



THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 449-2006

NEWPCC ELECTRICAL SWITCHGEAR INSPECTION

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 NEWPCC ELECTRICAL SWITCHGEAR INSPECTION

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, August 18, 2006.

B2.2 Bid Submissions determined by the Manager of Materials to have been received later than the Submission Deadline will not be accepted and will be returned upon request.

B2.3 The Contract Administrator or the Manager of Materials may extend the Submission Deadline by issuing an addendum at any time prior to the time and date specified in B2.1.

B3. SITE INVESTIGATION

B3.1 Further to GC.2.01, the Bidder may make an appointment to view the Site by contacting the Contract Administrator.

B3.2 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

B4.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

B4.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B4.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B4.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B4 unless that response or interpretation is provided by the Contract Administrator in writing.

B5. ADDENDA

B5.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site for addenda shortly before the Submission Deadline.

B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 8 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6. SUBSTITUTES

B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:

- (a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;
- (b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;
- (c) identify any anticipated cost or time savings that may be associated with the substitute;
- (d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;
- (e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an "approved equal" or as an "approved alternative", or may refuse to grant approval of the substitute.

B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.

B6.7 If the Contract Administrator approves a substitute as an "approved equal", any Bidder may use the approved equal in place of the specified item.

B6.8 If the Contract Administrator approves a substitute as an "approved alternative", any Bidder bidding that approved alternative shall base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B14.

B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B7. BID SUBMISSION

B7.1 The Bid Submission consists of the following components:

- (a) Form A: Bid;
- (b) Form B: Prices;

B7.2 All components of the Bid Submission shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely in ink, to constitute a responsive Bid.

B7.3 The Bid Submission shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.3.1 Samples or other components of the Bid Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid Submission.

B7.4 Bid Submissions submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.5 Bid Submissions shall be submitted to:

The City of Winnipeg
Corporate Finance Department
Materials Management Branch
185 King Street, Main Floor
Winnipeg MB R3B 1J1

B8. BID

B8.1 The Bidder shall complete Form A: Bid, making all required entries.

B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

- (a) if the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;
- (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
- (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;
- (d) if the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

B8.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.

B8.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B8.4 Paragraph 10 of Form A: Bid shall be signed in accordance with the following requirements:

- (a) if the Bidder is a sole proprietor carrying on business in his own name, it shall be signed by the Bidder;
- (b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;

- (c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers;
- (d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

B8.4.1 The name and official capacity of all individuals signing Form A: Bid shall be printed below such signatures.

B8.4.2 All signatures shall be original.

B8.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid Submission and the Contract, when awarded, shall be both joint and several.

B9. PRICES

B9.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B9.1.1 Notwithstanding GC.9.01(1), prices on Form B: Prices shall not include the Goods and Services Tax (GST) or Manitoba Retail Sales Tax (MRST, also known as PST), which shall be extra where applicable.

B9.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.

B9.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.

B9.4 The mark-up factor for material, specified on Form B, Item 2, shall be a percentage, that when multiplied by the base cost, shall represent the Contractor's handling charge and profit to supply the material. The total price for the material shall be the base cost, plus the base cost multiplied by the mark-up factor.

B9.4.1 The mark-up factor shall be based upon the Contractor's base cost. This base cost shall be the Contractor's procurement cost, or if the material is manufactured by the Contractor, the internal wholesale cost.

B10. QUALIFICATION

B10.1 The Bidder shall:

- (a) undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Bidder does not carry on business in Manitoba, in the jurisdiction where the Bidder does carry on business;
- (b) be responsible and not be suspended, debarred or in default of any obligation to the City;
- (c) be financially capable of carrying out the terms of the Contract;
- (d) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract;
- (e) have successfully carried out work, similar in nature, scope and value to the Work;
- (f) employ only Subcontractors who:
 - (i) are responsible and not suspended, debarred or in default of any obligation to the City (a list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>); and

- (ii) have successfully carried out work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of performing the Work required to be done in accordance with the terms of the Contract;
 - (g) have a written workplace safety and health program in accordance with The Workplace Safety and Health Act (Manitoba);
 - (h) be regularly engaged in the testing of electrical equipment devices, installations, and systems.
 - (i) use technicians who are regularly employed for testing services. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the continued serviceability or nonserviceability of the specific equipment.
- B10.2 The Bidder shall be prepared to submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.
- B10.3 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B11. OPENING OF BIDS AND RELEASE OF INFORMATION

- B11.1 Bid Submissions will not be opened publicly.
- B11.2 Within two (2) Business Day following the Submission Deadline, the names of the Bidders and their bid prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.
- B11.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract Amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.
- B11.4 The Bidder is advised that any information contained in any Bid Submission may be released if required by City policy or procedures, The Freedom of Information and Protection of Privacy Act (Manitoba), or by other authorities having jurisdiction.

B12. IRREVOCABLE BID

- B12.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 9 of Form A: Bid.
- B12.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 9 of Form A: Bid.

B13. WITHDRAWAL OF BIDS

- B13.1 A Bidder may withdraw his Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

- B13.1.1 Notwithstanding GC.7.06(2), the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.
- B13.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 10 of Form A: Bid, and only such person, has authority to give notice of withdrawal.
- B13.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials shall:
- (a) retain the Bid Submission until after the Submission Deadline has elapsed;
 - (b) open the Bid Submission to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 10 of Form A: Bid; and
 - (c) if the notice has been given by any one of the persons specified in B13.1.3(b), declare the Bid withdrawn.
- B13.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B12.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law.

