and be responsible for notifying client and engineer at least 15 business days before switchgear is ready for final testing, providing locations, manufacturer contact information, test times, and other related information.
 - 1.4.5.3 Supplier or manufacturer to have conducted all required tests prior to the witness test by the client and engineer and determined that the system(s) are operating and functioning properly. Subsequent site visits by the client and engineer as a result of the supplier or manufacturer's failure to provide acceptable performance of the equipment shall be at the expense of the contractor, including the engineer's time chargeable at the rate applicable and all travel expenses.
 - 1.4.5.4 Any costs associated with delays or cancellations of the FAT testing causing extra or subsequent visits to the factory by the client and engineer to be borne by the contractor. All costs will be substantiated by receipts and/or invoices.

1.5 DELIVERY, STORAGE, AND HANDLING

- 1.5.1 Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. Protect process controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage. In addition, protect process controllers from all forms of electrical and magnetic energy that could reasonably cause damage.
- 1.5.2 Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.
- 1.5.3 Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the NRC departmental Representative.

1.6 WARRANTY

- 1.6.1 Additional Owner Rights: The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- 1.6.2 Extended Warranty: The manufacturer shall provide a [2] year warranty for the switchgear assembly and components. The warranty period shall commence on the date of project Substantial Completion. The terms of the warranty shall provide for replacement of defective components, free of charge, at any time during the warranty period.

1.7 SPECIAL TOOLS AND SPARE PARTS

- 1.7.1 Any manufacturer specific special tool, not normally found in an electrician's toolbox, required to remove and install recommended or furnished spare parts shall be furnished. At a minimum the following shall be provided:

- 1.7.1.1 Provide a minimum of one operating handle used for manual spring charging and ground switch operation.
- 1.7.1.2 Provide a minimum of one can(s) of touch-up paint to cover blemishes incurred during shipping and installation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- 2.1.1 Products specified herein shall be the product of a single manufacturer. Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance. Products shall be modified as necessary by the manufacturer for compliance with requirements.
- 2.1.2 Service Conditions
 - 2.1.2.1 The switchgear shall be normally rated under the following conditions
 - 2.1.2.1.1 Altitude: Maximum of 3000m
 - 2.1.2.1.2 Ambient Operating Temperature: +40°C to -30°C
 - 2.1.2.1.3 Ambient Storage Temperature: +80°C to -40°C
 - 2.1.2.1.4 Maximum Humidity: 95% relative humidity

2.2 SWITCHGEAR ASSEMBLY

- 2.2.1 Provide the following specified product and manufacturer without exception, unless approved as a substitute by addendum to the Contract Documents prior to the bid date:
 - 2.2.1.1 Premset™ by Schneider Electric.
 - 2.2.1.2 Or approved equal
- 2.2.2 The switchgear shall consist of cubicles containing a circuit breaker, internal grounding switch, and all necessary components and accessories factory assembled and operationally checked.
- 2.2.3 The assembly shall be self-supporting and floor mounted on a level concrete pad. The integrated switchgear assembly shall withstand the effects of closing, carrying and interrupting currents up to the assigned maximum short circuit rating.

- 2.2.4 An internal camera with external USB connector be installed in the switch enclosure and located so as to enable visible inspection of the switch blades from outside the enclosure
- 2.2.5 System voltage: 2.4 kV nominal, three-phase, ungrounded system
- 2.2.6 Rated frequency: 60 Hz
- 2.2.7 Maximum design voltage: 15 kV.
- 2.2.8 Impulses withstand (Basic Impulse Level): 95 kV.
- 2.2.9 Power frequency withstand: 36 kV, 1 minute test.
- 2.2.10 Main bus ampacity: 600 amps, continuous.
- 2.2.11 Short time withstand current (main and ground bus): 25kA symmetrical, 2 second test.
- 2.2.12 Circuit breaker close and latch rating: 65kA asymmetrical
- 2.2.13 The control voltage used for powering relays, meters, breaker operation, and other low voltage devices shall be: 48VDC or 125VDC.
- 2.2.14 The switchgear shall implement a shielded solid insulation system by molding and enclosing all current carrying materials of the switchgear in EPDM (ethylene propylene diene monomer) rubber. An additional conductive or semi-conductive layer shall then be added to the top of the insulation layer in order to set all interior surfaces at ground potential. This system shall be implemented on each bus phase individually and shall be implemented throughout the switchgear including main bus bars, circuit breaker, isolating ground switch, and cable bussing.
- 2.2.15 The switchgear shall be rated as class PA, accidentally touchable, as defined by IEC 62271 Part 201 as a result of designing for minimum allowable levels of ground leakage current.

2.3 COMPONENTS

2.3.1 Vacuum Circuit Breaker

- 2.3.1.1 Vacuum circuit breakers shall be provided for all load and fault interruption. The circuit breaker shall be permanently fixed and factory enclosed to protect from environmental contaminants. The vacuum interrupter contacts including the mechanism for operating the movable side of the contacts shall be maintenance free for the lifetime of the switchgear.
- 2.3.1.2 The circuit breaker shall be rated for a maximum of 3 cycles of interrupting time.
- 2.3.1.3 The circuit breaker operating mechanism shall be a stored energy type operating mechanism. It shall include a handle operated spring charging mechanism for manual operation and an in-

ternal spring charging motor for remote operation. The closing speed of the moving contacts shall be independent of both the control voltage and the operator.

2.3.1.4 Circuit Breaker Operating Sequence: O-0.3s-CO-15s-CO

2.3.1.5 Trip coil, shall be compatible with CT-powered relay striker and auxiliary voltage powered trip relay output. Provide means of reset after trip by protection circuit.

2.3.1.6 Breaker lock-out and operating switches

2.3.1.6.1 Standard of Acceptance: Electroswitch

2.3.1.7 The front of each circuit breaker shall include an active mimic bus with indication of the status of the circuit breaker and isolating ground switch.

2.3.1.8 The circuit breaker shall be solidly and permanently connected to the rest of the current carrying bussing system

2.3.1.9 The front panel of the circuit breaker shall be removable without opening any compartment doors for ease of inspection and maintenance of the mechanism.

2.3.1.10 The vacuum breaker shall provide provision for padlocked to inhibit local/remote operation

2.3.1.11 Each circuit breaker shall be supplied with 4NO/4NC auxiliary contacts.

2.3.1.12 Auxiliaries:

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

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

2.3.2 Isolating Ground Switch

2.3.2.1 Each circuit breaker cubicle shall include an isolating ground switch integral to the switchgear. The switch shall be a two-position switch consisting of a circuit breaker connected position and a cable grounded position.

2.3.2.2 The circuit breaker and isolating ground switch shall be safety interlocked such that the ground switch shall not be operable when the circuit breaker is in the closed position, and the circuit breaker will not be operable when the grounding switch is in the cable grounded position.

2.3.2.3 The cable compartment panel shall be mechanically interlocked with the isolating ground switch such that the cable compartment shall not be accessible unless the cables are in a grounded state.

- 2.3.2.4 The isolating ground switch shall be rated for at a minimum 1000 mechanical operations and a minimum of five (5) 25kA current fault making operations.
- 2.3.3.3 An internal camera with external USB connector be installed in the switch enclosure and located so as to enable visible inspection of the switch blades from outside the enclosure. The image shall be brought to remote screen.
- 2.3.2.5 The isolating switch shall provide provision for padlocked to inhibit local/remote operation
- 2.3.3 Incoming Isolating Switch Section
 - 2.3.3.1 The isolating switch shall be a two-position switch consisting of an open and close position.
 - 2.3.3.2 The circuit breaker and isolating switch shall be safety interlocked such that the switch shall not be operable when the circuit breaker is in the closed position.
 - 2.3.3.4 The isolating switch shall be rated for at a minimum 1000 mechanical operations and a minimum of five (5) 25kA current fault making operations.
 - 2.3.3.5 An internal camera with external USB connector be installed in the switch enclosure and located so as to enable visible inspection of the switch blades from outside the enclosure. The image shall be brought to remote screen.
 - 2.3.3.6 The isolating switch shall provide provision for padlocked to inhibit local/remote operation.
- 2.3.4 Cable Compartment/Ground Bus
 - 2.3.4.1 Cable connection shall be dead-break, bolted cable elbow connections.
 - 2.3.4.2 The ground bus shall extend throughout the cable compartment for the full length of the switchgear.
 - 2.3.4.3 Additional vertical sections for cable connections shall not be required except for cable bus taps where required.
 - 2.3.4.4 When shown on the drawings, include a set of cable style distribution class surge arrestors in the cable compartment designated. The surge arrestors shall be appropriately sized for the system voltage.
- 2.3.5 Main Bus
 - 2.3.5.1 The main bus is to be rated 600 amps and be fully insulated and ground shielded for its entire length. Bussing shall be copper.
 - 2.3.5.2 Main bus shall not require any additional supporting system for structural integrity.
- 2.3.6 Doors and Panels

- 2.3.6.1 Relays, meters, control switches, etc., shall be mounted in a low voltage equipment compartment with hinged doors and hand operable knobs for latching.
- 2.3.7 Instrument Transformers
 - 2.3.7.1 Each cubicle shall allow for two sets of current transformers mounted on the cable side of the vacuum circuit breaker. Current transformers shall be wired to shorting terminal blocks. Current transformer ratios shall be as labeled in the drawings.
 - 2.3.7.2 Cable compartment shall allow for installation of an additional zero sequence window style current transformers around all cable phases.
 - 2.3.7.3 Voltage Transformers shall be low power style transformers of the resistive divider type. Voltage transformers shall be included as marked in the drawings.
 - 2.3.7.3.1 The low power voltage transformers shall contain internal surge protection.
 - 2.3.7.3.2 Cable side voltage transformers shall not require an additional cubicle beyond the breaker cubicle in which they are contained.
 - 2.3.7.3.3 Voltage transformer secondary shall be less than 5V_{peak}. A voltage power amplifier shall be included to raise the secondary voltage to a 120V_{peak} level in order to create the voltage measurement bus.
- 2.3.8 Control Wiring
 - 2.3.8.1 The switchgear shall be wired with type SIS #14 AWG, except where larger size wire is specified. The switchgear shall be provided with terminal blocks for customer control wire terminations. Wire markers shall be provided for each end of all control wires.
 - 2.3.8.2 Current transformer secondary connections shall be made with ring lug connections on shorting terminal blocks.
 - 2.3.8.3 Connections for control power shall be made with ring lugs.
- 2.3.9 Protective Relays: Provide relays as indicated on drawings for each circuit breaker.
 - 2.3.9.1 Micom P116 Model A – Dual Powered Relay
 - 2.3.9.1.1 Breakers shall include the dual-powered Micom P116 Protection Relay.
 - 2.3.9.1.2 The relay shall include overcurrent (50/51) and ground fault protection (50G/51G) functions, thermal overload protection (49), trip circuit supervision (74TC), latching/lockout (86), and current measurement functions. The relay's protection

functions shall be self-powered from the relay current transformers, but the relay shall allow for external control power input for communication functions.

2.3.9.1.3 Relay shall allow for communication via Modbus RS485. Relay shall include both local and remote trip indication.

2.3.9.1.4 Relay shall have two protective setting groups; the active group shall be enabled via binary inputs.

2.3.9.1.5 The relay shall have a USB connection port for programming.

2.3.10 Live Cable Interlock

2.3.10.1 Any circuit breaker unit shall be able to receive a dedicated device preventing the isolating ground switch from being closed into the grounded position if cables are still energized. This device should be locked-out in case of auxiliary power loss, with overriding by key interlock.

2.3.10.2 All main and feeder circuit breakers shall include live cable interlocks.

2.3.11 Cable Test Device

2.3.11.1 Provide a dedicated device for cable testing allowing the cable test equipment to be connected from the front of the cubicle without opening the cable compartment. The cable test device must be fully interlocked with the isolating ground switch.

2.3.12 Key Interlocks

2.3.12.1 Key interlocks shall be used to interlock either the circuit breaker or the disconnecting switch to enhance the safety and operation of the switchgear. The key interlock scheme shall be configured per the following description or as noted in the drawings.

2.3.13 Backup Power Supply System

2.3.13.1 Switchgear shall include the PS100 backup power supply and a 24 Ah long life battery. This system shall allow for up to 12 hours of additional control power supply to the switchgear in the event of control power loss. The backup power supply system shall be integral to the switchgear. The backup power supply system shall contain self-diagnosis to identify and alarm issues with the PS100 or the battery. The system shall contain as standard communication and monitoring via RJ45 Modbus communication.

2.3.14 Spare Parts

2.3.14.1 Touch-Up Paint

2.3.14.1.1 The switchgear shall include touch-up paint to cover blemishes incurred during shipping and installation.

2.3.14.2 Installation Kit

2.3.14.2.1 The switchgear shall include an installation kit that shall consist of the following:

2.3.14.2.1.1 One spare busbar cap of each type used

2.3.14.2.1.2 One 24mm hex-head socket for the installation of the busbar caps

2.3.14.2.1.3 One bag of spare hardware for cubicle assembly

2.3.15 Nameplates

2.3.15.1 Engraved nameplates shall be included and mounted on each cubicle per the drawing designations or table of circuit names.

2.4 ACCESSORIES

2.4.1 Space Heaters: For 120 VAC external source, sized by the manufacturer, with thermostats

2.4.2 Live line indicators

2.4.3 Vacuum Breaker remote control via PLC interface, provide Ethernet interface, refers to section 260950.

PART 3 - EXECUTION

3.1 FABRICATION

3.1.1 Construction: Each equipment bay shall be a separately constructed cubicle assembled to form a rigid freestanding unit. Adjacent bays shall be securely bolted together to form an integrated rigid structure. Each individual unit shall be braced to prevent distortion.

3.1.2 Dimensions: Base form dimensions per indoor section are: 14.75 in W x 70 in H x 36 in D

3.1.3 The switchgear shall be fully assembled, inspected and tested at the factory prior to shipment. Large line-ups shall be split to permit normal shipping and handling as well as for ease of rejoining at the job site.

- 3.1.4 For single bays, include a ground pad with lug. For multiple bay lineups, include continuous ground bus through the switchgear assembly, securely connected to the steel frame of each cubicle.

3.2 FACTORY FINISHING

- 3.2.1 All steel parts, except galvanized (if used), shall be cleaned and a zinc-phosphate (outdoor equipment) or iron phosphate (indoor equipment) pre-treatment applied prior to paint application.
- 3.2.2 Paint color shall be white; TGIC polyester powder, applied electrostatically through air. Following paint application, parts shall be baked to produce a hard durable finish. The average thickness of the paint film shall be 2.0 mils. Paint film shall be uniform in color and free from blisters, sags, flaking and peeling.
- 3.2.3 Salt spray withstand tests in accordance with ASTM #D-1654 and #B-117 shall be performed on a periodic basis to provide conformance with the corrosion resistance standard of at least 2500 hours minimum (outdoor equipment) or 600 hours minimum (indoor equipment).

