

Part 1 General

1.1 MINIMUM STANDARDS

- .1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada (NBC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.

1.2 TAXES

- .1 Pay all taxes properly levied by law including Federal, Provincial and Municipal.

1.3 FEES, PERMITS, AND CERTIFICATES

- .1 Pay all fees and obtain all permits. Provide authorities with plans and information for of acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.4 FIRE SAFETY REQUIREMENTS

- .1 Comply with the National Building Code of Canada (NBC) for fire safety in construction and the National Fire Code of Canada (NFC) for fire prevention, fire fighting and life safety in building in use.
- .2 Comply with Human Resources Development Canada (HRDC), Fire Commissioner of Canada (FCC) standards:
 - .1 No. 301: Standard for Construction Operations
 - .2 No. 302: Standard for Welding and Cutting
 - .3 No. 374: Fire Protection Standard for General Storage (Indoor and Outdoor)
 - .4 available from Fire Protection Engineering Services, Labour Program, HRSDC or following internet site: [http://info.load-otea.hrsdc-drhcc.gc.ca/ fire prevention/standards/commissioner.shtml](http://info.load-otea.hrsdc-drhcc.gc.ca/fire/prevention/standards/commissioner.shtml)
 - .5 Retain all fire safety documents and standards on site.

1.5 FIELD QUALITY CONTROL

- .1 Carry out Work using qualified licenced workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.
- .2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licenced workers
- .3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.6 HAZARDOUS MATERIALS

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials;

and regarding labelling and the provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.

- .2 For work in occupied buildings give 48 hours notice for work involving designated substances (Ontario Bill 208), hazardous substances (Canada Labour Code Part II Section 10), and before painting, caulking, installing carpet or using adhesives.

1.7 TEMPORARY UTILITIES

- .1 Existing services required for the work, excluding power required for space heating, may be used by the Contractor without charge. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility.
- .2 Notify the Departmental Representative and utility companies of intended interruption of services, obtain requisite permission.
- .3 Give the Departmental Representative 48 hours notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Keep duration of these interruptions to a minimum. Carry out all interruptions after normal working hours of the occupants, preferably on weekends.

1.8 REMOVED MATERIALS

- .1 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from site.

1.9 PROTECTION

- .1 Protect finished work against damage until take-over.
- .2 Protect adjacent work against the spread of dust and dirt beyond the work areas.
- .3 Protect operatives and other users of site from all hazards.

1.10 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to the normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated. Refer to article 24 Scheduling below for work that must be done during "off hours".
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Where elevators, dumbwaiters, conveyors or escalators exist Contractor may use these at Departmental Representative's discretion. Protect from damage, safety hazards and overloading of existing equipment.
- .5 Sanitary facilities will be assigned for Contractor's personnel. Others shall not be used. Keep facilities clean.
- .6 Closures: Protect work temporarily until permanent enclosures completed.

1.11 SITE STORAGE

- .1 Do not unreasonably encumber site with materials or equipment.

- .2 Move stored products or equipment which interfere with operations of Facility or other contractors.
- .3 Obtain and pay for use of additional storage or work areas needed for operations.

1.12 CUT, PATCH AND MAKE GOOD

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove all items so shown or specified.
- .3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.
- .4 Install firestops and smoke seals in accordance with ULC-S115, around pipe, ductwork, cables, and other objects penetrating fire separations to provide fire resistance not less than the fire resistance rating of surrounding floor, ceiling, and wall assembly.

1.13 SLEEVES, HANGERS AND INSERTS

- .1 Co-ordinate setting and packing of sleeves and supply and installation of hangers and inserts. Obtain Departmental Representative's approval before cutting into structure.

1.14 EXAMINATION

- .1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.

1.15 SIGNS

- .1 Provide common-use signs related to traffic control, information, instruction, use of equipment, public safety devices, etcetera, in both official languages or by the use of commonly-understood graphic symbols to the Departmental Representative's approval.
- .2 No advertising will be permitted on this project.