B14. EVALUATION OF BIDS

- B14.1 Award of the Contract shall be based on the following bid evaluation criteria:
- (a) compliance by the Bidder with the requirements of the Bid Opportunity (pass/fail);
 - (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B10 (pass/fail);
 - (c) Total Bid Price;
 - (d) economic analysis of any approved alternative pursuant to B6.
- B14.2 Further to B14.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid Submission is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements if the interests of the City so require.
- B14.3 Further to B14.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid Submission or in other information required to be submitted, that he is responsible and qualified.
- B14.4 Further to B14.1(c), the Total Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.
- B14.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.
- B14.5 This Contract will be awarded as a whole.

B15. AWARD OF CONTRACT

- B15.1 The City will give notice of the award of the Contract or will give notice that no award will be made.
- B15.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

- B15.2.1 Without limiting the generality of B15.2, the City will have no obligation to award a Contract where:
- (a) the prices exceed the available City funds for the Work;
 - (b) the prices are materially in excess of the prices received for similar work in the past;
 - (c) the prices are materially in excess of the City's cost to perform the Work, or a significant portion thereof, with its own forces;
 - (d) only one Bid is received; or
 - (e) in the judgment of the Award Authority, the interests of the City would best be served by not awarding a Contract.
- B15.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid.
- B15.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.
- B15.4 Notwithstanding GC.3.01 and GC.3.02, the City will issue a Purchase Order to the successful Bidder in lieu of the execution of a Contract.
- B15.5 The Contract Documents, as defined in GC.1.01(7), in their entirety shall be deemed to be incorporated in and to form a part of the Purchase Order notwithstanding that they are not necessarily attached to or accompany said Purchase Order.

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

C1.1 The *General Conditions for Provision of Services* (Revision 1996 02 05) are applicable to the Work of the Contract.

C1.1.1 The *General Conditions for Provision of Services* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at <http://www.winnipeg.ca/matmgt>.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

- D1.1 In addition to the *General Conditions for Provision of Services*, these Supplemental Conditions are applicable to the Work of the Contract.
- D1.2 The General Conditions are amended by striking out "The City of Winnipeg Act" wherever it appears in the General Conditions and substituting "The City of Winnipeg Charter".
- D1.3 The General Conditions are amended by striking out "Board of Commissioners" or "Commissioner" wherever it appears in the General Conditions and substituting the "Chief Administrative Officer".
- D1.4 The General Conditions are amended by striking out "Tender Package" wherever it appears in the General Conditions and substituting "Bid Opportunity".
- D1.5 The General Conditions are amended by striking out "Tender Submission" wherever it appears in the General Conditions and substituting "Bid Submission".
- D1.6 The General Conditions are amended by striking out "Bidding Instructions" wherever it appears in the General Conditions and substituting "Bidding Procedures".

D2. SCOPE OF WORK

- D2.1 The Work to be done under the Contract shall consist of performance testing and condition assessment of the 4160V switchgear and associated primary cables. The electrical switchgear is located in the electrical room of the Grit Building at the North End Water Pollution Control Centre, located at 2230 Main Street, Winnipeg, Manitoba.
- D2.2 The major components of the Work are as follows:
- (a) Inspect and test the 4160V main switchgear
 - (b) Inspect and test the DC Battery Bank and Charger used for the switchgear control power.
 - (c) Inspect and test the 4160V primary cables between the two Manitoba Hydro 7.5 MVA transformers and the main switchgear.
 - (d) Provide a thermographic inspection of the DC Battery Bank and Charger, and the 4160V switchgear.
 - (e) Provide a report detailing the inspection and test results
 - (f) Provide a quotation to repair defective switchgear components using the rates proposed in Form B.
 - (g) Repair defective switchgear components upon approval of the Contract Administrator. Award of this contract does not imply approval of the repair services.
- D2.3 The City reserves the right to request quotes from other contractors where the quotation to repair defective switch gear components is excessive in the opinion of the Contract Administrator.

D3. DEFINITIONS

- D3.1 When used in this Bid Opportunity:
- (a) "**Business Day**" means any Calendar Day, other than a Saturday, Sunday, or a Statutory or Civic Holiday;

- (b) "**Submission Deadline**" and "**Time and Date Set for the Final Receipt of Bids**" mean the time and date set out in the Bidding Procedures for final receipt of Bids;
- (c) "**NEWPCC**" means the North End Water Pollution Control Centre

D4. CONTRACT ADMINISTRATOR

- D4.1 The Contract Administrator is SNC-Lavalin Engineers & Constructors Inc., represented by:

David King, P.Eng.
Senior Electrical Engineer
SNC-Lavalin Engineers & Constructors Inc.
200 – 1600 Ness Avenue, Winnipeg, MB R3J 3W7

E-mail david.king@snclavalin.com

Telephone No. (204) 786-8080

Facsimile No. (204) 786-7934

- D4.2 Before commencement of Work, David King will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D5. CONTRACTOR'S SUPERVISOR

- D5.1 At the pre- commencement meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D6. NOTICES

- D6.1 GC.7.06 is hereby amended to delete reference to "registered mail" and to replace same with "ordinary mail".

- D6.2 GC.7.06 is further amended hereby to include delivery by facsimile transmission (fax) as an acceptable means of delivering notices, consents, approvals, statements, authorizations, documents or other communications required or permitted to be given under this Contract. Deliveries by fax will be deemed to have been received on the day of delivery, if a business day, or if not a business day, on the business day next following the day of delivery.

- D6.3 Further to GC.7.06, all notices, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.4, D6.5 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.