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

- A. The contractor shall furnish and install where indicated on the drawings a dead front type, low-voltage service entrance panel combining a main breaker, utility metering transformer compartment and distribution feeder section in a single enclosure. The panel must be completely factory assembled and CSA listed. The design shall allow for the assembly to be reversed in the field without modification, to accommodate either top or bottom entry of service cables.

1.02 RELATED SECTIONS

Section 262401 – Service Equipment

1.03 REFERENCES

- A. The low voltage switchboard assembly and all components shall be designed, manufactured, and tested in accordance with the latest applicable following standards:
1. CSA C22.2 #31
 2. CSA C22.2 #29
 3. CSA C22.2 #5

1.04 SUBMITTALS - FOR REVIEW / APPROVAL

- A. The following information shall be submitted to the Engineer.
1. Front view and plan view of the assembly.
 2. Single Line or three line diagram.
 3. Schematic diagram (where required).
 4. Component List
 5. Floor plan with conduit/cable space locations.
 6. Assembly ratings including:
 - a. Short circuit rating
 - b. Voltage class
 - c. Continuous current rating
 7. Major component ratings including:
 - a. Voltage class

- b. Continuous current
- c. Interrupting ratings
- 8. Cable lug/termination sizes
- B. Submit pdf format of the above information.

1.05 SUBMITTALS - FOR INFORMATION

- A. When requested by the Engineer, the following product information shall be submitted:
 - 1. Descriptive bulletins
 - 2. Product Sheets

1.06 SUBMITTALS - FOR CLOSE-OUT

- A. The following information shall be submitted for record purposes prior to final payment.
 - 1. Final as-built drawings for items listed in section 1.04.
 - 2. Wiring diagrams (where applicable)
 - 3. Installation information including equipment anchorage provisions.
- B. Submit six (6) copies of the above information.
- C. The final as-built drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.07 QUALIFICATIONS

- A. The manufacturer of the switchboard shall be the manufacturer of the major components within the assembly, including circuit breaker.
- B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this request.

1.08 REGULATORY REQUIREMENTS

- A. The switchboard shall comply with the latest standard CSA C22.2 #31. The assembly shall bear a CSA label. All circuit breakers and components contained in this switchboard shall also bear a CSA label. Circuit breakers shall comply with the latest issue of standard CSA C22.2 #5.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of

shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS ACCEPTANCE

- A. Schneider
- B. Or approved equivalent

2.02 RATINGS

- A. Voltage rating shall be as indicated on the drawings. The entire assembly shall be suitable for 600 volts maximum service.
- B. The service panel bus shall be rated maximum 2000 amperes.
- C. The assembly shall be rated, type tested and CSA listed to withstand a short circuit of 100kA at 480Vac, 50kA at 600V with main breaker, unless otherwise indicated on the drawing.
- D. All bussing shall be silver flashed copper and braced as per short circuit requirements of 2.02 (C).

2.03 CONSTRUCTION

The switchboard shall be NEMA 1, sprinkleproof enclosed, and fabricated from code gauge formed galvanized steel complete with flat sheet covers to form a rigid dead front totally enclosed structure. The switchboard shall be freestanding floor mounted.

All compartments are to be designed to make components totally front accessible to enable the panel to be installed against the wall.

The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with CSA requirements.

Isolation barriers shall be provided to separate the main disconnect device and the utility current / potential transformer section. The distribution section(s)/cell(s) shall be separately barriered and isolated from the main service entrance section. Ventilation shall be provided to meet CSA C22.2 #31 temperature rise requirements. Where a sprinkleproof switchboard is supplied, ventilation shall not jeopardize sprinkleproof rule 26-008 of the Canadian Electrical Code.

The removable circuit breaker element shall be equipped with disconnecting contacts, wheels and interlocks for drawout application. It shall have four positions, "connected", "test", "disconnected" and "removed" all of which permit closing the compartment door. The breaker drawout element shall contain a worm gear levering "in" and "out" mechanism with removable lever crank. Mechanical interlocking shall be provided so that the breaker is in the tripped position before levering "in" or "out" of the cell. The breaker shall include a provision for padlocking open to prevent manual or electric closing. The padlocking shall also secure the breaker in the connected, test, or disconnected position by preventing levering.

All structures and covers are to be painted ASA-61 Grey.

Provision shall be made for additional structures as required to accommodate future additions.

Lamacoid nameplates shall be supplied in accordance with the nameplate Schedule supplied by the contractor or Engineer.

2.04 ENTRANCE SECTION (SBD)

The main breaker shall be completed with RMS sensing electronic trip unit, rating as per drawing. Changing the breaker's continuous rating shall be accomplished by the use of a mechanically interlocked rating plug, with no exposure to live parts.

- A. All protective devices shall be drawout or fixed low-voltage two-step stored energy insulated circuit breaker or power air circuit breakers as per drawing. Frame ratings shall be 1600, 2000, 2500, 3000 or 4000 amperes. All breakers shall be CSA listed for application in their intended enclosures for 100% of their continuous ampere rating.
- B. Breakers shall be manually operated (MO) and electrically operated (EO).
- C. Electrically operated breakers shall be complete with 120 Vac operators, open/close pushbuttons or control switch, plus red and green indicating lights to indicate breaker contact position, AC source shall be taken from a control power transformer internal to the switchgear assembly.
- D. Circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes RMS at 600V, and 100,000 amperes RMS at 480V, or otherwise indicated on the drawing.
- E. TRIP UNITS
 - a. Each low voltage breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker.
 - b. The trip unit shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A red trip reset button shall be provided to turn off the LED indication after an automatic trip.
 - c. Complete system selective coordination shall be provided by the addition of the following individually adjustable time/current curve shaping solid-state elements:
 - 1. All breakers shall have adjustments for long delay pick-up and time.
 - 2. Main and Feeders shall have individual adjustments for short delay pick-up and time, and include I^2t setting.
 - 3. Main breaker shall have "fixed" instantaneous pick-up. The change of this

setting must be on controlled access, it can only be adjusted by certain level of security level, i.e. password protected.

4. Feeder breaker shall have adjustable instantaneous pick-up.
 5. Breakers where indicated on the drawings, shall have individually adjustable ground fault current pick-up and time, and include I^2t settings.
- d. The trip unit shall contain an integral test panel with a test selector switch and a test pushbutton. A potentiometer shall be provided to enable the user to select the values of test currents within a range of available settings. The basic protection functions shall not be affected during test operations. The breaker may be tested in the Trip or No trip test mode.
- e. Trip unit shall have thermal memory for enhanced circuit protection.
- f. A four-digit, 3/4 inch high, LED alpha-numeric display shall be provided to indicate the following data:
1. Cause of trip.
 2. Instantaneous value of maximum phase and ground current.
 3. Level of fault current that initiated an automatic trip operation.
 4. Display shall be high output LED for low-level light readability. LCD displays are unacceptable.
- g. The trip unit shall include a power/relay module which shall supply control power to the readout display. Following an automatic trip operation of the circuit breaker, it shall maintain the cause of trip history and the mode of trip LED indication as long as its internal power supply is available. Internal relays shall provide contacts for remote indication of mode of trip and high load.
- h. A red LED shall be provided on the face of the trip unit pre-set to turn on when 85% of load level is exceeded (a 40-second delay shall be provided to avoid nuisance alarms).
- i. Metering display accuracy of the complete system including current sensors, auxiliary CTOs, and the trip unit shall be +/- 2% of full scale for current values.
- j. The trip unit shall include a potential transformer module, suitable for operation up to 600V, 50/60 Hz. The primary of the PTM shall be connected internally to the load side of the circuit breaker through a dielectric disconnect plug. The unit shall calculate power monitoring parameters as follows:
1. Present voltage.
 2. Present demand (kilowatts).
 3. Present power factor.

- k. The power-monitoring parameter values shall be indicated in the trip unit alpha-numeric display panel.
- l. Metering display accuracy of the complete system of full scale shall be +/- 3% for power values, +/- 4% of full scale for energy values.
- m. The trip unit shall be equipped to permit communication via a network twisted pair for remote monitoring and control. Trip unit shall be compatible with MODBUS protocol.

F MISCELLANEOUS DEVICES

- a. Key interlocks shall be provided as indicated on the drawings.
- b. Fused control power transformers shall be provided as indicated on the drawings or as required for proper operation of the equipment. A manual disconnect shall be provided ahead of the primary fuses.
- c. Circuit breaker should be capable of motorized operation, including open and close.

2.05 UTILITY METERING

- A. Where indicated on the drawings, furnish a separate barriered-off Utility Metering Compartment complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. The utility metering compartment shall have provisions for current transformers and potential transformer as supplied and installed by utility. The provision shall have the flexibility of bar type or window type current transformers without site modification. Provide Service Entrance Label and provide necessary applicable service entrance features per CSA and local code requirements.

2.06 CUSTOMER METERING

- A. Current transformers where shown on the drawings or elsewhere specified shall be wired to shorting type terminal blocks.
- B. Potential transformers including primary and secondary fuses with disconnecting means for metering as shown on the drawings.

2.07 ADDITIONAL FEATURES

Drip shield for sprinklerproof requirements

Ground Bus in the panel section

200% rated neutral bus

Ground Fault on Main Breaker

Base channels

Door over distribution panel

Conduit/Cable gland mounting plates (aluminum / fibre)

Hydro stub (side entry) as required

Provision for Bus Duct as required

Wireway (unbussed / bussed) as required

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 00 10 00.
- .2 Submit stamped engineered drawings for structures supporting transformers on walls or other structures other than the floor.
- .3 Prior to any installation of circuit breakers in either a new or existing installation, Contractor must submit three (3) copies of a certificate of origin, from the manufacturer, duly signed by the factory and the local manufacturer's representative, certifying that all circuit breakers come from this manufacturer, they are new and they meet standards and regulations. These certificates must be submitted to the Departmental Representative for approval.
 - .1 The above applies to all breakers rated above 240V.
 - .2 The above applies to all breakers rated up to 240V and 100A or more.
- .4 A delay in the production of the certificate of origin won't justify any extension of the contract and additional compensation.
- .5 Any work of manufacturing, assembly or installation should begin only after acceptance of the certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate the manufacturer listed on circuit breakers to authenticate all new circuit breakers under the contract at the Contractor's expense.
- .6 In general, the certificate of origin must contain:
 - .1 The name and address of the manufacturer and the person responsible for authentication. The responsible person must sign and date the certificate;
 - .2 The name and address of the licensed dealer and the person of the distributor responsible for the Contractor's account.
 - .3 The name and address of the Contractor and the person responsible for the project.
 - .4 The name and address of the local manufacturer's representative. The local representative must sign and date the certificate.
 - .5 The name and address of the building where circuit breakers will be installed:
 - .1 Project title.
 - .2 End user's reference number.
 - .3 The list of circuit breakers.

1.2 IDENTIFICATION

- .1 Identification as per Section 26 05 00.

Part 2 Products

2.1 DISCONNECT SWITCHES, FUSED AND NON-FUSED

- .1 Fusible and non-fusible disconnect switches in EEMAC Enclosure as indicated.
- .2 Provision for padlocking in "OFF" switch position.
- .3 Mechanical voidable door interlock in "ON" position.
- .4 Fuses: size and type as indicated.
- .5 Fuseholders in each switch to be suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 "ON-OFF" switch position indication on switch enclosure cover.
- .8 Standard of acceptance: Square D, Cutler-Hammer, Siemens, ABB.

2.2 GROUNDING

- .1 Insulated grounding conductors in accordance with Section 26 05 00.
- .2 Compression connectors for grounding to equipment provided with lugs.

2.3 DRY TYPE TRANSFORMER

- .1 Type ANN, C802.2.
- .2 Single or three phase, KVA rating, input and output voltage as indicated.
- .3 Class 220, 150°C temperature rise insulation system.
- .4 Copper windings.
- .5 Four 2.5% taps, 2-FCAN and 2-FCBN.
- .6 EEMAC 1 enclosure with lifting lugs, removable metal front and side panels.
- .7 Drip shield.
- .8 Standard of acceptance: Hammond or approved equal.

2.4 PANELBOARDS

- .1 600 volt rated power panelboards: bus and breakers rated for 25,000 amp r.m.s. symmetrical interrupting capacity at 600V or as indicated.
- .2 250 volt lighting panelboards to have minimum interrupting capacity of 10,000 amp r.m.s. symmetrical.

- .3 Panelboards are to have a main breaker that shall be service entranced approved (i.e. barrier to separate main breaker from remainder of panels).
- .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .5 Panelboards: mains, number of circuits, number and size of branch circuit breakers as indicated.
- .6 Two keys for each panelboard and all panelboards to be keyed alike.
- .7 Copper bus, neutral and ground bar with neutral of same ampere rating as mains.
- .8 Suitable for: plug-in breaker for molded case circuit breaker, bolt-on breakers for miniature circuit breaker.
- .9 Hinged door, trim finish: baked grey enamel.
- .10 Drip shield.
- .11 Complete circuit directory with typewritten legend showing description of each circuit.
- .12 Manufacturer: Square D or approved equal.

2.5 MOLDED CASE CIRCUIT BREAKER

- .1 Thermal-magnetic moulded case circuit breakers, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers with single handle for multiple applications.
- .3 All new 120V to 600V circuit breakers installed on this project are to include the handle accessory, "Handle Padlock Attachment", which locks breakers on or off.
- .4 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches 10 times their setting.
- .5 Circuit breaker and panel to be of same manufacturer.
- .6 Circuit breakers minimum rating: 25KA for 600/347V or greater if indicated.
- .7 Standard of acceptance: Square D or approved equal.

2.6 FUSES

- .1 250V and 600V time delay, rejection style, HRC-I, Class RK5.
- .2 Standard of acceptance: Gould-Shawmut or approved equal.

Part 3 Execution

3.1 DISCONNECT SWITCHES

- .1 Install disconnect switches complete with fuses as indicated.

3.2 GROUNDING

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, conductors, compression connectors, accessories, as indicated, to conform to requirements of Engineer, and local authority having jurisdiction over installation. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Soldered joints not permitted.

3.3 DRY TYPE TRANSFORMER

- .1 Transformers above 75 kVA mount on floor.
- .2 Provide adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections shown on wiring diagram.
- .7 Energize transformers immediately after installation is completed, where practicable.
- .8 Provide equipment identification in accordance with Section 26 05 00.
- .9 Connect transformer through side of housing.

3.4 PANELBOARDS

- .1 Locate panelboards as indicated and mount securely, plumb, and square, to adjoining surfaces.
- .2 Mount panels to height specified in section 26 27 26 or as indicated.
- .3 Connect loads to circuits as indicated.
- .4 Connect neutral conductors to common neutral bus.