1.16 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.17 PUBLIC WAY PROTECTION

- .1 Design, erect and maintain hoarding and covered pedestrian walkways to support all loads including windloads and provide protection, complete with signs and electrical lighting as required by authority having jurisdiction.
- .2 Provide one lockable truck entrance gate and one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys. Paint public side of site enclosure in colour selected by Departmental Representative.

1.18 WASTE MANAGEMENT

- .1 Comply with the Environmental Protection Act, Ontario Regulations O.Reg. 102/94 and O. Reg. 103/94 for waste management program on construction and demolition projects.
- .2 Conduct "waste audit" to determine waste generated during demolition or construction operations, prepare written "waste reduction work plan" and implement procedures to reduce, reuse and recycle materials to the extent possible.
- .3 Provide a "source separation program" to disassemble and collect in an orderly fashion the following "materials designated for alternative disposal" from the "general waste" stream.
 - .1 brick and Portland cement concrete
 - .2 cardboard (corrugated)
 - .3 gypsum board (unfinished)
 - .4 steel
 - .5 wood (not including treated or laminated wood)
- .4 Submit complete records of all removals from site for both "materials designated for alternative disposal" and "general waste" including:
 - .1 Time and date of removal
 - .2 Description of material and quantities
 - .3 Proof that materials have been received at an Approved Waste Processing
 - .4 Site or certified Waste Disposal Site as required

1.19 GUARANTEES AND WARRANTIES

- .1 Before completion of work collect all manufacturer's guarantees and warranties and deposit with Departmental Representative.

1.20 SECURITY CHECK

- .1 Personnel will be checked daily at start of work shift and given a pass which must be worn at all times. Pass must be returned at the end of the work shift and personnel checked out.
- .2 All personnel must attend a mandatory 2 hour site specific safety training session. Provide minimum 72 hour notice to Departmental Representative requesting site training.

1.21 BUILDING SMOKING ENVIRONMENT

- .1 Smoking is not permitted in the Building. Obey smoking restrictions on building property.

1.22 DUST CONTROL

- .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and public.
- .2 Maintain and relocate protection until such work is complete.

- .3 Protect all furnishings within work area with 0.102 mm thick polyethylene film during construction. Remove film during non- construction hours and leave premises in clean, unencumbered and safe manner for normal daytime function.

1.23 SCHEDULING

- .1 On award of contract submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When schedule has been reviewed by the Departmental Representative, take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.
- .2 Carry out work during regular hour Monday to Friday from 07:30AM to 16:00PM hours and on Saturdays, Sundays and statutory holidays.
- .3 Carry out work in occupied areas during "off hours" Monday to Friday from 16:00PM to 07:30AM hours and on Saturdays, Sundays, and statutory holidays.
- .4 Give the Departmental Representative 48 hours notice for work to be carried out during "off hours".
- .5 All personnel employed on this project shall be escorted when executing work in non-public areas during normal working hours. Personnel shall be escorted in all areas after normal working hours.

1.24 COST BREAKDOWN

- .1 Before submitting first progress claim submit breakdown of Contract Amount in detail as directed by Departmental Representative and aggregating the Contract Amount. After approval by Departmental Representative cost breakdown will be used as the basis of progress payments.

1.25 PRECEDENCE

- .1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises renovation of electrical services, located at CFIA Fallowfield Rd.; and further identified as Building 201.

1.2 CONTRACT METHOD

- .1 Construct Work under stipulated price contract.

1.3 WORK BY OTHERS

- .1 Construct Work in stages to accommodate Departmental Representative's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Departmental Representative Occupancy during construction.
- .3 Construct Work in stages to provide for continuous occupancy with a minimum of shutdowns and as short of shutdowns as possible. Do not close off usage of facilities until use of one stage of Work will provide alternate usage.
- .4 Required stages: Two Phases:
 - .1 Phase-1 - Generator Control Upgrades - Building 201:
 - .1 The intent of this project in phase 1 is to replace the obsolete PLC controls for the main-tie-main breakers in the main emergency switchgear and also the existing outdated generator controls. All disruptive work shall be conducted during off-hours and temporary generators shall be provided to support the Facility's emergency back-up power requirements. Work shall proceed roughly in phases as follows:
 - .1 Install temporary distribution equipment for connection of temporary emergency back-up diesel engines.
 - .2 Provide emergency back-up diesel engines. Disconnect emergency switchboard and make temporary connections.
 - .3 Remove obsolete generator controls and obsolete PLC controls for breakers.
 - .4 Provide installation of new generator controls and main-tie-main breaker controls.
 - .5 Provide maintenance and cleaning of existing switchgear.
 - .6 Provide testing of new systems.
 - .7 Disconnect temporary facilities and connect new to system.
 - .8 Provide final commissioning and training.
 - .9 Remove all extraneous materials and forces from site.
 - .2 Phase 2 – Electrical Equipment Replacement - Building 201:
 - .1 The intent of the summary of work is to describe the scope of work to be completed by various parties and the delineation line between scopes of