- D6.4 All notices of appeal to the Chief Administrative Officer shall be sent to the following address or facsimile number:

The City of Winnipeg
Chief Administrative Officer Secretariat
Administration Building, 3rd Floor
510 Main Street
Winnipeg MB R3B 1B9

Facsimile No.: (204) 949-1174

- D6.5 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

The City of Winnipeg
Corporate Services Department
Legal Services Division
185 King Street, 3rd Floor

Winnipeg MB R3B 1J1
Facsimile No.: (204) 947-9155

SUBMISSIONS

D7. AUTHORITY TO CARRY ON BUSINESS

D7.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D8. WORKERS COMPENSATION

D8.1 The Contractor shall be registered with the Workers Compensation Board of Manitoba, shall provide and maintain Workers Compensation coverage throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D9. INSURANCE

D9.1 The Contractor shall provide and maintain commercial general liability insurance, in the amount of at least two million dollars (\$2,000,000.00) all inclusive, with The City of Winnipeg being added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, non-owned auto liability, unlicensed motor vehicle liability and a products and completed operations endorsement to remain in place at all times during the performance of the Work.

D9.2 Automobile liability insurance for owned automobiles used for or in connection with the project in the amount of at least two million dollars (\$2,000,000.00) to remain in place at all times during the performance of the Work.

D9.3 Deductibles shall be borne by the Contractor.

D9.4 The Contractor shall provide the Contract Administrator with a certificate of insurance of the policy at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than seven (7) Calendar Days from notification of the award of Contract.

D9.5 The Contractor shall not cancel, materially alter, or cause the policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

SCHEDULE OF WORK

D10. COMMENCEMENT

D10.1 The Contractor shall not commence any Work until he is in receipt of a Purchase Order authorizing the commencement of the Work.

D10.2 The Contractor shall not commence any Work on the Site until:

- (a) the Contract Administrator has confirmed receipt and approval of:
 - (i) evidence that the Contractor is in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba;
 - (ii) evidence of the workers compensation coverage specified in D8;
 - (iii) evidence of the insurance specified in D9.

- (b) the Contractor has attended a meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a meeting.

D10.3 The Contractor shall not commence the Work on the Site prior to receipt of written instructions, including a schedule of the Work, from the Contract Administrator. The Contractor shall not perform any Work outside the scope of the written instructions without prior approval of the Contract Administrator.

D11. TOTAL PERFORMANCE

D11.1 The Contractor shall achieve Total Performance within sixty (60) consecutive Working Days of the commencement of the Work as specified in D10.

D11.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D11.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

CONTROL OF WORK

D12. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D12.1 Further to GC.5.02, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

MEASUREMENT AND PAYMENT

D13. PAYMENT SCHEDULE

D13.1 Further to GC.9.01 and GC.9.03, only 80% of the Form B, Item 1 amount may be submitted for progress payments prior to completion of the inspection services specified in E2.11.

PART E - SPECIFICATIONS

GENERAL

E1. GENERAL

E1.1 These Specifications shall apply to the Work.

E1.2 The following Drawings are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
NEP-SK1	NEWPCC 4160V Single Line Diagram
NEP-SK2	NEWPCC 4160V Switchgear and DC Battery Bank Arrangement
NEP-SK3	NEWPCC Grit Building Electrical Room Layout

E2. SERVICES

E2.1 The Contractor shall provide all services in accordance with the requirements hereinafter specified. All material and equipment required to perform the inspection, maintenance, and testing shall also be supplied by the Contractor.

E2.2 All travel and living expenses associated with the services of the personnel defined above are to be included.

E2.3 The Contractor shall meet the following requirements:

- (a) a Professional Engineer on staff who is experienced with the equipment to design repairs or at least written confirmation that they have a suitable engineer on retainer who will provide immediate service if required;
- (b) as a minimum, an electrical technologist with experience maintaining, testing, and troubleshooting medium voltage switchgear.
- (c) inspection reports provided by the Contractor shall be sealed by a professional engineer.

E2.4 Attendance at three site planning meetings, of three hours duration each, to develop shutdown planning, coordination, and scheduling will be required. Additional meetings may be required and are eligible for Incremental Services, as defined in E2.10.

E2.5 Prior to a bank of switchgear being taken out of service, coordination with the Contract Administrator is required, along with approval that NEWPCC electrical distribution is appropriately configured for the shutdown. Similarly, coordination and approval are required prior to returning the switchgear into service.

E2.6 Scheduling of substantial portions of the Work will be subject to the availability of Manitoba Hydro to perform supply disconnection, open metering enclosures, disconnect metering PTs, and other services as required.

E2.7 All required Manitoba Hydro services will be arranged and scheduled by the Contract Administrator.

E2.8 The Work shall be scheduled and performed such that only one bank of the switchgear is out of service at a given time. In addition, the inspection on each bank shall be performed in a manner to reasonably minimize the amount of time to return the switchgear to service, if a work stoppage is required. Under no condition shall both banks of switchgear be out of service at the same time.

E2.9 Work associated with the DC Battery Bank, Charger, and associated wiring and equipment shall be scheduled and performed such that at no time will the protection DC power be removed for longer than 10 minutes. It is expected, but not confirmed, that this can be performed via

utilization of the battery banks during the charger testing, and vice-versa. If this is not feasible with the existing equipment, an alternate supply must be provided by the Contractor.

E2.10 Incremental Services:

- (a) Additional on-site service time that may be necessitated due to unforeseen circumstances that may arise during the course of the project as follows:
 - (i) It is expected that the Work will not be performed during periods of inclement weather, forecasted inclement weather, or high wastewater flows associated with significant rainfall events. It is also possible that equipment failure within the NEWPCC could cause an event where the equipment under inspection is immediately required. The City may, upon their sole discretion, delay or stop the Work at any time, and require the Contractor to return all or specified electrical switchgear into service as soon as possible. Charges for incremental services, are restricted to the extra services required as a result of the work stoppage. For cases where the Contractor is not yet on Site, no incremental services may be charged for scheduling changes where at least 24 hours notice is given prior to the Contractor's scheduled time to be on Site.
 - (ii) Additions by the Contract Administrator to the scope of Work, beyond that defined herein.
 - (iii) Additional planning meetings beyond that described in E2.4.
- (b) Additional services are to be quoted and invoiced on an hourly basis at rates specified on Form B.
- (c) Additional services will not be initiated for reasons of lack of performance or errors in execution.