3.5 MOLDED CASE CIRCUIT BREAKERS

- .1 Install circuit breakers as indicated.

3.6 FUSES

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Install fuses correctly sized to assigned electrical circuits.
- .3 Provide 3 spare fuses for each rating supplied.

END OF SECTION

PART 1: GENERAL

- 1 GENERAL**
- A. Capacitor unit(s) shall be manufactured by Schneider Electric AV6000 or Eaton AUTOVAR.
 - B. The complete equipment shall be manufactured per CSA C22.2 No.14, standard for Industrial Control Equipment, and as per CSA C155-M84, standard for Shunt Capacitors for AC Power Systems. Internal capacitor cells shall be CSA listed in compliance with C22.2 No.190, NEMA CP-1 and IEEE standards.
 - C. The complete equipment shall be pre-wired and factory assembled, including main terminal lugs, a micro-processor programmable controller, Class A resettable ground fault protected control voltage, individual capacitor stages including current limiting fuses, tuning reactors and contactors cabled to each capacitor bank step.
 - D. All major components and wiring shall be adequately marked for identification and shall agree with wiring diagrams and instructions provided with each unit.
 - E. Capacitor shall be dry-type with no liquid dielectric.
 - F. Normal operating ambient temperature range shall be: -10°C (+14°F) to +30°C (+86°F).
 - G. Design tests shall be performed to confirm proper operation of the complete equipment, including operation of all control circuits, pre-programming and functioning of the controller, and confirmation of kVAR power rating.

PART 2:

- 2. EQUIPMENT SIZE / RATING**
- A. Operating Voltage shall be 600 Volts (line to line), three phase, 60 Hertz.
 - B. Rated capacitor cell voltage shall be 690V for 600V networks (line to line). Capacitor elements must be Delta connected at rated voltage. Wye connected capacitor elements shall not be acceptable.
 - C. Total kVAR size at operating voltage is indicated on drawing.
 - D. Capacitor steps shall be 50 KVAR or 100 KVAR each as indicated.

- E. Filter tuning of each capacitive / inductive stage shall be 4.2 x 60 Hertz (252 Hertz).
- F. Basic Impulse Level: 30 Kilovolts @ 50 μ S.
- G. Main terminal lugs and buswork braced to withstand fault level at either 42 kA or at 65 kA RMS symmetrical.

PART 3:

3.1 ENCLOSURE

- A. Enclosure(s) shall be free standing, constructed of #14 gauge rigidly welded steel, minimum, including a hinged door, ground lug, and removable lifting eyes, finished in ASA 49 Gray textured polyester paint for indoor.
- B. Enclosure(s) shall be NEMA 1 for indoor installation.
- C. Enclosure door(s) shall be full height, key lockable with lexan viewing window for controller module. All components shall be dead front with the enclosure door open and no components requiring system level voltage shall be mounted on the enclosure door.

PART 4:

4. INTERNAL COMPONENTS

- A. INDIVIDUAL CAPACITOR/INDUCTOR STAGES
 - 1. Each capacitor / inductor stage shall consist of hermetically sealed three phase capacitor cell(s) on a modular assembly with the contactor, three phase fusing and thermistor relay. Each module shall be designed to facilitate maintenance if replacement should ever become necessary. Tuning Reactors shall be mounted in a vertical stack where possible to reduce risk of induced mutual inductance.
 - 2. Discharge resistors mounted internal to the cells shall be provided to reduce voltage on the cells to 50 Volts or less within one minute after the capacitor has been switched off.
 - 3. Individual cells shall be of a dry-type self-healing design utilizing a low loss metalized film dielectric system with a pressure sensitive circuit interrupter. Each element shall contain a 100 kA HRC fuse as part of the pressure interrupting circuit. Electrical losses, including contribution of discharge resistors, shall average less than 0.5 Watts per KVAR. Liquid filled or impregnated capacitors shall not be acceptable.
 - 4. Capacitor shall be rated for 115% continuous overvoltage and 140% continuous overcurrent.

B. INTERNAL PROTECTIVE FUSING

1. Class C fuses shall be provided in each phase of each capacitor cell and on the line side of the contactor and mounted so as to facilitate replacement without removing power wiring. Fuses shall be CSA certified and current limiting, rated at 200,000 RMS Amperes symmetrical.
2. Fuseholders shall be dead front with or without the fuses in place.

C. CONTACTORS

1. Contactors shall be CSA certified and rated 690VAC with 120V operating coils. Contactors shall be listed for use in switching capacitive currents without derating.

D. TUNING REACTORS

1. Tuning reactors for each capacitive stage shall be selected such that filter tuning of each stage is equal to 4.2×60 Hertz (252 Hertz).
2. Reactor shall be constructed of EI laminated low hysteresis core with a controlled air gap and three copper windings of rectangular cross section glass insulated copper conductor.

Reactor assembly shall be impregnated with high temperature thermo-setting insulation material. Reactor insulation shall be rated for 115°C rise over a 40°C ambient.

4. Center leg of tuning reactor shall have an embedded thermistor tied to a thermistor relay for the stage to deenergize the associated contactor in the event of overheating.

E. CONTROL POWER REQUIREMENTS

1. Low voltage, 120V control circuit transformation shall be provided within the enclosure.
2. Control power fusing to all major components including primary and single secondary transformer fusing shall be provided. All components shall be dead front and finger safe.
3. Control circuit shall be protected with a resettable Class A ground fault protection breaker.
4. Where new CT is required, a shorting terminal shall be provided for two incoming

current transformer wires. A single current transformer to be installed upstream of where the automatic capacitor is attached to the distribution system, shall be provided with a ratio indicated by drawing. The CT shall be donut or split core type with an opening large enough to facilitate installation on the cable or bus.

F. MICROPROCESSOR CONTROLLER

1. The controller shall be a microprocessor-based programmable unit with a single current input and single line-to-line or line-to-neutral voltage input required. The controller measures reactive power consumption in the load and, according to programmed control logic, will connect or disconnect the required amount of capacitor stages needed to maintain the preset power factor.
2. The controller shall utilize a switching logic that optimizes the use of capacitor elements and contactors in the bank.
3. An ON power indication and AUTOMATIC / MANUAL override control shall be provided.
4. A Liquid Crystal Display for display of power factor and alarms shall be provided. Indication of stage energization and inductive / capacitive condition shall be provided.
5. An alarm dry contact closure and annunciation shall be provided in the event that target power factor is not met, power to the controller has been lost or CT current is too high/low, temperature exceeds preset limits or a system overvoltage condition occurs.
6. An automatic shutdown and systematic re-staging of capacitor stages shall be provided in the event of a power loss, high internal system temperatures, a system undervoltage or overvoltage condition.
7. The controller shall automatically select the system frequency (50 or 60 Hertz) and the necessary C/K ratio. A reversed CT polarity shall be corrected automatically by the controller.
8. The controller shall permit programming of the switching stage response time, number of stages (12 maximum) and switching program.



TP1 Amount Payable – General

1.1 Subject to any other provisions of the contract, Her Majesty shall pay the Contractor, at the times and in the manner hereinafter set out, the amount by which

1.1.1 the aggregate of the amounts described in TP2 exceeds

1.1.2 the aggregate of the amounts described in TP3

and the Contractor shall accept that amount as payment in full satisfaction for everything furnished and done by him in respect of the work to which the payment relates.

TP2 Amounts Payable to the Contractor

2.1 The amounts referred to in TP1.1.1 are the aggregate of

2.1.1 the amounts referred to in the Articles of Agreement, and

2.1.2 the amounts, if any, that are payable to the Contractor pursuant to the General Conditions.

TP3 Amounts Payable to Her Majesty

3.1 The amounts referred to in TP1.1.2 are the aggregate of the amounts, in any, that the Contractor is liable to pay Her Majesty pursuant to the contract.

3.2 When making any payments to the Contractor, the failure of Her Majesty to deduct an amount referred to in TP3.1 from an amount referred to in TP2 shall not constitute a waiver of the right to do so, or an admission of lack of entitlement to do so in any subsequent payment to the Contractor.

TP4 Time of Payment

4.1 In these Terms of Payment

4.1.1 The “payment period” means a period of 30 consecutive days or such other longer period as is agreed between the Contractor and the Departmental Representative.

4.1.2 An amount is “due and payable” when it is due and payable by Her Majesty to the Contractor according to TP4.4, TP4.7 or TP4.10.

4.1.3 An amount is overdue when it is unpaid on the first day following the day upon which it is due and payable.

4.1.4 The “date of payment” means the date of the negotiable instrument of an amount due and payable by the Receiver General for Canada and given for payment.

4.1.5 The “Bank Rate” means the discount rate of interest set by the Bank of Canada in effect at the opening of business on the date of payment.



- 4.2 The Contractor shall, on the expiration of a payment period, deliver to the Departmental Representative in respect of that payment period a written progress claim that fully describes any part of the work that has been completed, and any material that was delivered to the work site but not incorporated into the work during that payment period.
- 4.3 The Departmental Representative shall, not later than ten days after receipt by him of a progress claim referred to in TP4.2,
- 4.3.1 inspect the part of the work and the material described in the progress claim; and
- 4.3.2 issue a progress report, a copy of which the Departmental Representative will give to the Contractor, that indicates the value of the part of the work and the material described in the progress claim that, in the opinion of the Departmental Representative,
- 4.3.2.1 is in accordance with the contract, and
- 4.3.2.2 was not included in any other progress report relating to the contract.
- 4.4 Subject to TP1 and TP4.5 Her Majesty shall, not later than 30 days after receipt by the Departmental Representative of a progress claim referred to in TP4.2, pay the Contractor
- 4.4.1 an amount that is equal to 95% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has been furnished by the Contractor, or
- 4.4.2 an amount that is equal to 90% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has not been furnished by the Contractor.
- 4.5 It is a condition precedent to Her Majesty's obligation under TP4.4 that the Contractor has made and delivered to the Departmental Representative,
- 4.5.1 a statutory declaration described in TP4.6 in respect of a progress claim referred to in TP4.2,
- 4.5.2 in the case of the Contractor's first progress claim, a construction schedule in accordance with the relevant sections of the Specifications, and
- 4.5.3 if the requirement for a schedule is specified, an update of the said schedule at the times identified in the relevant sections of the Specifications.
- 4.6 A statutory declaration referred to in TP4.5 shall contain a deposition by the Contractor that
- 4.6.1 up to the date of the Contractor's progress claim, the Contractor has complied with all his lawful obligations with respect to the Labour Conditions; and
- 4.6.2 up to the date of the Contractor's immediately preceding progress claim, all lawful obligations of the Contractor to subcontractors and suppliers of material in respect of the



work under the contract have been fully discharged.

- 4.7 Subject to TP1 and TP4.8, Her Majesty shall, not later than 30 days after the date of issue of an Interim Certificate of Completion referred to in GC44.2, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.7.1 the sum of all payments that were made pursuant to TP4.4;
 - 4.7.2 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty or rectifying defects described in the Interim Certificate of Completion; and
 - 4.7.3 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty of completing the parts of the work described in the Interim Certificate of Completion other than the defects referred to in TP4.7.2.
- 4.8 It is a condition precedent to Her Majesty's obligation under TP4.7 that the Contractor has made and delivered to the Departmental Representative,
- 4.8.1 a statutory declaration described in TP4.9 in respect of an Interim Certificate of Completion referred to in GC44.2, and
 - 4.8.2 if so specified in the relevant sections of the Specifications, and update of the construction schedule referred to in TP4.5.2 and the updated schedule shall, in addition to the specified requirements, clearly show a detailed timetable that is acceptable to the Departmental Representative for the completion of any unfinished work and the correction of all defects.
- 4.9 A statutory declaration referred to in TP4.8 shall contain a deposition by the contractor that up to the date of the Interim Certificate of Completion the Contractor has
- 4.9.1 complied with all of the Contractor's lawful obligations with respect to the Labour Conditions;
 - 4.9.2 discharged all of the Contractor's lawful obligations to the subcontractors and suppliers of material in respect of the work under the contract; and
 - 4.9.3 discharged the Contractor's lawful obligations referred to in GC14.6.
- 4.10 Subject to TP1 and TP4.11, Her Majesty shall, not later than 60 days after the date of issue of a Final Certificate of Completion referred to in GC44.1, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.10.1 the sum of all payments that were made pursuant to TP4.4; and
 - 4.10.2 the sum of all payments that were made pursuant to TP4.7.
- 4.11 It is a condition precedent to Her Majesty's obligation under TP4.10 that the Contractor has made and delivered a statutory declaration described in TP4.12 to the Departmental Representative.



- 4.12 A statutory declaration referred to in TP4.11 shall, in addition to the depositions described in TP4.9, contain a deposition by the Contractor that all of the Contractor's lawful obligations and any lawful claims against the Contractor that arose out of the performance of the contract have been discharged and satisfied.

TP5 Progress Report and Payment Thereunder Not Binding on Her Majesty

- 5.1 Neither a progress report referred to in TP4.3 nor any payment made by Her Majesty pursuant to these Terms of Payment shall be construed as an admission by Her Majesty that the work, material or any part thereof is complete, is satisfactory or is in accordance with the contract.

TP6 Delay in Making Payment

- 6.1 Notwithstanding GC7 any delay by Her Majesty in making any payment when it is due pursuant to these Terms of Payment shall not be a breach of the contract by Her Majesty.

- 6.2 Her Majesty shall pay, without demand from the Contractor, simple interest at the Bank Rate plus 1 -1/4 per centum on any amount which is overdue pursuant to TP4.1.3, and the interest shall apply from and include the day such amount became overdue until the day prior to the date of payment except that

- 6.2.1 interest shall not be payable or paid unless the amount referred to in TP6.2 has been overdue for more than 15 days following

6.2.1.1 the date the said amount became due and payable, or

6.2.1.2 the receipt by the Departmental Representative of the Statutory Declaration referred to in TP4.5, TP4.8 or TP4.11,

whichever is the later, and

- 6.6.2 interest shall not be payable or paid on overdue advance payments if any.

TP7 Right of Set-off

- 7.1 Without limiting any right of set-off or deduction given or implied by law or elsewhere in the contract, Her Majesty may set off any amount payable to Her Majesty by the Contractor under this contract or under any current contract against any amount payable to the Contractor under this contract.

- 7.2 For the purposes of TP7.1, "current contract" means a contract between Her Majesty and the Contractor

7.2.1 under which the Contractor has an undischarged obligation to perform or supply work, labour or material, or

7.2.2 in respect of which Her Majesty has, since the date of which the Articles of Agreement were made, exercised any right to take the work that is the subject of the contract out of the Contractor's hands.



TP8 Payment in Event of Termination

- 8.1 If the contract is terminated pursuant to GC41, Her Majesty shall pay the Contractor any amount that is lawfully due and payable to the Contractor as soon as is practicable under the circumstances.