responsibility. It is not the intent to be a complete list of the total requirements of the project. It is the contractor's responsibility to review all contract drawings and documents and have a complete understanding of the project scope.

- .1 Supply and install 13.8kV primary switchgear, 600A complete with load break switch, circuit breaker, protection and metering,
 - .2 Supply and install of two unit substations with 2000KVA, dry type 13.8kV/600V transformer complete with draw out type circuit breakers and normal and emergency CDPs
 - .3 Supply and install two 250KVAR power factor correction units complete with sensing CT's
 - .4 Supply and install transfer switch 225A, 600V open transition
 - .5 New HV & LV feeders where shown in drawings
 - .6 Reconnect and swing over existing feeders where shown in drawings
 - .7 Supply and install 600V cabling from CDP N2B of Swbd 2B to Panel CA (PDU).
 - .8 Supply and install control wiring from Swbd 1A to PFC-1A and Swbd 2B to PFC-2B.
 - .9 Supply and replace in each PDU (13 Nos - Four PDUs are in electrical room and nine PDUs are in storage room) open dry type transformer in existing large FPE enclosure and replacement of new CDP 208/120V in existing large FPE enclosure of each PDU. Please note that one PDU (PEA 9) has a 600V as well as 208/120V.
 - .10 Removal of old electrical equipment under this project from Building 201 electrical room and dispose .
 - .11 Shipping, receiving, loading and unloading, routing to electrical room and necessary tools required for electrical equipment installation under this project. Please note that crane/boom truck is required to lower down electrical equipment in sump pit area. Verify dimension of existing height and width restriction on routing path for equipment delivery prior to bring equipment at site.
 - .12 Supply and install new or extend existing cable trays, conduits as required.
 - .13 Grounding and bonding of new and interties to existing electrical equipment grounding system.
 - .14 System coordination, verification and testing by engaging independent test organization per specification.
- .2 The intent of this project in phase 2 in regard to the main high voltage and low voltage equipment is to utilize redundant equipment and feeders wherever possible and energize new equipment while maintaining supply to the existing equipment. The existing non-redundant loads and feeders will then be sequentially swung over to the new equipment to minimize

length of shutdowns. The major electrical equipment replacement work sequence are as under. It is the contractor's responsibility to review all sequence prior to executing at site in coordination with contract drawings and documents, to have a complete understanding.