E2.11 The inspection, maintenance, and testing is comprised of the following:

- (a) Confirm and update the provided single line diagram, as prescribed in E3.1.
- (b) Perform an inspection and test of the switchgear DC Battery Bank and Charger as prescribed in E3.5 and E3.6.
- (c) Perform a an inspection of the main service ground connection as prescribed in E3.14.
- (d) Perform an inspection and test of the Bank 1 primary cables between the Manitoba Hydro owned 7.5 MVA transformer and the 4160V switchgear as prescribed in E3.2.
- (e) Perform inspection and testing of the 4160V Bank 1 switchgear as prescribed in E3.4. The equipment associated with the Bank 1 switchgear inspection is defined in E2.12.
- (f) Perform an inspection and test of the Bank 2 primary cables between the Manitoba Hydro owned 7.5 MVA transformer and the 4160V switchgear as prescribed in E3.2.
- (g) Perform inspection and testing of the 4160V Bank 2 switchgear as prescribed in E3.4. The equipment associated with the Bank 1 switchgear inspection is defined in E2.13.
- (h) Perform a thermographic survey of the 4160V switchgear and the DC Battery Bank and Charger as prescribed in E3.15. The equipment associated with the thermographic survey is identified in E2.14.
- (i) Prepare and submit a report of all investigations and tests in conformance with E3.19.

E2.12 The 4160V Bank 1 switchgear inspection shall be comprised of the following equipment:

- (a) 52-L1 – Bank 1 Main Breaker
- (b) LBT1 – Grit Building Fused Disconnect Switch
- (c) 52-F1 – Dewatering Building Feeder Breaker
- (d) 52-F2 – Secondary Building Feeder Breaker
- (e) 52-F3 – Main Building Feeder Breaker
- (f) Protection, instrumentation, and controls associated with the above.

- E2.13 The 4160V Bank 2 switchgear inspection shall be comprised of the following equipment:
- (a) 52-T – Tie Breaker
 - (b) 52-L2 – Bank 2 Main Breaker
 - (c) 52-F4 – Main Building Feeder Breaker
 - (d) 52-F5 – Secondary Building Feeder Breaker
 - (e) 52-F6 – Dewatering Building Feeder Breaker
 - (f) LBT2 – Grit Building Fused Disconnect Switch
 - (g) Protection, instrumentation, and controls associated with the above.
 - (h) Note that 52-F7 and 52-TU1 are not within the scope of this inspection.
- E2.14 The thermographic survey shall include the following equipment:
- (a) BC Battery Bank & Charger
 - (b) 52-L1 – Bank 1 Main Breaker
 - (c) LBT1 – Grit Building Fused Disconnect Switch
 - (d) 52-F1 – Dewatering Building Feeder Breaker
 - (e) 52-F2 – Secondary Building Feeder Breaker
 - (f) 52-F3 – Main Building Feeder Breaker
 - (g) 52-T – Bank 1/2 Tie Breaker
 - (h) 52-L2 – Bank 2 Main Breaker
 - (i) 52-F4 – Main Building Feeder Breaker
 - (j) 52-F5 – Secondary Building Feeder Breaker
 - (k) 52-F6 – Dewatering Building Feeder Breaker
 - (l) LBT2 – Grit Building Fused Disconnect Switch
 - (m) 52-F7 – UV Building Feeder Breaker
 - (n) 52-TU1 – UV Building Tie Breaker
 - (o) 52-U1 – UV Building Feeder Breaker
- E2.15 Repair services shall be comprised of the following:
- (a) Attendance at a site planning meeting to develop shutdown planning, coordination, and scheduling.
 - (b) Repair of the deficiency.
 - (c) Reinspect the repaired equipment as prescribed in the applicable section of E3.
 - (d) Provide a supplemental report of the repair services performed, including inspection values and results obtained both prior to, and subsequent to the repair work.
- E2.16 Provide a quotation for repair services, as defined in E2.15, for each deficiency. Individual prices shall be provided for each deficiency, with separate labour prices and individual material costs.
- (a) The price for material shall be the Contractor base cost, as defined in B9.4, multiplied by the mark-up factor specified in Form B, Item 2.
 - (b) A price for labour shall be provided for each deficiency. Each price shall be a maximum number of hours multiplied by the labour rate specified in Form B, Item 4. Payment for labour shall be based upon the actual hours expended, up to the maximum hours specified in the quotation.
- E2.17 Provide repair services for each deficiency approved by the Contract Administrator, as quoted in E2.16.