TP9 Interest on Settled Claims

- 9.1 Her Majesty shall pay to the Contractor simple interest on the amount of a settled claim at an average Bank Rate plus 1 ¼ per centum from the date the settled claim was outstanding until the day prior to the date of payment.
- 9.2 For the purposes of TP9.1,
- 9.2.1 a claim is deemed to have been settled when an agreement in writing is signed by the Departmental Representative and the Contractor setting out the amount of the claim to be paid by Her Majesty and the items or work for which the said amount is to be paid.
- 9.2.2 an "average Bank Rate" means the discount rate of interest set by the Bank of Canada in effect at the end of each calendar month averaged over the period the settled claim was outstanding.
- 9.2.3 a settled claim is deemed to be outstanding from the day immediately following the date the said claim would have been due and payable under the contract had it not been disputed.
- 9.3 For the purposes of TP9 a claim means a disputed amount subject to negotiation between Her Majesty and the Contractor under the contract.



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GC1 Interpretation

1.1 In the contract

- 1.1.1 where reference is made to a part of the contract by means of numbers preceded by letters, the reference shall be construed to be a reference to the particular part of the contract that is identified by that combination of letters and numbers and to any other part of the contract referred to therein;
- 1.1.2 “contract” means the contract document referred to in the Articles of Agreement;
- 1.1.3 “contract security” means any security given by the Contractor to Her Majesty in accordance with the contract;
- 1.1.4 “Departmental Representative” means the officer or employee of Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract and is so designated in writing to the Contractor;
- 1.1.5 “material” includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work;
- 1.1.6 “Minister” includes a person acting for, or if the office is vacant, in place of the Minister and his successors in the office, and his or their lawful deputy and any of his or their representatives appointed for the purposes of the contract;
- 1.1.7 “person” includes, unless the context otherwise requires, a partnership, proprietorship, firm, joint venture, consortium and a corporation;
- 1.1.8 “plant” includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract;
- 1.1.9 “subcontractor” means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work;
- 1.1.10 “superintendent” means the employee of the Contractor who is designated by the Contractor to act pursuant to GC19;
- 1.1.11 “work includes, subject only to any express stipulation in the contract to the contrary, everything that is necessary to be done, furnished or delivered by the Contractor to perform the contract.

1.2 The headings in the contract documents, other than in the Plans and Specifications, form no part of the contract but are inserted for convenience of reference only.

1.3 In interpreting the contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.



- 1.4 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between
- 1.4.1 the Plans and Specifications, the Specifications govern;
 - 1.4.2 the Plans, the Plans drawn with the largest scale govern; and
 - 1.4.3 figured dimensions and scaled dimensions, the figured dimensions govern.

GC2 Successors and Assigns

- 2.1 The contract shall inure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

GC3 Assignment of Contract

- 3.1 The contract may not be assigned by the Contractor, either in whole or in part, without the written consent of the Minister.

GC4 Subcontracting by Contractor

- 4.1 Subject to this General Condition, the Contractor may subcontract any part of the work.
- 4.2 The Contractor shall notify the Departmental Representative in writing of his intention to subcontract.
- 4.3 A notification referred to in GC4.2 shall identify the part of the work, and the subcontractor with whom it is intended to subcontract.
- 4.4 The Departmental Representative may object to the intended subcontracting by notifying the Contractor in writing within six days of receipt by the Departmental Representative of a notification referred to in GC4.2.
- 4.5 If the Departmental Representative objects to a subcontracting pursuant to GC4.4, the Contractor shall not enter into the intended subcontract.
- 4.6 The contractor shall not, without the written consent of the Departmental Representative, change a subcontractor who has been engaged by him in accordance with this General Condition.
- 4.7 Every subcontract entered into by the Contractor shall adopt all of the terms and conditions of this contract that are of general application.
- 4.8 Neither a subcontracting nor the Departmental Representative's consent to a subcontracting by the Contractor shall be construed to relieve the Contractor from any obligation under the contract or to impose any liability upon Her Majesty.

GC5 Amendments



- 5.1 No amendment or change in any of the provisions of the contract shall have any force or effect until it is reduced to writing.

GC6 No Implied Obligations

- 6.1 No implied terms or obligations of any kind by or on behalf of Her Majesty shall arise from anything in the contract and the express covenants and agreements therein contained and made by Her Majesty are the only covenants and agreements upon which any rights against Her Majesty are to be founded.
- 6.2 The contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work that were made prior to the date of the contract.

GC7 Time of Essence

- 7.1 Time is of the essence of the contract.

GC8 Indemnification by Contractor

- 8.1 The Contractor shall indemnify and save Her Majesty harmless from and against all claims, demand, losses, costs, damages, actions, suits, or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor, his servants, agents, subcontractors and sub-subcontractors in performing the work including an infringement or an alleged infringement of a patent of invention or any other kind of intellectual property.
- 8.2 For the purpose of GC8.1, "activities" includes any act improperly carried out, any omission to carry out an act and any delay in carrying out an act.

GC9 Indemnification by Her Majesty

- 9.1 Her Majesty shall, subject to the Crown Liability Act, the Patent Act, and any other law that affects Her Majesty's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract that are directly attributable to
- 9.1.1 lack of or a defect in Her Majesty's title to the work site whether real or alleged; or
- 9.1.2 an infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of the contract employing a model, plan or design or any other thing related to the work that was supplied by Her Majesty to the Contractor.

GC10 Members of House of Commons Not to Benefit



- 10.1 As required by the Parliament of Canada Act, it is an express condition of the contract that no member of the House of Commons shall be admitted to any share of part of the contract or to any benefit arising therefrom.

GC11 Notices

- 11.1 Any notice, consent, order, decision, direction or other communication, other than a notice referred to in GC11.4, that may be given to the Contractor pursuant to the contract may be given in any manner.
- 11.2 Any notice, consent, order, decision, direction or other communication required to be given in writing, to any party pursuant to the contract shall, subject to GC11.4, be deemed to have been effectively given
- 11.2.1 to the Contractor, if delivered personally to the Contractor or the Contractor's superintendent, or forwarded by mail, telex or facsimile to the Contractor at the address set out in A4.1, or
- 11.2.2 to Her Majesty, if delivered personally to the Departmental Representative, or forwarded by mail, telex or facsimile to the Departmental Representative at the address set out in A1.2.1.
- 11.3 Any such notice, consent, order, decision, direction or other communication given in accordance with GC11.2 shall be deemed to have been received by either party
- 11.3.1 if delivered personally, on the day that it was delivered,
- 11.3.2 if forwarded by mail, on the earlier of the day it was received and the sixth day after it was mailed, and
- 11.3.3 if forwarded by telex or facsimile, 24 hours after it was transmitted.
- 11.4 A notice given under GC38.1.1, GC40 and GC41, if delivered personally, shall be delivered to the Contractor if the Contractor is doing business as sole proprietor or, if the Contractor is a partnership or corporation, to an officer thereof.

GC12 Material, Plant and Real Property Supplied by Her Majesty

- 12.1 Subject to GC12.2, the Contractor is liable to Her Majesty for any loss of or damage to material, plant or real property that is supplied or placed in the care, custody and control of the Contractor by Her Majesty for use in connection with the contract, whether or not that loss or damage is attributable to causes beyond the Contractor's control.
- 12.2 The Contractor is not liable to Her Majesty for any loss or damage to material, plant or real property referred to in GC12.1 if that loss or damage results from and is directly attributable to reasonable wear and tear.
- 12.3 The Contractor shall not use any material, plant or real property referred to in GC12.1 except for



the purpose of performing this contract.

- 12.4 When the Contractor fails to make good any loss or damage for which he is liable under GC12.1 within a reasonable time after being required to do so by the Departmental Representative, the Departmental Representative may cause the loss or damage to be made good at the Contractor's expense, and the Contractor shall thereupon be liable to Her Majesty for the cost thereof and shall, on demand, pay to Her Majesty an amount equal to that cost.
- 12.5 The Contractor shall keep such records of all material, plant and real property referred to in GC12.1 as the Departmental Representative from time to time requires and shall satisfy the Departmental Representative, when requested, that such material, plant and real property are at the place and in the condition which they ought to be.

GC13 Material, Plant and Real Property Become Property of Her Majesty

- 13.1 Subject to GC14.7 all material and plant and the interest of the Contractor in all real property, licenses, powers and privileges purchased, used or consumed by the Contractor for the contract shall, after the time of their purchase, use or consumption be the property of Her Majesty for the purposes of the work and they shall continue to be the property of Her Majesty.
- 13.1.1 in the case of material, until the Departmental Representative indicates that he is satisfied that it will not be required for the work, and
- 13.1.2 in the case of plant, real property, licenses, powers and privileges, until the Departmental Representative indicates that he is satisfied that the interest vested in Her Majesty therein is no longer required for the purposes of the work.
- 13.2 Material or plant that is the property of Her Majesty by virtue of GC13.1 shall not be taken away from the work site or used or disposed of except for the purposes of the work without the written consent of the Departmental Representative.
- 13.3 Her Majesty is not liable for loss of or damage from any cause to the material or plant referred to in GC13.1 and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of Her Majesty.

GC14 Permits and Taxes Payable

- 14.1 The Contractor shall, within 30 days after the date of the contract, tender to a municipal authority an amount equal to all fees and charges that would be lawfully payable to that municipal authority in respect of building permits as if the work were being performed for a person other than Her Majesty.
- 14.2 Within 10 days of making a tender pursuant to GC14.1, the Contractor shall notify the Departmental Representative of his action and of the amount tendered and whether or not the municipal authority has accepted that amount.
- 14.3 If the municipal authority does not accept the amount tendered pursuant to GC14.1 the Contractor shall pay that amount to Her Majesty within 6 days after the time stipulated in GC14.2.



- 14.4 For the purposes of GC14.1 to GC14.3 “municipal authority” means any authority that would have jurisdiction respecting permission to perform the work if the owner were not Her Majesty.
- 14.5 Notwithstanding the residency of the Contractor, the Contractor shall pay any applicable tax arising from or related to the performance of the work under the contract.
- 14.6 In accordance with the Statutory Declaration referred to in TP4.9, a Contractor who has neither residence nor place of business in the province in which work under the contract is being performed shall provide Her Majesty with proof of registration with the provincial sales tax authorities in the said province.
- 14.7 For the purpose of the payment of any applicable tax or the furnishing of security for the payment of any applicable tax arising from or related to the performance of the work under the contract, the Contractor shall, notwithstanding the fact that all material, plant and interest of the Contractor in all real property, licenses, powers and privileges, have become the property of Her Majesty after the time of purchase, be liable, as a user or consumer, for the payment or for the furnishing of security for the payment of any applicable tax payable, at the time of the use or consumption of that material, plant or interest of the Contractor in accordance with the relevant legislation.

GC15 Performance of Work under Direction of Departmental Representative

- 15.1 The Contractor shall
- 15.1.1 permit the Departmental Representative to have access to the work and its site at all times during the performance of the contract;
 - 15.1.2 furnish the Departmental Representative with such information respecting the performance of the contract as he may require; and
 - 15.1.3 give the Departmental Representative every possible assistance to enable the Departmental Representative to carry out his duty to see that the work is performed in accordance with the contract and to carry out any other duties and exercise any powers specially imposed or conferred on the Departmental Representative under the contract.

CG16 Cooperation with Other Contractors

- 16.1 Where, in the opinion of the Departmental Representative, it is necessary that other contractors or workers with or without plant and material, be sent onto the work or its site, the Contractor shall, to the satisfaction of the Departmental Representative, allow them access and cooperate with them in the carrying out of their duties and obligation.
- 16.2 If
- 16.2.1 the sending onto the work or its site of other contractors or workers pursuant to GC16.1 could not have been reasonably foreseen or anticipated by the Contractor when entering into the contract, and



16.2.2 the Contractor incurs, in the opinion of the Departmental Representative, extra expense in complying with GC16.1, and

16.2.3 The Contractor has given the Departmental Representative written notice of his claim for the extra expense referred to in GC16.2.2 within 30 days of the date that the other contractors or workers were sent onto the work or its site,

Her Majesty shall pay the Contractor the cost, calculated in accordance with GC48 to GC50, of the extra labour, plant and material that was necessarily incurred.

GC17 Examination of Work

17.1 If, at any time after the commencement of the work but prior to the expiry of the warranty or guarantee period, the Departmental Representative has reason to believe that the work or any part thereof has not been performed in accordance with the contract, the Departmental Representative may have that work examined by an expert of his choice.

17.2 If, as a result of an examination of the work referred to in GC17.1, it is established that the work was not performed in accordance with the contract, then, in addition to and without limiting or otherwise affecting any of Her Majesty's rights and remedies under the contract either at law or in equity, the Contractor shall pay Her Majesty, on demand, all reasonable costs and expenses that were incurred by Her Majesty in having that examination performed.

GC18 Clearing of Site

18.1 The Contractor shall maintain the work and its site in a tidy condition and free from the accumulation of waste material and debris, in accordance with any directions of the Departmental Representative.

18.2 Before the issue of an interim certificate referred to in GC44.2, the Contractor shall remove all the plant and material not required for the performance of the remaining work, and all waste material and other debris, and shall cause the work and its site to be clean and suitable for occupancy by Her Majesty's servants, unless otherwise stipulated in the contract.

18.3 Before the issue of a final certificate referred to in GC44.1, the Contractor, shall remove from the work and its site all of the surplus plant and material and any waste material and other debris.

18.4 The Contractor's obligations described in GC18.1 to GC18.3 do not extend to waste material and other debris caused by Her Majesty's servants or contractors and workers referred to in GC16.1.

GC19 Contractor's Superintendent

19.1 The Contractor shall, forthwith upon the award of the contract, designate a superintendent.

19.2 The Contractor shall forthwith notify the Departmental Representative of the name, address and telephone number of a superintendent designate pursuant to GC19.1.



- 19.3 A superintendent designated pursuant to GC19.1 shall be in full charge of the operations of the Contractor in the performance of the work and is authorized to accept any notice, consent, order, direction, decision or other communication on behalf of the Contractor that may be given to the superintendent under the contract.
- 19.4 The Contractor shall, until the work has been completed, keep a competent superintendent at the work site during working hours.
- 19.5 The Contractor shall, upon the request of the Departmental Representative, remove any superintendent who, in the opinion of the Departmental Representative, is incompetent or has been conducting himself improperly and shall forthwith designate another superintendent who is acceptable to the Departmental Representative.
- 19.6 Subject to GC19.5, the Contractor shall not substitute a superintendent without the written consent of the Departmental Representative.
- 19.7 A breach by the Contractor of GC19.6 entitles the Departmental Representative to refuse to issue any certificate referred to in GC44 until the superintendent has returned to the work site or another superintendent who is acceptable to the Departmental Representative has been substituted.