- .1 Install new 13.2kV primary switchgear.
- .2 Install new SWBD-1A (Note: floor space to be verified with shop drawings as 52-02 cell space may be required (see step 3)). If floor space is sufficient to install new SWBD 1A then follow step 4 onwards.
- .3 Open 52-02 and disconnect SWBD 1A transformer if floor space of 52-02 is required (verify). A complete building shutdown will be required if cell 52-02 is required to be removed. Completely remove all 52-02 related connections of line side to the bus and all LB-8 switch load side connection to bus and then remove complete 52-02 cell.
- .4 Close existing tie breaker (Tie-2B) of SWBD-2B to feed existing SWBD 1A. Ensure and monitor existing tie breaker (Tie--2B) breaker is not overloaded. Open existing SWBD 1A 600V main breaker.
- .5 Feed building 201 SWBD 2B and 1A from 13.8kV, LB-7 switch and 52-01 circuit breaker, T2 2MVA 13.8kV/600V transformer and Tie-2B feeder.
- .6 Open 13.8kV LBS#6 switch in main substation & move existing LB-8 line side HV feeder to new LB-8.
- .7 Install new HV feeder from new 52-02 to new T1 2MVA transformer.
- .8 Energize new 13.8kV LBS#6 switch in main substation, new 13.8kV LB-8 & 52-02, new T1 transformer 2MVA and 600V main breaker of new SWBD-1A. SWBD 1A bus is energized.
- .9 On agreed shutdown(s) schedule with Departmental Representative, sequentially swing over all normal feeders. Assume maximum of 8 to 12 hour shutdown after hours. After hours are defined as Monday to Thursday evenings from 6PM to 6AM and weekends starting Friday at 6.00PM to Monday morning at 6.00AM. Contractor should swing over multiple feeders per shutdown to meet overall schedule.
- .10 Close ATS#1-Bypass breaker in new SWBD 1A to supply 'normal' power to emergency section. Follow Kirk key operation of breakers as per shop drawings.
- .11 On agreed shutdown(s) schedule with Departmental Representative, sequentially swing over all emergency feeders including ATS#1 emergency feeders. Assume maximum of 8 to 12 hour shutdown after hours. After hours are defined as Monday to Thursday evenings from 6PM to 6AM and weekends starting Friday at 6.00PM to Monday morning at 6.00AM. Contractor should swing over multiple feeders per shutdown to

- meet overall schedule. (Note: during this period, the relocated feeders only have a 'normal' supply. Assume sequential nights to swing over all feeders until completion.)
- .12 Swing over ATS-1 normal supply and load cables from existing SWBD 1A to the new SWBD 1A. Must be completed in a single shutdown on a sequential night to above scope.
 - .13 Open ATS#1-Bypass breaker and Close ATS#1-N breaker in new SWBD 1A to supply 'normal' power to emergency section and also close ATS#1-E breaker to supply generator power in case of utility failure to emergency section of SWBD 1A. Follow Kirk key operation of breakers as per shop drawings. Minor power interruption during Kirk key operation.
 - .14 Install new ATS-4 and new power cables from SWBD-1A to ATS-4 on normal side. Reroute existing MCC-EH power cables inside conduit to new ATS-4 load side.
 - .15 Once entire existing SWBD-1A feeders are transferred to new SWBD 1A, open existing SWBD 2B tie breaker (Tie-2B). Disconnect existing power cables between old SWBD 1A and old SWBD 2A. Shutdown may require at existing Tie-2B to get access to disconnect load side power cables.
 - .16 Remove old SWBD 1A.
 - .17 Install new SWBD 2B.
 - .18 Open new SWBD 2B 600V main breaker, install new power cables between new SWBD 1A Tie-1A to new SWBD 2B Tie-2B (shutdown required for access to connect power cables at SWBD 1A).
 - .19 Sequentially energize new SWBD 2B from new SWBD 1A by closing new tie breaker Tie-1A & Tie-2B.
 - .20 Similar to items 10 through 14 perform scope for SWBD 2B (i.e. substitute '2B' for '1A' and ATS#1 for ATS#2 in articles 9 through 13).
 - .21 Install new power cables from SWBD-2B to ATS-4 on emergency side.
 - .22 Where new feeders and equipment are shown (i.e. ATS-4, PFC-1A, PFC-2B, F-5 cable etc.)b the work should be completed before affiliated SWBD energization.
 - .23 Open 13.8kV LBS#3 switch in main substation & move existing LB-7 line side HV feeder to new LB-7.
 - .24 Install new HV feeder from new 52-01 to new T2 2MVA transformer.
 - .25 Open new SWBD 2B breaker Tie-2B and SWBD-1A breaker Tie-1A.
 - .26 Energize new 13.8kV LBS#3 switch in main substation, new 13.8kV LB-7 & 52-01, new T2 transformer 2MVA and 600V main breaker of new SWBD -2B. SWBD 2B bus is energized.