E3. INSPECTION, MAINTENANCE, AND TESTING REQUIREMENTS

- E3.1 The existing single line diagram shall be confirmed for accuracy, and updated where changes are required. The updated single line diagram shall be included in the report.
- E3.2 All inspection values, readings, corrections, and assessments shall be clearly recorded for inclusion within the report specified in E3.20. Where corrections are made, such as tightening of a bolted connection, both before and after correction readings shall be recorded, along with the corrective action taken.
- E3.3 Inspection and testing of 4160V cables shall be comprised of the following:
- (a) Inspect exposed sections of cables for physical damage and evidence of overheating and corona.
 - (b) Inspect terminations and splices for physical damage and evidence of overheating and corona.
 - (c) Inspect bolted electrical connections for high resistance using a low resistance ohmmeter to measure resistance through bolted connections.
 - (d) Inspect compression applied connectors for correct cable match and indentation.
 - (e) Inspect shield grounding and cable support.
 - (f) Verify that visible cable bends meet or exceed the minimum allowable bending radius.
 - (g) If cables are terminated through window-type current transformers, inspect to verify that neutral and ground conductors are correctly placed and that shields are correctly terminated for operation of protective devices.
 - (h) Perform a shield-continuity test on each power cable by ohmmeter method. The shielding must exhibit continuity. Investigate resistance values in excess of 10 ohms per 1000 feet of cable.
 - (i) Perform an insulation-resistance test on each conductor utilizing a megohmmeter with a voltage output of at least 2500 volts. Individually test each conductor with all other conductors and shields grounded. The test duration shall be one minute. Investigate resistances less than 1000 megaohms.
 - (j) Perform a Very Low Frequency (VLF) AC high-potential test on all cables. Adhere to all precautions and limits as specified in the applicable NEMA / ICEA Standard for the specific cable. Perform tests in accordance with IEEE Standard 400.2. Test procedure shall be as follows, and the results for each cable test shall be recorded as specified herein. The test voltage shall be sinusoidal with a frequency of 0.1 Hz, and shall not exceed cable manufacturer's maintenance test value or 7 kV RMS phase-to-ground. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the overpotential test, the test specimen is considered to have passed the test.
 - (i) Ensure that the input voltage to the test set is regulated.
 - (ii) Current-sensing circuits in test equipment shall measure only the leakage current associated with the cable under test and shall not include internal leakage of the test equipment.
 - (iii) Record wet and dry-bulb temperatures or relative humidity and temperature.
 - (iv) Test each section of cable individually.
 - (v) Individually test each conductor with all other conductors grounded. Ground all shields.
 - (vi) Terminations shall be adequately corona-suppressed by guard ring, field reduction sphere, or other suitable methods as necessary.
 - (vii) Ensure that the maximum test voltage does not exceed the limits for terminators specified in IEEE Standard 48 or manufacturer's specifications.
 - (viii) Raise the conductor test voltage to the specified maximum test voltage and hold for five minutes. Record leakage current.
 - (ix) Apply grounds for a time period adequate to drain all insulation-stored charge.

- (k) Perform a Dissipation Factor (Tangent Delta) test on all cables.
 - (i) Perform tests in accordance with IEEE Standard 400.2.
 - (ii) The test voltage applied shall be a 0.1 Hz sinusoidal waveform.
 - (iii) The dissipation factor shall be calculated for an applied voltage of 2400V (u_0) RMS.
 - (iv) Provided that the dissipation factor does not rise significantly while raising the voltage, the dissipation factor shall also be calculated for an applied voltage of 4800V ($2u_0$) RMS.
- (l) In the event of a cable failure discovered during testing, assist as required in the repair or replacement of the cable. All services for cable repair or replacement are to be considered as Incremental Services.
- (m) Affix an inspection sticker or inspection tag in an appropriate place so that it will be conspicuous to all authorized personnel. This inspection notice must include, but is not limited to, testing company name, date of inspection and the inspector's name. The sticker shall not obscure any equipment nameplates, readouts, or indicators.

E3.4 The inspection of 4160V switchgear shall include the following:

- (a) Inspect the switchgear physical, electrical, and mechanical condition including evidence of moisture or corona.
- (b) Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.
- (c) Inspect all doors, panels, and sections for dents, holes, fit, and missing hardware.
- (d) Verify that fuse and / or circuit breaker sizes and types correspond to drawings and coordination study as well as to the circuit breaker's address for microprocessor-communication packages.
- (e) Verify that current and potential transformer ratios correspond to drawings.
- (f) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- (g) Confirm correct operation and sequencing of electrical and mechanical interlock systems.
 - (i) Attempt closure on locked-open devices. Attempt to open locked-closed devices.
 - (ii) Make key exchange with all devices included in the interlock scheme as applicable.
- (h) Clean switchgear.
- (i) Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
- (j) Inspect insulators for evidence of physical damage or contaminated surfaces.
- (k) Verify correct barrier and shutter installation and operation.
- (l) Exercise all active components.
- (m) Inspect all mechanical indicating devices for correct operation.
- (n) Verify that filters are in place and / or vents are clear.
- (o) Test operation, alignment, and penetration of instrument transformer withdrawal disconnects, current-carrying and grounding contacts.
- (p) Perform point to point ground-resistance tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and / or derived neutral points. Investigate point-to-point resistance values which exceed 0.5 ohm.
- (q) Perform insulation-resistance tests at 2500 volts dc for one minute on each bus section, phase-to-phase and phase-to-ground. Note any resistance values less than 1,000 megaohms.

- (r) Perform an phase-to-ground overpotential test on each bus section, in accordance with manufacture's published data. Each phase not under test shall be grounded. If manufacturer has no recommendation for this test, the test voltages applied for 5kV rated equipment shall be 11.2 kV AC or 16 kV DC. The test voltage shall be applied for one minute. Do not perform this test unless insulation resistance tests performed in (q) are higher than the specified minimum value.
 - (i) All bus sections from the termination of the primary cables to every feeder fused disconnect or feeder breaker shall be tested.
 - (ii) Ensure that primary cables are disconnected.
 - (iii) Ensure that feeder fused disconnects and feeder breakers are open.
- (s) Perform current injection tests on the entire current circuit in each section of switchgear.
 - (i) Perform current tests by primary injection, where possible, with magnitudes such that a minimum of 1.0 ampere flows in the secondary circuit.
 - (ii) Where primary injection is impractical, utilize secondary injection with a minimum current of 1.0 ampere.
 - (iii) Test current at each device.
- (t) Verify operation of any present switchgear heaters.
- (u) Inspect control power transformers as specified in E3.7.
- (v) Inspect all current instrument transformers as specified in E3.8 with the exception of Manitoba Hydro owned revenue metering transformers.
- (w) Inspect potential transformers as specified in E3.9 with the exception of Manitoba Hydro owned revenue metering transformers.
- (x) Inspect all metering devices as specified in E3.10.
- (y) Inspect fused disconnect switches as specified in E3.11.
- (z) Inspect and test medium voltage air circuit breakers as specified in E3.12.
- (aa) Inspect and test protective relays as specified in E3.13.
- (bb) Perform a system function test to prove the correct interaction of all sensing, processing, and action devices. Perform system function tests upon completion of the maintenance tests defined, as system conditions allow.
 - (i) Develop test parameters and perform tests for the purpose of evaluating performance of all integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
 - (ii) Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.
 - (iii) Verify the correct operation of all sensing devices, alarms, and indicating devices.
 - (iv) With the assistance of City personnel, verify operation of the DCS status and alarm points for the 4160V switchgear. The DCS tags to be verified are:
 - ◆ GAG542QF – Bank 1 Alarm
 - ◆ GAG543QF – Bank 2 Alarm
 - ◆ DDG901JT – Bank 1 Real Power
 - ◆ DDG902XT – Bank 1 Reactive Power
 - ◆ DDG903JT – Bank 2 Real Power
 - ◆ DDG904XT – Bank 2 Reactive Power
- (cc) Affix an inspection sticker or inspection tag to each switchgear cell in an appropriate place so that it will be conspicuous to all authorized personnel. This inspection notice must include, but is not limited to, testing company name, date of inspection and the inspector's name. The sticker shall not obscure any equipment nameplates, readouts, or indicators.