GC20 National Security

- 20.1 If the Minister is of the opinion that the work is of a class or kind that involves the national security, he may order the Contractor
- 20.1.1 to provide him with any information concerning persons employed or to be employed by him for purposes of the contract; and
 - 20.1.2 to remove any person from the work and its site if, in the opinion of the Minister, that person may be a risk to the national security.
- 20.2 The Contractor shall, in all contracts with persons who are to be employed in the performance of the contract, make provision for his performance of any obligation that may be imposed upon him under GC19 to GC21.
- 20.3 The Contractor shall comply with an order of the Minister under GC20.1

GC21 Unsuitable Workers

- 21.1 The Contractor shall, upon the request of the Departmental Representative, remove any person employed by him for purposes of the contract who, in the opinion of the Departmental Representative, is incompetent or has conducted himself improperly, and the Contractor shall not permit a person who has been removed to return to the work site.

GC22 Increased or Decreased Costs



- 22.1 The amount set out in the Articles of Agreement shall not be increased or decreased by reason of any increase or decrease in the cost of the work that is brought about by an increase or decrease in the cost of labour, plant or material or any wage adjustment arising pursuant to the Labour Conditions.
- 22.2 Notwithstanding GC22.1 and GC35, an amount set out in the Articles of Agreement shall be adjusted in the manner provided in GC22.3, if any change in a tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property
- 22.2.1 occurs after the date of the submission by the Contractor of his tender for the contract,
- 22.2.2 applies to material, and
- 22.2.3 affects the cost to the Contractor of that material.
- 22.3 If a change referred to in GC22.2 occurs, the appropriate amount set out in the Articles of Agreement shall be increased or decreased by an amount equal to the amount that is established by an examination of the relevant records of the Contractor referred to in GC51 to be the increase or decrease in the cost incurred that is directly attributable to that change.
- 22.4 For the purpose of GC22.2, where a tax is changed after the date of submission of the tender but public notice of the change has been given by the Minister of Finance before that date, the change shall be deemed to have occurred before the date of submission of the tender.

GC23 Canadian Labour and Material

- 23.1 The Contractor shall use Canadian labour and material in the performance of the work to the full extent to which they are procurable, consistent with proper economy and expeditious carrying out of the work.
- 23.2 Subject to GC23.1, the Contractor shall, in the performance of the work, employ labour from the locality where the work is being performed to the extent to which it is available, and shall use the offices of the Canada Employment Centres for the recruitment of workers wherever practicable.
- 23.3 Subject to GC23.1 and GC23.2, the Contractor shall, in the performance of the work, employ a reasonable proportion of persons who have been on active service with the armed forces of Canada and have been honourably discharged therefrom.

GC24 Protection of Work and Documents

- 24.1 The Contractor shall guard or otherwise protect the work and its site, and protect the contract, specifications, plans, drawings, information, material, plant and real property, whether or not they are supplied by Her Majesty to the Contractor, against loss or damage from any cause, and he shall not use, issue, disclose or dispose of them without the written consent of the Minister, except as may be essential for the performance of the work.



- 24.2 If any document or information given or disclosed to the Contractor is assigned a security rating by the person who gave or disclosed it, the Contractor shall take all measures directed by the Departmental Representative to be taken to ensure the maintenance of the degree of security that is ascribed to that rating.
- 24.3 The Contractor shall provide all facilities necessary for the purpose of maintaining security, and shall assist any person authorized by the Minister to inspect or to take security measures in respect of the work and its site.
- 24.4 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure compliance with or to remedy a breach of GC24.1 to GC24.3.

GC25 Public Ceremonies and Signs

- 25.1 The Contractor shall not permit any public ceremony in connection with the work without the prior consent of the Minister.
- 25.2 The Contractor shall not erect or permit the erection of any sign or advertising on the work or its site without the prior consent of the Departmental Representative.

GC26 Precautions against Damage, Infringement of Rights, Fire, and Other Hazards

- 26.1 The Contractor shall, at his own expense, do whatever is necessary to ensure that
- 26.1.1 no person, property, right, easement or privilege is injured, damaged or infringed by reasons of the Contractor's activities in performing the contract;
 - 26.1.2 pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the work or plant;
 - 26.1.3 fire hazards in or about the work or its site are eliminated and, subject to any direction that may be given by the Departmental Representative, any fire is promptly extinguished;
 - 26.1.4 the health and safety of all persons employed in the performance of the work is not endangered by the method or means of its performance;
 - 26.1.5 adequate medical services are available to all persons employed on the work or its site at all times during the performance of the work;
 - 26.1.6 adequate sanitation measures are taken in respect of the work and its site; and
 - 26.1.7 all stakes, buoys and marks placed on the work or its site by or under the authority of the Departmental Representative are protected and are not removed, defaced, altered or destroyed.
- 26.2 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure



compliance with or to remedy a breach of GC26.1.

- 26.3 The Contractor shall, at his own expense, comply with a direction of the Departmental Representative made under GC26.2.

GC27 Insurance

- 27.1 The Contractor shall, at his own expense, obtain and maintain insurance contracts in respect of the work and shall provide evidence thereof to the Departmental Representative in accordance with the requirements of the Insurance Conditions "E".

- 27.2 The insurance contracts referred to in GC27.1 shall

27.2.1 be in a form, of the nature, in the amounts, for the periods and containing the terms and conditions specified in Insurance Conditions "E", and

27.2.2 provide for the payment of claims under such insurance contracts in accordance with GC28.

GC28 Insurance Proceeds

- 28.1 In the case of a claim payable under a Builders Risk/Installation (All Risks) insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid directly to Her Majesty, and

28.1.1 the monies so paid shall be held by Her Majesty for the purposes of the contract, or

28.1.2 if Her Majesty elects, shall be retained by Her Majesty, in which event they vest in Her Majesty absolutely.

- 28.2 In the case of a claim payable under a General Liability insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid by the insurer directly to the claimant.

- 28.3 If an election is made pursuant to GC28.1, the Minister may cause an audit to be made of the accounts of the Contractor and of Her Majesty in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between

28.3.1 the aggregate of the amount of the loss or damage suffered or sustained by Her Majesty, including any cost incurred in respect of the clearing and cleaning of the work and its site and any other amount that is payable by the Contractor to Her Majesty under the contract, minus any monies retained pursuant to GC28.12, and

28.3.2 the aggregate of the amounts payable by Her Majesty to the Contractor pursuant to the contract up to the date of the loss or damage.

- 28.4 A difference that is established pursuant to GC28.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the



creditor.

- 28.5 When payment of a deficiency has been made pursuant to GC28.4, all rights and obligations of Her Majesty and the Contractor under the contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC28.3, be deemed to have been expended and discharged.
- 28.6 If an election is not made pursuant to GC28.1.2 the Contractor shall, subject to GC28.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at his own expense as if that part of the work had not yet been performed.
- 28.7 When the Contractor clears and cleans the work and its site and restores and replaces the work referred to in GC 28.6, Her Majesty shall pay him out of the monies referred to in GC28.1 so far as they will thereunto extend.
- 28.8 Subject to GC28.7, payment by Her Majesty pursuant to GC28.7 shall be made in accordance with the contract but the amount of each payment shall be 100% of the amount claimed notwithstanding TP4.4.1 and TP4.4.2.

GC29 Contract Security

- 29.1 The Contractor shall obtain and deliver contract security to the Departmental Representative in accordance with the provisions of the Contract Security Conditions.
- 29.2 If the whole or a part of the contract security referred to in GC29.1 is in the form of a security deposit, it shall be held and disposed of in accordance with GC43 and GC45.
- 29.3 If a part of the contract security referred to in GC29.1 is in the form of a labour and material payment bond, the Contractor shall post a copy of that bond on the work site.

GC30 Changes in the Work

- 30.1 Subject to GC5, the Departmental Representative may, at any time before he issues his Final Certificate of Completion,
- 30.1.1 order work or material in addition to that provided for in the Plans and Specifications;
and
- 30.1.2 delete or change the dimensions, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications or in any order made pursuant to GC30.1.1,
- if that additional work or material, deletion, or change is, in his opinion, consistent with the general intent of the original contract.
- 30.2 The Contractor shall perform the work in accordance with such orders, deletions and changes that are made by the Departmental Representative pursuant to GC30.1 from time to time as if they had appeared in and been part of the Plans and Specifications.



- 30.3 The Departmental Representative shall determine whether or not anything done or omitted by the Contractor pursuant to an order, deletion or change referred to in GC30.1 increased or decreased the cost of the work to the Contractor.
- 30.4 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been increased, Her Majesty shall pay the Contractor the increased cost that the Contractor necessarily incurred for the additional work calculated in accordance with GC49 or GC50.
- 30.5 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been decreased, Her Majesty shall reduce the amount payable to the Contractor under the contract by an amount equal to the decrease in the cost caused by the deletion or change referred to in GC30.1.2 and calculated in accordance with GC49.
- 30.6 GC30.3 to GC30.5 are applicable only to a contract or a portion of a contract for which a Fixed Price Arrangement is stipulated in the contract.
- 30.7 An order, deletion or change referred to in GC30.1 shall be in writing, signed by the Departmental Representative and given to the Contractor in accordance with GC11.

GC31 Interpretation of Contract by Departmental Representative

- 31.1 If, at any time before the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, any question arises between the parties about whether anything has been done as required by the contract or about what the Contractor is required by the contract to do, and, in particular but without limiting the generality of the foregoing, about
- 31.1.1 the meaning of anything in the Plans and Specification,
 - 31.1.2 the meaning to be given to the Plans and Specifications in case of any error therein, omission therefrom, or obscurity or discrepancy in their working or intention,
 - 31.1.3 whether or not the quality or quantity of any material or workmanship supplied or proposed to be supplied by the Contractor meets the requirements of the contract,
 - 31.1.4 whether or not the labour, plant or material provided by the Contractor for performing the work and carrying out the contract are adequate to ensure that the work will be performed in accordance with the contract and that the contract will be carried out in accordance with its terms,
 - 31.1.5 what quantity of any kind of work has been completed by the Contractor, or
 - 31.1.6 the timing and scheduling of the various phases of the performance of the work,
- the question shall be decided by the Departmental Representative whose decision shall be final and conclusive in respect of the work.
- 31.2 The Contractor shall perform the work in accordance with any decisions of the Departmental



Representative that are made under GC31.1 and in accordance with any consequential directions given by the Departmental Representative.

GC32 Warranty and Rectification of Defects in Work

32.1 Without restricting any warranty or guarantee implied or imposed by law or contained in the contract documents, the Contractor shall, at his own expense,

32.1.1 rectify and make good any defect or fault that appears in the work or comes to the attention of the Minister with respect to those parts of the work accepted in connection with the Interim Certificate of Completion referred to GC44.2 within 12 months from the date of the Interim Certificate of Completion;

32.1.2 rectify and make good any defect or fault that appears in or comes to the attention of the Minister in connection with those parts of the work described in the Interim Certificate of Completion referred to in GC44.2 within 12 months from the date of the Final Certificate of Completion referred to in GC44.1.

32.2 The Departmental Representative may direct the Contractor to rectify and make good any defect or fault referred to in GC32.1 or covered by any other expressed or implied warranty or guarantee.

32.3 A direction referred to in GC32.2 shall be in writing, may include a stipulation in respect of the time within which a defect or fault is required to be rectified and made good by the Contractor, and shall be given to the Contractor in accordance with GC11.

32.4 The Contractor shall rectify and make good any defect or fault described in a direction given pursuant to GC32.2 within the time stipulated therein.

GC33 Non-Compliance by Contractor

33.1 If the Contractor fails to comply with any decision or direction given by the Departmental Representative pursuant to GC18, GC24, GC26, GC31 or GC32, the Departmental Representative may employ such methods as he deems advisable to do that which the Contractor failed to do.

33.2 The Contractor shall, on demand, pay Her Majesty an amount that is equal to the aggregate of all cost, expenses and damage incurred or sustained by Her Majesty by reason of the Contractor's failure to comply with any decision or direction referred to in GC33.1, including the cost of any methods employed by the Departmental Representative pursuant to GC33.1.

GC34 Protesting Departmental Representative's Decisions

34.1 The Contractor may, within ten days after the communication to him of any decision or direction referred to in GC30.3 or GC33.1, protest that decision or direction.

34.2 A protest referred to in GC34.1 shall be in writing, contain full reasons for the protest, be signed



by the Contractor and be given to Her Majesty by delivery to the Departmental Representative.

- 34.3 If the Contractor gives a protest pursuant to GC34.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction, or prevent the Contractor from taking whatever action he considers appropriate in the circumstances.
- 34.4 The giving of a protest by the Contractor pursuant to GC34.2 shall not relieve him from complying with the decision or direction that is the subject of the protest.
- 34.5 Subject to GC34.6, the Contractor shall take any action referred to in GC34.3 within three months after the date that a Final Certificate of Completion is issued under GC44.1 and not afterwards.
- 34.6 The Contractor shall take any action referred to in GC34.3 resulting from a direction under GC32 within three months after the expiry of a warranty or guarantee period and not afterwards.
- 34.7 Subject to GC34.8, if Her Majesty determines that the Contractor's protest is justified, Her Majesty shall pay the Contractor the cost of the additional labour, plant and material necessarily incurred by the Contractor in carrying out the protested decision or direction.
- 34.8 Costs referred to in GC34.7 shall be calculated in accordance with GC48 to GC50.

GC35 Changes in Soil Conditions and Neglect or Delay by Her Majesty

- 35.1 Subject to GC35.2 no payment, other than a payment that is expressly stipulated in the contract, shall be made by Her Majesty to the Contractor for any extra expense or any loss or damage incurred or sustained by the Contractor.
- 35.2 If the Contractor incurs or sustains any extra expense or any loss or damage that is directly attributable to
- 35.2.1 a substantial difference between the information relating to soil conditions at the work site that is contained in the Plans and Specifications or other documents supplied to the Contractor for his use in preparing his tender or a reasonable assumption of fact based thereon made by the Contractor, and the actual soil conditions encountered by the Contractor at the work site during the performance of the contract, or
- 35.2.2 any neglect or delay that occurs after the date of the contract on the part of Her Majesty in providing any information or in doing any act that the contract either expressly requires Her Majesty to do or that would ordinarily be done by an owner in accordance with the usage of the trade,

he shall, within ten days of the date the actual soil conditions described in GC35.2.1 were encountered or the neglect or delay described in GC35.2.2 occurred, give the Departmental Representative written notice of his intention to claim for that extra expense or that loss or damage.

- 35.3 When the Contractor has given a notice referred to in GC35.2, he shall give the Departmental Representative a written claim for extra expense or loss or damage within 30 days of the date that



a Final Certificate of Completion referred to in GC44.1 is issued and not afterwards.