- .27 Both new 13.8kV switch and breaker and SWBD 1A & SWBD-2B are in service with respective SWBD tie breakers open.
- .28 Remove existing old 13.8kV SWBD with LB-7, LB-8, 52-01, 52-02 and SWBD-2B.
- .29 The intent of the project with respect to the Power Distribution Units (PDU) is to utilize the existing transformer and distribution section(s) enclosures and replace the 'open' transformer and panel interior(s) respectively. Each PDU require a separate shutdown. The changeover of the transformer and distribution section of PDU must be accomplished in a single approximately 8 hour shutdown. For PDUs replacement, assume multiple screws per shutdown each working on a separate PDU.
- .30 There are 13 PDUs in total. Nine PDUs are in storage room and four PDUs are in electrical room. Preliminary plan to take shutdown after hours as per below. Assume maximum of 8 to 12 hour shutdown after hours. After hours are defined as Monday to Thursday evenings from 6PM to 6AM and weekends starting Friday at 6.00PM to Monday morning at 6.00AM. Contractor to determine labour requirement for each PDU to meet schedule.
- .31 For Storage Room 9 PDUs upgrade preliminary shutdown plan are as under For Simultaneous PDU upgrade, Contractor has to plan and set up multiple groups of technicians to minimize number of shutdown:
 - .1 Simultaneous Panel AD & Panel AH.
 - .2 Simultaneous Panel AB & Panel AG
 - .3 Simultaneous Panel AA & Panel AC
 - .4 Simultaneous Panel AG & Panel AE
 - .5 Panel PEA 9
- .32 For Electrical Room 4 PDUs preliminary shutdown plan are as under:
 - .1 Simultaneous Panel EB & Panel BA
 - .2 Simultaneous Panel CA & Panel BB
- .33 Contractor is responsible for System Coordination-Short Circuit Device Evaluation Study-Arc Flash Hazard Analysis as per Section 26 05 01.
- .34 Contractor is responsible for testing, commissioning, demonstration and training as per applicable specifications.
- .35 Many functions are critical to operations and a full 8 to 12 hour outage cannot be tolerated. Hence Departmental Representative will arrange temporary feeders and extension cords as required prior to EVERY shutdown and removed after shutdown. Contractor to work in coordinate with Departmental Representative for each shutdown and provide detail schedule of activities for Departmental Representative to review in advance of minimum two weeks prior to each shutdown.

1.4 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for work, storage and access to allow:
 - .1 Departmental Representative occupancy.
- .2 Co-ordinate use of premises under direction of Departmental Representative regarding washroom and lunchroom facilities.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.5 DEPARTMENTAL REPRESENTATIVE OCCUPANCY

- .1 Departmental Representative will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Departmental Representative in scheduling operations to minimize conflict and to facilitate Departmental Representative usage.

1.6 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations, occupants and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Use only elevators existing in building for moving workers and material.
 - .1 Protect walls of passenger elevators, to approval of Departmental Representative prior to use.
 - .2 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.7 EXISTING SERVICES

- .1 Notify, Departmental Representative of intended interruption of services and obtain required permission. Where Work involves breaking into or connecting to existing services, give
- .2 Provide 7 days notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by Departmental Representative with minimum disturbance to operations.
- .3 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

- .4 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .5 Provide temporary services when directed by Departmental Representative to maintain critical building and systems.
- .6 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed and abandoned service lines.

1.8 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

PART 1 – GENERAL

1.1 REGULATORY REQUIREMENTS

1.1.2 An investigation into the presence of designated substances for the **Electrical Replacement Project** at Building 201 as well as the basement of the Heating Plant at the Canadian Food Inspection Agency Campus located at 3851 Fallowfield Road in Ottawa, ON, was performed in order to meet the requirements of Section 30 of the *Ontario Occupational Health and Safety Act, Revised Statutes of Ontario, 1990, Chapter O.1*. The *Canada Labour Code* also stipulates under Part II, Section 124 that every employer shall ensure that the health and safety at work of every person employed by the employer is protected. By having a Designated Substances Report (DSR) completed, the Departmental Representative will be able to inform his or her employees, contractors, and tenants of any designated substances that may be present and possibly disturbed throughout the duration of the project. The informed Departmental Representative will then be able to impose appropriate health and safety precautions for all applicable personnel as required. The *Guide to Green Government* sets out the policy requirements for federal government to meet or exceed federal environmental statutes and regulations, and the emulation of best practices from the public and private sector. Within the *Guide to Green Government*, pollutant prevention efforts are required in federal projects. Pollution prevention is defined as the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste and reduce overall risk to human health and environment. These policies must be adhered to throughout the duration of any of the scheduled renovation/demolition/repair work to be performed in association with the Electrical Replacements project.