E3.5 Inspection of Valve-Regulated Lead Acid DC Battery Banks shall include the following:

- (a) Verify the battery ventilation system is operable.

- (b) Inspect physical and mechanical condition.
- (c) Inspect battery support racks or cabinets, mounting, anchorage, clearances, alignment, and grounding.
- (d) Neutralize acid on exterior surfaces and rinse with water.
- (e) Clean corroded/oxidized terminals and apply an oxide inhibitor.
- (f) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- (g) Measure negative post temperature. Negative post temperature should be within manufacturer's published data or IEEE 1188.
- (h) Measure charger float and equalizing voltage levels. Charger float and equalize voltage levels should be in accordance with the battery manufacturer's published data.
- (i) Measure each monoblock/cell voltage and total battery voltage with charger energized and in float mode of operation. Monoblock/cell voltages should be in accordance with manufacturer's published data. Monoblock/cell internal ohmic values (resistance, impedance, or conductance) should not vary by more than 25 percent between identical monoblocks/cells that are in a fully charged state.
- (j) Measure inter-cell connection resistances.
- (k) Perform internal ohmic measurement tests.
- (l) Perform a load test in accordance with manufacturer's specifications or IEEE 1188, Recommended Practice for Maintenance, Testing and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications. Results of load tests should be in accordance with manufacturer's published data or IEEE 1188.
- (m) Affix an inspection sticker or inspection tag in an appropriate place so that it will be conspicuous to all authorized personnel. This inspection notice must include, but is not limited to, testing company name, date of inspection and the inspector's name. The sticker shall not obscure any equipment nameplates, readouts, or indicators.

E3.6 Inspection of DC Battery Bank Chargers shall include the following:

- (a) Inspect for physical and mechanical condition.
- (b) Inspect anchorage, alignment, and grounding.
- (c) Clean the unit.
- (d) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- (e) Inspect filter and tank capacitors.
- (f) Verify operation of cooling fans. Clean filters if provided.
- (g) Verify float voltage, equalize voltage, and high-voltage shutdown settings. Float and equalize voltage settings should be in accordance with the battery manufacturer's published data.
- (h) Verify current limit. Current limit should be within manufacturer's recommended maximum.
- (i) Verify correct load sharing (parallel chargers). Results of load sharing between parallel chargers should be in accordance with system design specifications.
- (j) Verify calibration of meters in accordance with E3.10.
- (k) Verify operation of all alarms. With the assistance of City personnel, verify operation of the DCS alarm for the DC Power Supply. The DCS tag for the associated alarm is GAG544EL.

- (l) Measure and record input and output voltage and current.
- (m) Measure and record ac ripple current and/or voltage imposed on battery. AC ripple current and/or voltage imposed on the battery should be in accordance with manufacturer's published data.
- (n) Perform full load testing of charger. Charger should be capable of manufacturer's specified full load.
- (o) Affix an inspection sticker or inspection tag in an appropriate place so that it will be conspicuous to all authorized personnel. This inspection notice must include, but is not limited to, testing company name, date of inspection and the inspector's name. The sticker shall not obscure any equipment nameplates, readouts, or indicators.

E3.7 Inspection of control power transformers shall include the following:

- (a) Record the equipment nameplate data for inclusion in the report.
- (b) Inspect physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
- (c) Verify that primary and secondary fuse ratings or circuit breakers match available drawings. Where drawings are not available, note fuses that appear to be sized incorrectly, based upon application of the Canadian Electrical Code.
- (d) Verify correct functioning of drawout disconnecting and grounding contacts and interlocks.
- (e) Verify correct primary and secondary fuse sizes for control power transformers
- (f) Perform insulation-resistance tests. Perform measurements from winding-to-winding and each winding-to-ground. Test voltages shall be a minimum of 2500 volts dc unless otherwise specified by manufacturer. Investigate resistance test values less than 1000 megohms.
- (g) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm correct potential at all devices.