- 35.4 A written claim referred to in GC35.3 shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the claim to enable the Departmental Representative to determine whether or not the claim is justified and the Contractor shall supply such further and other information for that purpose as the Departmental Representative requires from time to time.
- 35.5 If the Departmental Representative determines that a claim referred to in GC35.3 is justified, Her Majesty shall make an extra payment to the Contractor in an amount that is calculated in accordance with GC47 to GC50.
- 35.6 If, in the opinion of the Departmental Representative, an occurrence described in GC35.2.1 results in a savings of expenditure by the Contractor in performing the contract, the amount set out in the Articles of Agreement shall, subject to GC35.7, be reduced by an amount that is equal to the saving.
- 35.7 The amount of the saving referred to in GC35.6 shall be determined in accordance with GC47 to GC49.
- 35.8 If the Contractor fails to give a notice referred to in GC35.2 and a claim referred to in GC35.3 within the times stipulated, an extra payment shall not be made to him in respect of the occurrence.

GC36 Extension of Time

- 36.1 Subject to GC36.2, the Departmental Representative may, on the application of the Contractor made before the day fixed by the Articles of Agreement for completion of the work or before any other date previously fixed under this General Condition, extend the time for its completion by fixing a new date if, in the opinion of the Departmental Representative, causes beyond the control of the Contractor have delayed its completion.
- 36.2 An application referred to in GC36.1 shall be accompanied by the written consent of the bonding company whose bond forms part of the contract security.

GC37 Assessments and Damages for Late Completion

- 37.1 For the purposes of this General Condition
- 37.1.1 the work shall be deemed to be completed on the date that an Interim Certificate of Completion referred to in GC44.2 is issued, and
- 37.1.2 "period of delay" means the number of days commencing on the day fixed by the Articles of Agreement for completion of the work and ending on the day immediately preceding the day on which the work is completed but does not include any day within a period of extension granted pursuant to GC36.1, and any other day on which, in the opinion of the Departmental Representative, completion of the work was delayed for reasons beyond the control of the Contractor.



- 37.2 If the Contractor does not complete the work by the day fixed for its completion by the Articles of Agreement but completes it thereafter, the Contractor shall pay Her Majesty an amount equal to the aggregate of
- 37.2.1 all salaries, wages and travelling expenses incurred by Her Majesty in respect of persons overseeing the performance of the work during the period of delay;
 - 37.2.2 the cost incurred by Her Majesty as a result of the inability to use the completed work for the period of delay; and
 - 37.2.3 all other expenses and damages incurred or sustained by Her Majesty during the period of delay as a result of the work not being completed by the day fixed for its completion.
- 37.3 The Minister may waive the right of Her Majesty to the whole or any part of the amount payable by the Contractor pursuant to GC37.2 I, in the opinion of the Minister, it is in the public interest to do so.

GC38 Taking the Work Out of the Contractor's Hands

- 38.1 The Minister may, at his sole discretion, by giving a notice in writing to the Contractor in accordance with GC11, take all or any part of the work out of the Contractor's hands, and may employ such means as he sees fit to have the work completed if the Contractor
- 38.1.1 Has not, within six days of the Minister or the Departmental Representative giving notice to the Contractor in writing in accordance with GC11, remedied any delay in the commencement or any default in the diligent performance of the work to the satisfaction of the Departmental Representative;
 - 38.1.2 has defaulted in the completion of any part of the work within the time fixed for its completion by the contract;
 - 38.1.3 has become insolvent;
 - 38.1.4 has committed an act of bankruptcy;
 - 38.1.5 has abandoned the work;
 - 38.1.6 has made an assignment of the contract without the consent required by GC3.1; or
 - 38.1.7 has otherwise failed to observe or perform any of the provisions of the contract.
- 38.2 If the whole or any part of the work is taken out of the Contractor's hands pursuant to GC38.1,
- 38.2.1 the Contractor's right to any further payment that is due or accruing due under the contract is, subject only to GC38.4, extinguished, and
 - 38.2.2 the Contractor is liable to pay Her Majesty, upon demand, an amount that is equal to the amount of all loss and damage incurred or sustained by Her Majesty in respect of the



Contractor's failure to complete the work.

- 38.3 If the whole or any part of the work that is taken out of the Contractor's hands pursuant to GC38.1 is completed by Her Majesty, the Departmental Representative shall determine the amount, if any, of the holdback or a progress claim that had accrued and was due prior to the date on which the work was taken out of the Contractor's hands and that is not required for the purposes of having the work performed or of compensating Her Majesty for any other loss or damage incurred or sustained by reason of the Contractor's default.
- 38.4 Her Majesty may pay the Contractor the amount determined not to be required pursuant to GC38.3.

GC39 Effect of Taking the Work Out of the Contractor's Hands

- 39.1 The taking of the work or any part thereof out of the Contractor's hands pursuant to GC38 does not operate so as to relieve or discharge him from any obligation under the contract or imposed upon him by law except the obligation to complete the performance of that part of the work that was taken out of his hands.
- 39.2 If the work or any part thereof is taken out of the Contractor's hands pursuant to GC38, all plant and material and the interest of the Contractor is all real property, licenses, powers and privileges acquired, used or provided by the Contractor under the contract shall continue to be the property of Her Majesty without compensation to the Contractor.
- 39.3 When the Departmental Representative certifies that any plant, material, or any interest of the Contractor referred to in GC39.2 is no longer required for the purposes of the work, or that it is not in the interest of Her Majesty to retain that plant, material or interest, it shall revert to the Contractor.

G40 Suspension of Work by Minister

- 40.1 The Minister may, when in his opinion it is in the public interest to do so, require the Contractor to suspend performance of the work either for a specified or an unspecified period by giving a notice of suspension in writing to the Contractor in accordance with GC11.
- 40.2 When a notice referred to in GC40.1 is received by the Contractor in accordance with GC11, he shall suspend all operations in respect of the work except those that, in the opinion of the Departmental Representative, are necessary for the care and preservation of the work, plant and material.
- 40.3 The Contractor shall not, during a period of suspension, remove any part of the work, plant or material from its site without the consent of the Departmental Representative.
- 40.4 If a period of suspension is 30 days or less, the Contractor shall, upon the expiration of that period, resume the performance of the work and he is entitled to be paid the extra cost, calculated in accordance with GC48 to GC50, of any labour, plant and material necessarily incurred by him as a result of the suspension.



- 40.5 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor agree that the performance of the work will be continued by the Contractor, the Contractor shall resume performance of the work subject to any terms and conditions agreed upon by the Minister and the Contractor.
- 40.6 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor do not agree that performance of the work will be continued by the Contractor or upon the terms and conditions under which the Contractor will continue the work, the notice of suspension shall be deemed to be a notice of termination pursuant to GC41.

GC41 Termination of Contract

- 41.1 The Minister may terminate the contract at any time by giving a notice of termination in writing to the Contractor in accordance with GC11.
- 41.2 When a notice referred to in GC41.1 is received by the Contractor in accordance with GC11, he shall, subject to any conditions stipulated in the notice, forthwith cease all operations in performance of the contract.
- 41.3 If the contract is terminated pursuant to GC41.1, Her Majesty shall pay the Contractor, subject to GC41.4, an amount equal to
- 41.3.1 the cost to the contractor of all labour, plant and material supplied by him under the contract up to the date of termination in respect of a contract or part thereof for which a Unit Price Arrangement is stipulated in the contract, or
 - 41.3.2 the lesser of
 - 41.3.2.1 an amount, calculated in accordance with the Terms and Payment, that would have been payable to the Contractor had he completed the work, and
 - 41.3.2.2 an amount that is determined to be due to the Contractor pursuant to GC49 in respect of a contract or part thereof for which a Fixed Price Arrangement is stipulated in the contract
- less the aggregate of all amounts that were paid to the Contractor by Her Majesty and all amounts that are due to Her Majesty from the Contractor pursuant to the contract.
- 41.4 If Her Majesty and the Contractor are unable to agree about an amount referred to in GC41.3 that amount shall be determined by the method referred to in GC50.

GC42 Claims Against and Obligations of the Contractor or Subcontractor

- 42.1 Her Majesty may, in order to discharge lawful obligations of and satisfy claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or the subcontractor but such amount if any, as is paid by Her Majesty, shall not exceed that amount which the Contractor would have been obliged to pay to



such claimant had the provisions of the Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, been applicable to the work. Any such claimant need not comply with the provisions of such legislation setting out the steps by way of notice, registration or otherwise as might have been necessary to preserve or perfect any claim for lien or privilege which claimant might have had;

42.2 Her Majesty will not make any payment as described in GC42.1 unless and until that claimant shall have delivered to Her Majesty:

42.2.1 a binding and enforceable Judgment or Order of a court of competent jurisdiction setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or

42.2.2 a final and enforceable award of an arbitrator setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or

42.2.3 the consent of the Contractor authorizing a payment.

For the purposes of determining the entitlement of a claimant pursuant to GC42.2.1 and GC42.2.2, the notice required by GC42.8 shall be deemed to replace the registration or provision of notice after the performance of work as required by any applicable legislation and no claim shall be deemed to have expired, become void or unenforceable by reason of the claimant not commencing any action within the time prescribed by any applicable legislation.

42.3 The Contractor shall, by the execution of his contract, be deemed to have consented to submit to binding arbitration at the request of any claimant those questions that need be answered to establish the entitlement of the claimant to payment pursuant to the provisions of GC42.1 and such arbitration shall have as parties to it any subcontractor to whom the claimant supplied material, performed work or rented equipment should such subcontractor wish to be adjoined and the Crown shall not be a party to such arbitration and, subject to any agreement between the Contractor and the claimant to the contrary, the arbitration shall be conducted in accordance with the Provincial or Territorial legislation governing arbitration applicable in the Province or Territory in which the work is located.

42.4 A payment made pursuant to GC42.1 is, to the extent of the payment, a discharge of Her Majesty's liability to the Contractor under the contract and may be deducted from any amount payable to the Contractor under the contract.

42.5 To the extent that the circumstances of the work being performed for Her Majesty permit, the Contractor shall comply with all laws in force in the Province or Territory where the work is being performed relating to payment period, mandatory holdbacks, and creation and enforcement of mechanics' liens, builders' liens or similar legislation or in the Province of Quebec, the law relating to privileges.

42.6 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires Her



Majesty to pay the Contractor.

- 42.7 The Contractor shall, whenever requested to do so by the Departmental Representative, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC42.6.
- 42.8 GC42.1 shall only apply to claims and obligations
- 42.8.1 the notification of which has been received by the Departmental Representative in writing before payment is made to the Contractor pursuant to TP4.10 and within 120 days of the date on which the claimant
- 42.8.1.1 should have been paid in full under the claimant's contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or
- 42.8.1.2 performed the last of the services, work or labour, or furnished the last of the material pursuant to the claimant's contract with the Contractor or subcontractor where the claim is not for money referred to in GC42.8.1.1, and
- 42.8.2 the proceedings to determine the right to payment of which, pursuant to GC42.2. shall have commenced within one year from the date that the notice referred to in GC42.8.1 was received by the Departmental Representative, and
- the notification required by GC42.8.1 shall set forth the amount claimed to be owing and the person who by contract is primarily liable.
- 42.9 Her Majesty may, upon receipt of a notice of claim under GC42.8.1, withhold from any amount that is due and payable to the Contractor pursuant to the contract the full amount of the claim or any portion thereof.
- 42.10 The Departmental Representative shall notify the Contractor in writing of receipt of any claim referred to in GC42.8.1 and of the intention of Her Majesty to withhold funds pursuant to GC42.9 and the Contractor may, at any time thereafter and until payment is made to the claimant, be entitled to post, with Her Majesty, security in a form acceptable to Her Majesty in an amount equal to the value of the claim, the notice of which is received by the Departmental Representative and upon receipt of such security Her Majesty shall release to the Contractor any funds which would be otherwise payable to the Contractor, that were withheld pursuant to the provisions of GC42.9 in respect of the claim of any claimant for whom the security stands.

GC43 Security Deposit – Forfeiture or Return

- 43.1 If
- 43.1.1 the work is taken out of the Contractor's hands pursuant to GC38,
- 43.1.2 the contract is terminated pursuant to GC41, or
- 43.1.3 the Contractor is in breach of or in default under the contract,



Her Majesty may convert the security deposit, if any, to Her own use.

- 43.2 If Her Majesty converts the contract security pursuant to GC43.1, the amount realized shall be deemed to be an amount due from Her Majesty to the Contractor under the contract.
- 43.3 Any balance of an amount referred to in GC43.2 that remains after payment of all losses, damage and claims of Her Majesty and others shall be paid by Her Majesty to the Contractor if, in the opinion of the Departmental Representative, it is not required for the purposes of the contract.

GC44 Departmental Representative's Certificates

44.1 On the date that

44.1.1 the work has been completed, and

44.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Departmental Representative, the Departmental Representative shall issue a Final Certificate of Completion to the Contractor.

44.2 If the Departmental Representative is satisfied that the work is substantially complete he shall, at any time before he issues a certificate referred to in GC44.1, issue an Interim Certificate of Completion to the Contractor, and

44.2.1 for the purposes of GC44.2 the work will be considered to be substantially complete,

44.2.1.1 when the work under the contract or a substantial part thereof is, in the opinion of the Departmental Representative, ready for use by Her Majesty or is being used for the purpose intended; and

44.2.1.2 when the work remaining to be done under the contract is, in the opinion of the Departmental Representative, capable of completion or correction at accost of not more than

44.2.1.2.1 -3% of the first \$500,000, and

44.2.1.2.2 -2% of the next \$500,000, and

44.2.1.2.3 -1% of the balance

of the value of the contract at the time this cost is calculated.

44.3 For the sole purpose of GC44.2.1.2, where the work or a substantial part thereof is ready for use or is being used for the purposes intended and the remainder of the work or a part thereof cannot be completed by the time specified in A2.1, or as amended pursuant to GC36, for reasons beyond the control of the Contractor or where the Departmental Representative and the Contractor agree not to complete a part of the work within the specified time, the cost of that part of the work



which was either beyond the control of the Contractor to complete or the Departmental Representative and the Contractor have agreed not to complete by the time specified shall be deducted from the value of the contract referred to GC44.2.1.2 and the said cost shall not form part of the cost of the work remaining to be done in determining substantial completion.

44.4 An Interim Certificate of Completion referred to in GC44.2 shall describe the parts of the work not completed to the satisfaction of the Departmental Representative and all things that must be done by the Contractor

44.4.1 before a Final Certificate of Completion referred to in GC44.1 will be issued, and

44.4.2 before the 12-month period referred to in GC32.1.2 shall commence for the said parts and all the said things.

44.5 The Departmental Representative may, in addition to the parts of the work described in an Interim Certificate of Completion referred to in GC44.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the satisfactory completion of the work.