1.1.3 The designated substances identified in the Occupational Health and Safety Act and corresponding regulations are:

1.1.3.1 **Acrylonitrile:** “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.2 **Arsenic:** “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.3 **Asbestos**

1.1.3.3.1 “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.3.2 “General – Waste Management” *O.Reg 347/09*, as amended

1.1.3.3.3 “Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations” *O.Reg 278/05* (as amended)

1.1.3.3.4 PWGSC Departmental Policy DP-057 – “Asbestos Management”

1.1.3.4 **Benzene:** “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.5 **Coke Oven Emissions:** “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.6 **Ethylene Oxide:** “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.7 **Isocyanates:** “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.8 **Lead:**

1.1.3.8.1 “Designated Substances” *O.Reg 490/09*, as amended.

1.1.3.8.2 “General – Waste Management” *O.Reg 347/09*, as amended

1.1.3.8.3 Hazardous Products Act’s Surface Coating Materials Regulations SOR/2005-109, as amended (2011)

1.1.3.9 **Mercury:**

1.1.3.9.1 “Designated Substances” *O.Reg*

490/09, as amended.

1.1.3.9.2 "General – Waste Management"

O.Reg 347/09, as amended

1.1.3.10 **Silica:** "Designated Substances" O.Reg 490/09, as amended

1.1.3.11 **Vinyl Chloride:** "Designated Substances" O.Reg 490/09, as amended

1.1.4 All contractors requesting tenders from subcontractors shall furnish this report to subcontractors.

1.2 VALIDITY DATE

1.2.2 Greenough Environmental Consulting Inc. (GEC) conducted the on-site survey for this report in December of 2015 as well as February of 2016.

1.2.3 GEC Staff completed a visual inspection of building materials for the presence of suspected designated substances within the project area, the extent of which was indicated to GEC by an on-site Canadian Food Inspection Agency (CFIA) representative. The project areas included the areas to be impacted by the pending Electrical Replacement project.

1.2.3.1 The scope of work for this report involved a visual inspection of building materials and contents for the presence of suspected designated substances within the project areas relating to the Electrical Replacements CFIA Project M10139).

1.2.3.2 Based on the visual inspection, nine (9) suspect materials were sampled and analyzed for asbestos. The samples were submitted for asbestos analysis at a qualified third party laboratory in Ottawa, Ontario.

1.2.3.3 Based on the visual inspection, two (2) suspect materials were sampled and analyzed for lead. The samples were submitted for asbestos analysis at a qualified third party laboratory in Ottawa, Ontario.

1.2.3.4 GEC also referenced the sampling and analytical results of the following past designated substances

survey:

1.2.3.4.1 *Designated Substance Survey Report, Building 201, Animal Research Institute, 3851 Fallowfield Road, Ottawa, ON. Prepared for PWGSC by TROW, July 2003.*

1.2.3.4.2 *Bulk Sampling Report, Building 201, 3851 Fallowfield Road, Ottawa, ON. Prepared for JSK Insulation by GEC, June 2015.*

1.2.3.5 The survey was limited to those areas that could be safely accessed by non-destructive means. The visual inspection and sampling was limited to readily accessible areas. Destructive tested was not included in the investigation. Due to the nature of construction, some inherent limitations exist as to the possible thoroughness of the designated substance survey.

1.2.3.6 It is possible that designated substances are present in non-accessible areas and concealed spaces. No other areas outside the defined work area accessed.

1.2.3.7 Prior to beginning work, it must be confirmed that the Departmental Representative that no additional designated substances have been brought to the project area.

1.2.3.8 There is a possibility that materials that could not be reasonably identified within the scope of this assessment or which were not apparent during previous site visits may exist. Should any designated substance be encountered in the course of demolition, renovation, or repair, work must be stopped, preventative measures taken, and the Departmental Representative must be notified immediately. Do not proceed until written instructions have been received.