E3.8 Inspection of current instrument transformers shall include the following:

- (a) Inspect physical and mechanical condition
- (b) Record the equipment nameplate data for inclusion in the report.
- (c) Verify that current circuits are grounded and have only one grounding point in accordance with ANSI/IEEE C57.13.3.
- (d) Perform an insulation resistance test of the current transformer and wiring to ground at 1000 volts dc. Do not perform this test on solid-state devices. Investigate any resistance values less than 25 megaohms.
- (e) Perform a polarity test of each current transformer in accordance with ANSI/IEEE C57.13.1.
- (f) Perform a ratio-verification test using the voltage or current method in accordance with ANSI/IEEE C57.13.1. Note any ratio accuracies not within 0.5% of nameplate or manufacturer's published data.
- (g) Perform an excitation test on transformers used for relaying applications in accordance with ANSI C57.13.1.
- (h) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

E3.9 Inspection of potential transformers shall include the following:

- (a) Record the equipment nameplate data for inclusion in the report.
- (b) Inspect physical and mechanical condition

- (c) Verify that all required grounding and shorting connections provide contact
- (d) Verify correct operation of transformer withdrawal mechanism and grounding operation.
- (e) Verify correct primary and secondary fuse sizes for potential transformers
- (f) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- (g) Perform an insulation resistance test for winding to winding and winding to ground. For 4160V windings, test voltages of at least 2500 volts dc shall be applied for one minute. Do not perform this test with solid-state devices connected. Investigate any resistance values less than 5000 megaohms for 5kV rated windings.
- (h) Perform a polarity test on each transformer to verify the polarity marks or H1-X1 relationship as applicable.
- (i) Perform a turns ratio verification test. Note any ratio accuracies not within 0.5% of the nameplate or manufacturer's published data.

E3.10 Inspection of metering devices shall include the following:

- (a) Inspect physical and mechanical condition.
- (b) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- (c) Inspect cover gasket, cover glass, condition of spiral spring, disk clearance, contacts, and case-shorting contacts, as applicable.
- (d) Clean the unit.
- (e) Verify freedom of movement, end play, and alignment of rotating disk(s).
- (f) Verify accuracy of meters at all cardinal points.
- (g) Calibrate meters in accordance with manufacturer's published data.

E3.11 Inspection of fused disconnect switches shall include the following:

- (a) Note the equipment nameplate data for inclusion in the report.
- (b) Inspect physical and mechanical condition.
- (c) Inspect anchorage, alignment, grounding, and required clearances.
- (d) Clean the unit.
- (e) Verify correct blade alignments, blade penetration, travel stops and mechanical operation.
- (f) Verify that fuse sizes and types are in accordance with available drawings and short circuit and coordination studies. Note fuse size and type for inclusion in the report.
- (g) Verify that expulsion-limiting devices are in place on all fuses having expulsion-type elements.
- (h) Verify that each fuse holder has adequate mechanical support and contact integrity.
- (i) Verify that phase-barrier mounting is intact.
- (j) Verify correct operation of all indicating and control devices.
- (k) Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
- (l) Measure contact resistance across each switchblade assembly and fuseholder.
- (m) Measure the resistance of all fuses. Investigate fuse resistance values that deviate from each other by more than 15 percent.

- (n) 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. The test voltage shall be in accordance with manufacturer's published data or 2500 volts dc. Investigate resistance values less than 1000 megaohms.

E3.12 Inspection, testing, and maintenance of medium voltage air circuit breakers shall include the following:

- (a) Note the equipment nameplate data for inclusion in the report.
- (b) Inspect physical and mechanical condition.
- (c) Inspect anchorage, alignment, and grounding. Inspect arc chutes. Inspect moving and stationary contacts for condition, wear, and alignment.
- (d) Verify that all maintenance devices are available for servicing and operating the breaker.
- (e) Inspect moving and stationary contacts for condition, wear, and alignment.
- (f) If recommended by manufacturer, slow close/open breaker and check for binding, friction, contact alignment, contact sequence, and penetration.
- (g) Perform all mechanical operation tests on the operating mechanism in accordance with manufacturer's published data.
- (h) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- (i) Check cell fit and element alignment.
- (j) Check racking mechanism.
- (k) Inspect puffer operation.
- (l) Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
- (m) Perform time-travel analysis.
- (n) Record as-found and as-left operation-counter readings.
- (o) Measure insulation resistance pole-to-pole, pole-to-ground and across open poles. Use a minimum test voltage of 2500 volts dc. Investigate insulation resistances below 1000 megaohms.
- (p) Perform insulation-resistance tests on all control wiring with respect to ground. The applied potential shall be 500 volts dc for 300-volt rated cable and 1000 volts dc for 600-volt rated cable. Test duration shall be one minute. For units with solid-state components or control devices that cannot tolerate the applied voltage, follow manufacturer's recommendation. Investigate resistances less than 25 megaohms for 300-volt cable and 100 megaohms for 600-volt cable.
- (q) Perform a contact/pole-resistance test. 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 values that deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.
- (r) With breaker in the test position, make the following tests:
 - (i) Trip and close breaker with the control switch.
 - (ii) Trip breaker by operating each of its protective relays.
 - (iii) Verify mechanism charge, trip-free, and antipump functions.
- (s) Perform an overpotential test on each phase with the circuit breaker closed and the poles not under test grounded. Test voltage should be in accordance with manufacturer's published data. In the absence of manufacturer's published data, the maximum voltage shall not be greater than 11.4 kV ac or 16.1 kV dc.
- (t) Verify blowout coil circuit continuity.