44.6 If the contract or a part thereof is subject to a Unit Price Arrangement, the Departmental Representative shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

44.7 The Contractor shall assist and co-operate with the Departmental Representative in the performance of his duties referred to in GC44.6 and shall be entitled to inspect any record made by the Departmental Representative pursuant to GC44.6.

44.8 After the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, he shall, if GC44.6 applies, issue a Final Certificate of Measurement.

44.9 A Final Certificate of Measurement referred to in GC44.8 shall

44.9.1 contain the aggregate of all measurements of quantities referred to in GC44.6, and

44.9.2 be binding upon and conclusive between Her Majesty and the Contractor as to the quantities referred to therein.

GC45 Return of Security Deposit

45.1 After an Interim Certificate of Completion referred to in GC44.2 has been issued, Her Majesty shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Departmental Representative, is not required for the purposes of the contract.

45.2 After a Final Certificate of Completion referred to in GC44.1 has been issued, Her Majesty shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.



- 45.3 If the security deposit was paid into the Consolidated Revenue Fund of Canada, Her Majesty shall pay interest thereon to the Contractor at a rate established from time to time pursuant to section 21(2) of the Financial Administration Act.

GC46 Clarification of Terms in GC47 to GC50

- 46.1 For the purposes of GC47 to GC50,
- 46.1.1 "Unit Price Table" means the table set out in the Articles of Agreement, and
- 46.1.2 "plant" does not include tools customarily provided by a tradesman in practicing his trade.

GC47 Additions or Amendments to Unit Price Table

- 47.1 Where a Unit Price Arrangement applies to the contract or a part thereof the Departmental Representative and the Contractor may, by an agreement in writing,
- 47.1.1 add classes of labour or material, and units of measurement, prices per unit and estimated quantities to the Unit Price Table if any labour, plant or material that is to be included in the Final Certificate of Measurement referred to in GC44.8 is not included in any class of labour, plant or material set out in the Unit Price Table; or
- 47.1.2 subject to GC47.2 and GC47.3, amend a price set out in the Unit Price Table for any class of labour, plant or material included therein if the Final Certificate of Measurement referred to in GC44.8 shows or is expected to show that the total quantity of that class of labour, plant or material actually performed, used or supplied by the Contractor in performing the work is
- 47.1.2.1 less than 85% of that estimated total quantity, or
- 47.1.2.2 in excess of 115% of that estimated total quantity.
- 47.2 In no event shall the total cost of an item set out in the Unit Price Table that has been amended pursuant to GC47.1.2.1 exceed the amount that would have been payable to the Contractor had the estimated total quantity actually been performed, used or supplied.
- 47.3 An amendment that is made necessary by GC47.1.2.2 shall apply only to the quantities that are in excess of 115%.
- 47.4 If the Departmental Representative and the Contractor do not agree as contemplated in GC47.1, the Departmental Representative shall determine the class and the unit of measurement of the labour, plant or material and, subject to GC47.2 and GC47.3, the price per unit therefore shall be determined in accordance with GC50.

GC48 Determination of Cost – Unit Price Table



- 48.1 Whenever, for the purposes of the contract, it is necessary to determine the cost of labour, plant or material, it shall be determined by multiplying the quantity of that labour, plant or material expressed in the unit set out in column 3 of the Unit Price Table by the price of that unit set out in column 5 of the Unit Price Table.

GC49 Determination of Cost – Negotiation

- 49.1 If the method described in GC48 cannot be used because the labour, plant or material is of a kind or class that is not set out in the Unit Price Table, the cost of that labour, plant or material for the purposes of the contract shall be the amount agreed upon from time to time by the Contractor and the Departmental Representative.
- 49.2 For the purposes of GC49.1, the Contractor shall submit to the Departmental Representative any necessary cost information requested by the Departmental Representative in respect of the labour, plant and material referred to in GC49.1

GC50 Determination of Cost – Failing Negotiation

- 50.1 If the methods described in GC47, GC48 or GC49 fail for any reason to achieve a determination of the cost of labour, plant and material for the purposes referred to therein, that cost shall be equal to the aggregate of
- 50.1.1 all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the labour, plant and material that falls within one of the classes of expenditure described in GC50.2 that are directly attributable to the performance of the contract,
 - 50.1.2 an allowance for profit and all other expenditures or costs, including overhead, general administration cost, financing and interest charges, and every other cost, charge and expenses, but not including those referred to in GC50.1.1 or GC50.1.3 or a class referred to in GC50.2, in an amount that is equal to 10% of the sum of the expenses referred to in GC50.1.1, and
 - 50.1.3 interest on the cost determined under GC50.1.1 and GC50.1.2, which interest shall be calculated in accordance with TP9,

provide that the total cost of an item set out in the Unit Price Table that is subject to the provisions of GC47.1.2.1 does not exceed the amount that would have been payable to the Contractor had the estimated total quantity of the said item actually be performed, used or supplied.

- 50.2 For purposes of GC50.1.1 the classes of expenditure that may be taken into account in determining the cost of labour, plant and material are,
- 50.2.1 payments to subcontractors;
 - 50.2.2 wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living



and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless they are engaged at the work site with the approval of the Departmental Representative,

- 50.2.3 assessments payable under any statutory authority relating to workmen's compensation, unemployment insurance, pension plan or holidays with pay;
- 50.2.4 rent that is paid for plant or an amount equivalent of the said rent if the plant is owned by the Contractor that is necessary for and used in the performance of the work, if the rent of the equivalent amount is reasonable and use of that plant has been approved by the Departmental Representative;
- 50.2.5 payments for maintaining and operating plant necessary for and used in the performance of the work, and payments for effecting such repairs thereto as, in the opinion of the Departmental Representative, are necessary to the proper performance of the contract other than payments for any repairs to the plant arising out of defects existing before its allocation to the work;
- 50.2.6 payments for material that is necessary for and incorporated in the work, or that is necessary for and consumed in the performance of the contract;
- 50.2.7 payments for preparation, delivery, handling, erection, installation, inspection protection and removal of the plant and material necessary for and used in the performance of the contract; and
- 50.2.8 any other payments made by the Contractor with the approval of the Departmental Representative that are necessary for the performance of the contract.

GC51 Records to be kept by Contractor

51.1 The Contractor shall

- 51.1.1 maintain full records of his estimated and actual cost of the work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto.
- 51.1.2 make all records and material referred to in GC5.1.1 available to audit and inspection by the Minister and the Deputy Receiver General for Canada or by persons acting on behalf of either of both of them, when requested;
- 51.1.3 allow any of the person referred to in GC51.1.2 to make copies of and to take extracts from any of the records and material referred to in GC51.1.1; and
- 51.1.4 furnish any person referred to in GC51.1.2 with any information he may require from time to time in connection with such records and material.

51.2 The records maintained by the Contractor pursuant to GC51.1.1 shall be kept intact by the Contractor until the expiration of two years after the date that a Final Certificate of Completion referred to in GC44.1 was issued or until the expiration of such other period of time as the



Minister may direct.

- 51.3 The Contractor shall cause all subcontractors and all other persons directly or indirectly controlled by or affiliated with the Contractor and all persons directly or indirectly having control of the Contractor to comply with GC51.1 and GC51.2 as if they were the Contractor.

GC52 Conflict of Interest

- 52.1 It is a term of this contract that no former public office holder who is not in compliance with the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from this contract.

GC53 Contractor Status

- 53.1 The Contractor shall be engaged under the contract as an independent contractor.
- 53.2 The Contractor and any employee of the said Contractor is not engaged by the contract as an employee, servant or agent of Her Majesty.
- 53.3 For the purposes of GC53.1 and GC53.2 the Contractor shall be solely responsible for any and all payments and deductions required to be made by law including those required for Canada or Quebec Pension Plans, Unemployment Insurance, Worker's Compensation or Income Tax.



GENERAL CONDITONS

- IC 1 Proof of Insurance**
- IC 2 Risk Management**
- IC 3 Payment of Deductible**
- IC 4 Insurance Coverage**

GENERAL INSUANCE COVERAGES

- GCI 1 Insured**
- GIC 2 Period of Insurance**
- GIC 3 Proof of Insurance**
- GIC 4 Notification**

COMMERCIAL GENERAL LIABILITY

- CGL 1 Scope of Policy**
- CGL 2 Coverages/Provisions**
- CGL 3 Additional Exposures**
- CGL 4 Insurance Proceeds**
- CGL 5 Deductible**

BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS

- BR 1 Scope of Policy**
- BR 2 Property Insured**
- BR 3 Insurance Proceeds**
- BR 4 Amount of Insurance**
- BR 5 Deductible**
- BR 6 Subrogation**
- BR 7 Exclusion Qualifications**

INSURER'S CERTIFICATE OF INSURANCE



General Conditions

IC 1 Proof of Insurance (02/12/03)

Within thirty (30) days after acceptance of the Contractor's tender, the Contractor shall, unless otherwise directed in writing by the Contracting Officer, deposit with the Contracting Officer an Insurer's Certificate of Insurance in the form displayed in this document and, if requested by the Contracting Officer, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the Insurance Coverage Requirements shown hereunder.

IC 2 Risk Management (01/10/94)

The provisions of the Insurance Coverage Requirements contained hereunder are not intended to cover all of the Contractor's obligations under GC8 of the General Conditions "C" of the contract. Any additional risk management measures or additional insurance coverages the Contractor may deem necessary to fulfill its obligations under GC8 shall be at its own discretion and expense.

IC 3 Payment of Deductible (01/10/94)

The payment of monies up to the deductible amount made in satisfaction of a claim shall be borne by the Contractor.

IC 4 Insurance Coverage (02/12/03)

The Contractor has represented that it has in place and effect the appropriate and usual liability insurance coverage as required by these Insurance Conditions and the Contractor has warranted that it shall obtain, in a timely manner and prior to commencement of the Work, the appropriate and usual property insurance coverage as required by these Insurance Conditions and, further, that it shall maintain all required insurance policies in place and effect as required by these Insurance Conditions.



INSURANCE COVERAGE REQUIREMENTS

PART I GENERAL INSURANCE COVERAGES (GIC)

GCI 1 Insured (02/12/03)

Each insurance policy shall insure the Contractor, and shall include, as an Additional Named Insured, Her Majesty the Queen in right of Canada, represented by the National Research Council Canada.

GIC 2 Period of Insurance (02/12/03)

Unless otherwise directed in writing by the Contracting Officer or otherwise stipulated elsewhere in these Insurance Conditions, the policies required hereunder shall be in force and be maintained from the date of the contract award until the day of issue of the Departmental Representative's Final Certificate of Completion.

GIC 3 Proof of Insurance (01/10/94)

Within twenty five (25) days after acceptance of the Contractor's tender, the Insurer shall, unless otherwise directed by the Contractor, deposit with the Contractor an Insurer's Certificate of Insurance in the form displayed in the document and, if requested, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the requirements of these Insurance Coverages.

GIC 4 Notification (01/10/94)

Each Insurance policy shall contain a provision that (30) days prior written notice shall be given by the Insurer to Her Majesty in the event of any material change in or cancellation of coverage. Any such notice received by the Contractor shall be transmitted forthwith to Her Majesty.

PART II COMMERCIAL GENERAL LIABILITY

CGL 1 Scope of Policy (01/10/94)

The policy shall be written on a form similar to that known and referred to in the insurance industry as IBC 2100 – Commercial General Liability policy (Occurrence form) and shall provide for limit of liability of not less than \$2,000,000 inclusive for Bodily Injury and Property Damage for any one occurrence or series of occurrences arising out of one cause. Legal or defence cost incurred in respect of a claim or claims shall not operate to decrease the limit of liability.

CGL 2 Coverages/Provisions (01/10/94)



The policy shall include but not necessarily be limited to the following coverages/provisions.

- 2.1 Liability arising out of or resulting from the ownership, existence, maintenance or use of premises by the Contractor and operations necessary or incidental to the performance of this contract.
- 2.2 "Broad Form" Property Damage including the loss of use of property.
- 2.3 Removal or weakening of support of any building or land whether such support be natural or otherwise.
- 2.4 Elevator liability (including escalators, hoists and similar devices).
- 2.5 Contractor's Protective Liability
- 2.6 Contractual and Assumed Liabilities un this contact.
- 2.7 Completed Operations Liability – The insurance, including all aspects of this Part II of these Insurance Conditions shall continue for a period of at least one (1) year beyond the date of the Departmental Representative's Final Certificate of Completion for the Completed Operations.
- 2.8 Cross Liability – The Clause shall be written as follows:

Cross Liability – The insurance as is afforded by this policy shall apply in respect to any claim or action brought against any one Insured by any other Insured. The coverage shall apply in the same manner and to the same extent as though a separate policy had been issued to each Insured. The inclusion herein of more than one Insured shall not increase the limit of the Insurer's liability.

- 2.9 Severability of Interests – The Clause shall be written as follows:

Severability of Interests – This policy, subject to the limits of liability stated herein, shall apply separately to each Insured in the same manner and to the same extent as if a separate policy had been issued to each. The inclusion herein of more than one insured shall not increase the limit of the Insurer's liability.

CGL 3 Additional Exposures (02/12/03)

The policy shall either include or be endorsed to include the following exposures of hazards if the Work is subject thereto:

- 3.1 Blasting
- 3.2 Pile driving and calsson work
- 3.3 Underpinning
- 3.4 Risks associated with the activities of the Contractor on an active airport



- 3.5 Radioactive contamination resulting from the use of commercial isotopes
- 3.6 Damage to the portion of an existing building beyond that directly associated with an addition, renovation or installation contract.
- 3.7 Marine risks associated with the contraction of piers, wharves and docks.

**CGL 4 Insurance Proceeds
(01/10/94)**

Insurance Proceeds from this policy are usually payable directly to a Claimant/Third Party.

**CGL 5 Deductible
(02/12/03)**

This policy shall be issued with a deductible amount of not more than \$10,000 per occurrence applying to Property Damage claims only.

**PART III
BUILDER'S RISK - INSTALLATION FLOATER - ALL RISKS**

**BR 1 Scope of Policy
(01/10/94)**

The policy shall be written on an "All Risks" basis granting coverages similar to those provided by the forms known and referred to in the insurance industry as "Builder's Risk Comprehensive Form" or "Installation Floater - All Risks".

**BR 2 Property Insured
(01/10/94)**

The property insured shall include:

- 2.1 The Work and all property, equipment and materials intended to become part of the finished Work at the site of the project while awaiting, during and after installation, erection or construction including testing.
- 2.2 Expenses incurred in the removal from the construction site of debris of the property insured, including demolition of damaged property, de-icing and dewatering, occasioned by loss, destruction or damage to such property and in respect of which insurance is provided by this policy.