- E3.13 Inspection of protective relays shall include the following:
- (a) Inspect relays and cases for physical damage.
 - (b) Clean the unit.
 - (c) Perform the following to the relay case:
 - (i) Tighten case connections.
 - (ii) Inspect cover for correct gasket seal.
 - (iii) Clean cover glass. Inspect shorting hardware, connection paddles, and/or knife switches.
 - (iv) Remove any foreign material from the case.
 - (v) Verify target reset.
 - (d) Perform the following inspection of the relay mechanism:
 - (i) Inspect relay for foreign material, particularly in disk slots of the damping and electromagnets.
 - (ii) Verify disk clearance. Verify contact clearance and spring bias.
 - (iii) 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.
 - (e) Verify that all settings are in accordance with coordination study or setting sheet supplied. Note the value and compliance of each setting for inclusion in the report. Where no setting is provided, note the current protective relay setting value, and identify this setting in the report.
 - (f) Perform insulation-resistance test on each circuit-to-frame. Procedures for performing insulation-resistance tests on solid-state relays should be determined from the relay manufacturer's published data.
 - (g) Inspect targets and indicators.
 - (i) Determine pickup and dropout of electromechanical targets.
 - (ii) Verify operation of all light-emitting diode indicators.
 - (iii) Set contrast for liquid-crystal display readouts.
 - (h) 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.
 - (i) For Undervoltage Relays (27):
 - (i) Determine dropout voltage.
 - (ii) Determine time delay.
 - (iii) Determine the time delay at a second point on the timing curve for inverse time relays.
 - (j) For Instantaneous Overcurrent relay (50):
 - (i) Determine pickup.
 - (ii) Determine dropout.
 - (iii) Determine time delay.
 - (k) For Time Overcurrent Relay (51):
 - (i) Determine minimum pickup
 - (ii) Determine time delays at two points on the time current curve.
- E3.14 Inspection of grounding systems shall include the following:
- (a) Verify the ground system is in compliance with the Canadian Electrical Code.
 - (b) Inspect physical and mechanical condition. Identify any visible corrosion.
 - (c) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.

- (d) Inspect anchorage.
- (e) Perform fall-of-potential or alternative test in accordance with IEEE Standard 81 on the main grounding electrode or system. Investigate a calculated resistance larger than 5 ohms.
- (f) Affix an inspection sticker or inspection tag in an appropriate place so that it will be conspicuous to all authorized personnel. This inspection notice must include, but is not limited to, testing company name, date of inspection and the inspector's name. The sticker shall not obscure any equipment nameplates, readouts, or indicators.

E3.15 Thermographic inspections shall include the following:

- (a) Remove all necessary covers prior to thermographic inspection.
- (b) Equipment to be inspected shall include all current-carrying devices.
- (c) Test Parameters
 - (i) Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 °C at 30 °C.
 - (ii) Equipment shall detect emitted radiation and convert detected radiation to a visual signal.
 - (iii) Thermographic surveys should be performed during periods of maximum possible loading but not less than 40% of rated load of the electrical equipment being inspected. Coordinate with City as required.
 - (iv) Note all temperature differences larger than 1°C. Investigate all temperature differences larger than 4 °C. Loose connections identified are to be tightened immediately.
- (d) Provide a report which shall include the following:
 - (i) Description of the equipment tested.
 - (ii) Discrepancies.
 - (iii) Temperature difference between the area of concern and the reference area.
 - (iv) Probable cause of temperature difference.
 - (v) Identify any repairs made during the thermographic inspection. If no repairs were made, provide recommended action for repair.
 - (vi) Areas inspected. Identify inaccessible and / or unobservable areas and / or equipment.
 - (vii) Identify load conditions at time of inspection.
 - (viii) Provide photographs and / or thermograms of all areas investigated, with deficient areas identified.

E3.16 All parties involved must be cognizant of industry-standard safety procedures. It is recognized that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required to be ungrounded or energized for certain tests.

E3.17 Suitability of Test Equipment

- (a) All test equipment shall meet the requirements in E3.18 and be in good mechanical and electrical condition.
- (b) Field test metering used to check power system meter calibration must be more accurate than the instrument being tested.
- (c) Accuracy of metering in test equipment shall be appropriate for the test being performed.
- (d) Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and the tested equipment.

E3.18 Test Instrument Calibration

- (a) The testing organization shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
- (b) The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
- (c) Instruments shall be calibrated in accordance with the following frequency schedule:
- (d) Field instruments: Analog, 6 months maximum. Digital, 12 months maximum.
- (e) Laboratory instruments: 12 months maximum.
- (f) Leased specialty equipment: 12 months maximum.
- (g) Dated calibration labels shall be visible on all test equipment.
- (h) Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.
- (i) Calibrating standard shall be of higher accuracy than that of the instrument tested.

E3.19 Prepare a report of all investigations and tests in conformance with E3.20.

- (a) The Contractor shall furnish five paper copies and two electronic copies on CD of the test report, as specified in E3.19. The electronic copies of the test report shall be provided in PDF format.
- (b) The report shall be neat and organized. Any omissions, inconsistencies, or incomplete work identified by the Contract Administrator shall be corrected and incorporated into the report in the appropriate section, and completely resubmitted as defined in (a)

E3.20 The test report shall include the following:

- (a) Summary of project.
- (b) Testing Equipment
 - (i) Detail the type, manufacturer, model, and last calibration date of all testing equipment.
- (c) Description of equipment tested.
- (d) Description of all tests.
- (e) Test data.
 - (i) Identification of the testing organization.
 - (ii) Equipment identification.
 - (iii) Humidity, temperature, and other conditions that may affect the results of the tests/calibrations.
 - (iv) Date of inspections, tests, maintenance, and/or calibrations.
 - (v) Identification of the testing technician.
 - (vi) Indication of inspections, tests, maintenance, and/or calibrations performed and recorded, along with charts, and graphs as applicable. All measurements and readings taken shall be noted for inclusion in the report. Where repairs are made, measurements and readings before and after the repair shall be included.
 - (vii) Indication of expected results, when calibrations are to be performed.
 - (viii) Indication of "as-found" and "as-left" results, as applicable.
- (f) Itemized list of all repaired deficiencies which shall include:
 - (i) Detailed description of the deficiency
 - (ii) The cost associated with the deficiency repair.
- (g) Itemized list of all unrepaired deficiencies encountered which shall include:
 - (i) Detailed description of the deficiency
 - (ii) Priority level

- (iii) A cost estimate to repair the deficiency including the estimated hours to repair, labour cost, and material costs.
- (h) Analysis and recommendations.