**BR 3 Insurance Proceeds
(01/10/94)**

- 3.1 Insurance proceeds from this policy are payable in accordance with GC28 of the General Conditions "C" of the contract.
- 3.2 This policy shall provide that the proceeds thereof are payable to Her Majesty or as the Minister may direct.



- 3.3 The Contractor shall do such things and execute such documents as are necessary to effect payment of the proceeds.

BR 4 Amount of Insurance
(01/10/94)

The amount of insurance shall not be less than the sum of the contract value plus the declared value (if any) set forth in the contract documents of all material and equipment supplied by Her Majesty at the site of the project to be incorporated into and form part of the finished Work.

BR 5 Deductible
(02/12/03)

The Policy shall be issued with a deductible amount of not more than \$10,000.

BR 6 Subrogation
(01/10/94)

The following Clause shall be included in the policy:

"All rights of subrogation or transfer of rights are hereby waived against any corporation, firm, individual or other interest, with respect to which, insurance is provided by this policy".

BR 7 Exclusion Qualifications
(01/10/94)

The policy may be subject to the standard exclusions but the following qualifications shall apply:

- 7.1 Faulty materials, workmanship or design may be excluded only to the extent of the cost of making good thereof and shall not apply to loss or damage resulting therefrom.
- 7.2 Loss or damage caused by contamination by radioactive material may be excluded except for loss or damage resulting from commercial isotopes used for industrial measurements, inspection, quality control radiographic or photographic use.
- 7.3 Use and occupancy of the project or any part of section thereof shall be permitted where such use and occupancy is for the purpose for which the project is intended upon completion.



INSURER'S CERTIFICATE OF INSURANCE

(TO BE COMPLETED BY INSURER (NOT BOKER) AND DELIVERD TO NATIONAL RESEARCH COUNCIL CANADA WITH 30 DAYS FOLLOWING ACCEPTANCE OF TENDER)

CONTRACT

DESCRIPTION OF WORK	CONTRACT NUMBER	AWARD DATE
LOCATION		

INSURER

NAME
ADDRESS

BROKER

NAME
ADDRESS

INSURED

NAME OF CONTRACTOR
ADDRESS

ADDITIONAL INSURED

HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY THE NATIONAL RESEARCH COUNCIL CANADA

THIS DOCUENT CERTIFIES THAT THE FOLLOWING POLICES OF INSURANCE ARE AT PRESENT IN FORCE COVERING ALL OPERATIONS OF THE INSURE IN CONNECTION WITH THE CONTRACT MADE BETWEEN THE NAMED INSURED AND THE NATIONAL RESEARCH COUNCIL CANADA AND IN ACCORDANCE WITH THE INSURANCE CONDITIONS "E"

POLICY					
TYPE	NUMBER	INCEPTION DATE	EXPIRY DATE	LIMITS OF LIABILITY	DEDUCTIBLE
COMMERCIAL GENERAL LIABILITY					
BUILDERS RISK "AL RISKS"					
INSTALLATION FLOATER "ALL RISKS"					

THE INSURER AGREES TO NOTIFY THE NATIONAL RESEARCH COUNCIL CANADA IN WRITING 30 DAYS PRIOR TO ANY MATERIAL CHANGE IN OR CANCELLATION OF ANY POLICY OR COVERAGE SPECIFICALLY RELATED TO THE CONTRACT

NAME OF INSURER'S OFFICER OR AUTHORIZED EMPLOYEE	SIGNATURE	DATE:
		TELEPHONE NUMBER:

ISSUANCE OF THIS CERTIFIATE SHALL NOT LIMIT OR RESTRICT THE RIGHT OF THE NATIONAL RESEARCH COUNCIL CANADA TO REQUEST AT ANY TIME DUPLICATE COPIES OF SAID INSURANCE POLICIES



CS1 Obligation to provide Contract Security

- 1.1 The Contractor shall, at the Contractor's own expense, provide one or more of the forms of contract security prescribed in CS2.
- 1.2 The Contractor shall deliver to the Departmental Representative the contract security referred to in CS1.1 within 14 days after the date that the Contractor receives notice that the Contractor's tender or offer was accepted by Her Majesty.

CS2 Prescribed Types and Amounts of Contract Security

- 2.1 The Contractor shall deliver to the Departmental Representative pursuant to CS1
 - 2.1.1 a performance bond and a labour and material payment bond each in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, or
 - 2.1.2 a labour and material payment bond in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, and a security deposit in an amount that is equal to
 - 2.1.2.1 not less than 10% of the contract amount referred to in the Articles of Agreement where that amount does not exceed \$250,000, or
 - 2.1.2.2 \$25,000 plus 5% of the part of the contract amount referred to in the Articles of Agreement that exceeds \$250,000, or
 - 2.1.3 a security deposit in an amount prescribed by CS2.12 plus an additional amount that is equal to 10% of the contract amount referred to in the Articles of Agreement.
- 2.2 A performance bond and a labour and material payment bond referred to in CS2.1 shall be in a form and be issued by a bonding or surety company that is approved by Her Majesty.
- 2.3 The amount of a security deposit referred to in CS2.1.2 shall not exceed \$250,000 regardless of the contract amount referred to in the Articles of Agreement.
- 2.4 A security deposit referred to in CS2.1.2 and CS2.1.3 shall be in the form of
 - 2.4.1 a bill of exchange made payable to the Receiver General of Canada and certified by an approved financial institution or drawn by an approved financial institution on itself, or
 - 2.4.2 bonds of or unconditionally guaranteed as to principal and interest by the Government of Canada.
- 2.5 For the purposes of CS2.4
 - 2.5.1 a bill of exchange is an unconditional order in writing signed by the Contractor and addressed to an approved financial institution, requiring the said institution to pay, on demand, at a fixed or determinable future time a sum certain of money to, or to the order



of, the Receiver General for Canada, and

- 2.5.2 If a bill of exchange is certified by a financial institution other than a chartered bank then it must be accompanied by a letter or stamped certification confirming that the financial institution is in at least one of the categories referred to in CS2.5.3
- 2.5.3 an approved financial institution is
 - 2.5.3.1 any corporation or institution that is a member of the Canadian Payments Association,
 - 2.5.3.2 a corporation that accepts deposits that are insured by the Canada Deposit Insurance Corporation or the Régie de l'assurance-dépôts du Québec to the maximum permitted by law,
 - 2.5.3.3 a credit union as defined in paragraph 137(6)(b) of the *Income Tax Act*,
 - 2.5.3.4 a corporation that accepts deposits from the public, if repayment of the deposit is guaranteed by Her Majesty in right of a province, or
 - 2.5.3.5 The Canada Post Corporation.
- 2.5.4 the bonds referred to in CS2.4.2 shall be
 - 2.5.4.1 made payable to bearer, or
 - 2.5.4.2 accompanied by a duly executed instrument of transfer of the bonds to the Receiver General for Canada in the form prescribed by the Domestic Bonds of Canada Regulations, or
 - 2.5.4.3 registered, as to principal or as to principal and interest in the name of the Receiver General for Canada pursuant to the Domestic Bonds of Canada Regulations, and
 - 2.5.4.4 provided on the basis of their market value current at the date of the contract.



Contract Number / Numéro du contrat 780996
Security Classification / Classification de sécurité UNCLASSIFIED

**SECURITY REQUIREMENTS CHECK LIST (SRCL)
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)**

PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE

1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine	2. Branch or Directorate / Direction générale ou Direction ASPM/SAGI
---	---

3. a) Subcontract Number / Numéro du contrat de sous-traitance	3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant
--	---

4. Brief Description of Work / Brève description du travail M58 electrical room upgrade
--

5. a) Will the supplier require access to Controlled Goods? Le fournisseur aura-t-il accès à des marchandises contrôlées?	<input checked="" type="checkbox"/> No / Non	<input type="checkbox"/> Yes / Oui
--	--	------------------------------------

5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?	<input checked="" type="checkbox"/> No / Non	<input type="checkbox"/> Yes / Oui
--	--	------------------------------------

6. Indicate the type of access required / Indiquer le type d'accès requis

6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c) (Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)	<input checked="" type="checkbox"/> No / Non	<input type="checkbox"/> Yes / Oui
--	--	------------------------------------

6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.	<input type="checkbox"/> No / Non	<input checked="" type="checkbox"/> Yes / Oui
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6. c) Is this a commercial courier or delivery requirement with no overnight storage? S'agit-il d'un contrat de messagerie ou de livraison commerciale sans entreposage de nuit?	<input checked="" type="checkbox"/> No / Non	<input type="checkbox"/> Yes / Oui
---	--	------------------------------------

7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès
Canada <input checked="" type="checkbox"/> NATO / OTAN <input type="checkbox"/> Foreign / Étranger <input type="checkbox"/>

7. b) Release restrictions / Restrictions relatives à la diffusion		
No release restrictions / Aucune restriction relative à la diffusion <input checked="" type="checkbox"/>	All NATO countries / Tous les pays de l'OTAN <input type="checkbox"/>	No release restrictions / Aucune restriction relative à la diffusion <input type="checkbox"/>
Not releasable / À ne pas diffuser <input type="checkbox"/>		
Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>
Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:

7. c) Level of information / Niveau d'information		
PROTECTED A / PROTÉGÉ A <input type="checkbox"/>	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ <input type="checkbox"/>	PROTECTED A / PROTÉGÉ A <input type="checkbox"/>
PROTECTED B / PROTÉGÉ B <input type="checkbox"/>	NATO RESTRICTED / NATO DIFFUSION RESTREINTE <input type="checkbox"/>	PROTECTED B / PROTÉGÉ B <input type="checkbox"/>
PROTECTED C / PROTÉGÉ C <input type="checkbox"/>	NATO CONFIDENTIAL / NATO CONFIDENTIEL <input type="checkbox"/>	PROTECTED C / PROTÉGÉ C <input type="checkbox"/>
CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>	NATO SECRET / NATO SECRET <input type="checkbox"/>	CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>
SECRET / SECRET <input type="checkbox"/>	COSMIC TOP SECRET / COSMIC TRÈS SECRET <input type="checkbox"/>	SECRET / SECRET <input type="checkbox"/>
TOP SECRET / TRÈS SECRET <input type="checkbox"/>		TOP SECRET / TRÈS SECRET <input type="checkbox"/>
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>



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PART A (continued) / PARTIE A (suite)

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS?
If Yes, indicate the level of sensitivity:
Dans l'affirmative, indiquer le niveau de sensibilité :

No / Non Yes / Oui

9. Will the supplier require access to extremely sensitive INFOSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate?

No / Non Yes / Oui

Short Title(s) of material / Titre(s) abrégé(s) du matériel :
Document Number / Numéro du document :

PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

- | | | | |
|---|---|---|--|
| <input checked="" type="checkbox"/> RELIABILITY STATUS
COTE DE FIABILITÉ | <input type="checkbox"/> CONFIDENTIAL
CONFIDENTIEL | <input type="checkbox"/> SECRET
SECRET | <input type="checkbox"/> TOP SECRET
TRÈS SECRET |
| <input type="checkbox"/> TOP SECRET - SIGINT
TRÈS SECRET - SIGINT | <input type="checkbox"/> NATO CONFIDENTIAL
NATO CONFIDENTIEL | <input type="checkbox"/> NATO SECRET
NATO SECRET | <input type="checkbox"/> COSMIC TOP SECRET
COSMIC TRÈS SECRET |
| <input type="checkbox"/> SITE ACCESS
ACCÈS AUX EMPLACEMENTS | | | |

Special comments:

Commentaires spéciaux : _____

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.

REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work?
Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail?

No / Non Yes / Oui

If Yes, will unscreened personnel be escorted?

Dans l'affirmative, le personnel en question sera-t-il escorté?

No / Non Yes / Oui

PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)

INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises?
Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS?

No / Non Yes / Oui

11. b) Will the supplier be required to safeguard COMSEC information or assets?
Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC?

No / Non Yes / Oui

PRODUCTION

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises?
Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ?

No / Non Yes / Oui

INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data?
Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS?

No / Non Yes / Oui

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency?
Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale?

No / Non Yes / Oui



PART C - (continued) / PARTIE C - (suite)

For users completing the form manually use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.

Les utilisateurs qui remplissent le formulaire manuellement doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form online (via the internet), the summary chart is automatically populated by your responses to previous questions.

Dans le cas des utilisateurs qui remplissent le formulaire en ligne (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

SUMMARY CHART / TABLEAU RÉCAPITULATIF

Category / Catégorie	PROTECTED / PROTÉGÉ			CLASSIFIED / CLASSIFIÉ			NATO				COMSEC						
	A	B	C	CONFIDENTIAL	SECRET	TOP SECRET	NATO RESTRICTED	NATO CONFIDENTIAL	NATO SECRET	COSMIC TOP SECRET / COSMIC TRÈS SECRET	PROTECTED / PROTÉGÉ			CONFIDENTIAL	SECRET	TOP SECRET	
				CONFIDENTIEL		TRÈS SECRET	NATO DIFFUSION RESTREINTE	NATO CONFIDENTIEL			A	B	C	CONFIDENTIEL		TRÈS SECRET	
Information / Assets / Renseignements / Bénéfices / Production																	
IT Media / Support TI																	
IT Link / Lien électronique																	

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?
La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?

No / Non Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".
Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?
La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?

No / Non Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).
Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquez qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).



Contract Number / Numéro du contrat 780996
Security Classification / Classification de sécurité UNCLASSIFIED

PART D - AUTHORIZATION / PARTIE D - AUTORISATION

13. Organization Project Authority / Chargé de projet de l'organisme

Name (print) - Nom (en lettres moulées) Derek Foot	Title - Titre Construction Project Manager	Signature
Telephone No. - N° de téléphone 613-991-4451	Facsimile No. - N° de télécopieur 613-957-9828	E-mail address - Adresse courriel derek.foot@nrc-cnrc.gc.ca
		Date Nov 27 17

14. Organization Security Authority / Responsable de la sécurité de l'organisme

Name (print) - Nom (en lettres moulées) Richard Bramucci	Title - Titre Analyst, Security in Contracting	Signature
Telephone No. - N° de téléphone (613) 991-1093	Facsimile No. - N° de télécopieur (613) 990-0946	E-mail address - Adresse courriel richard.bramucci@nrc-cnrc.gc.ca
		Date 21 NOV 2017

15. Are there additional instructions (e.g. Security Guide, Security Classification Guide) attached?
Des instructions supplémentaires (p. ex. Guide de sécurité, Guide de classification de la sécurité) sont-elles jointes?

No / Non Yes / Oui

16. Procurement Officer / Agent d'approvisionnement

Name (print) - Nom (en lettres moulées) 	Title - Titre Senior Proc. Officer	Signature
Telephone No. - N° de téléphone 613 991-9990	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel
		Date

17. Contracting Security Authority / Autorité contractante en matière de sécurité

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel
		Date