PART 2 – DESIGNATED SUBSTANCES

2.1 SURVEY RESULTS

2.1.1 **ACRYLONITRILE:** Not Identified

2.1.2 **ARSENIC:** Not Identified

2.1.3 **ASBESTOS:** Identified

2.1.3.1. Asbestos is a naturally occurring material. In general, it has been intentionally added to many building materials in the construction industry to increase thermal or chemical resistance properties. More common uses are thermal insulation for pipes and boilers, structural steelwork fireproofing, floor tiles and in-wall and ceiling plasters. There are two classes of asbestos-containing materials: friable and non-friable. Friable asbestos-containing materials are loose in composition or can be easily crumbled using hand pressure. Non-friable asbestos-containing materials are more durable and are held together by a binder such as cement, vinyl or asphalt.

Representative bulk samples from materials located within the project area, collected as part of the current and past designated substance surveys indicate that select samples contain asbestos in the project area.

Table 1 Summarizes the analytical results of building material samples collected from the project areas that were analyzed for asbestos content, that were either collected as part of previous assessments referenced in Part 1 (and that were identified as asbestos containing), or during the most recent assessment

performed by GEC:

TABLE 1 – ASBESTOS CONTAINING MATERIALS ELECTRICAL REPLACEMENT PROJECT AREA 3851 FALLOWFIELD ROAD, BUILDING 201, OTTAWA, ON			
Sample Description	Building Material Description	Location of Samples	Result & Type
TROW, 2003	Elbow Pipe Insulation (Parging Cement) on Steam Lines	Throughout	50% - 75% CH
TROW, 2003	Straight Run Pipe Insulation (Steam Lines)	Throughout	20%-50% CH
GEC, JUNE 2015	White Skim Coat on Fibreglass Insulation Pipe Fittings (Chilled Water Lines)	A-001	5.42% CH
GEC, JUNE 2015	Pipe Fitting Insulation (Parging Cement) on Chilled Water Lines	A-001	20% CH
GEC, JUNE 2015	Black Tar Paper on Fibreglass Pipe Straights (Chilled Water Lines)	A-001	ND
GEC, SEPT 2015	Brown Firestop Caulking at Wall Penetrations	Basement	10% CH
GEC, SEPT 2015	Grey Cementitious Firestop at Wall Penetrations	Basement	6.9% CH
GEC, SEPT 2015	Rope Caulking	Basement	34.95 AM
GEC, DEC 2015	Drywall Joint Compound	A-001 – Storage Room #15, Wall Adj. Storage Room #16/17 and Wall South of Storage Room #14	ND
GEC, DEC 2015	Diesel Generator Exhaust Breeching	Diesel Generator Room	ND
GEC, DEC 2015	Remnant Brown Adhesive Pucks on Concrete Walls and Ceilings	Diesel Generator Room	1.28% CH
GEC, DEC 2015	Drywall Joint Compound	Electrical Room surrounding the Telephone Room	1% CH

- Based on the analytical sampling results, limited observations noted during the survey and a review of previous documentation, the following friable asbestos-containing materials were identified in the project areas (Basement of Building 201 and heating Plant). All quantities, where provided, are approximations only and are to be confirmed on-site prior to removal or disturbance:
 - Elbow pipe insulation (parging cement) located within the project areas was found to contain 20% - 75% Chrysotile asbestos. The upcoming project does not reportedly include the manipulation of this material; however, contractors should be made aware of its presence. All parging cement elbow pipe insulation within the project area was found to be in GOOD condition at the time of the survey.
 - Straight run pipe insulation located within the project area was found to contain 20% - 50% Chrysotile asbestos. The upcoming project does not reportedly include the manipulation of this material; however, contractors should be made aware of its presence. All straight run pipe insulation within the project area was found to be in GOOD condition at the time of the survey.
 - White skim coat on fibreglass insulation pipe fittings located within the project area was found to contain 5.42% Chrysotile asbestos. The upcoming project does not reportedly include the manipulation of this material; however, contractors should be made aware of its presence. All white skim coat on fibreglass insulation pipe fittings within the project area were found to be in GOOD condition at the time of the survey.
- Based on the analytical sampling, limited observations noted during the survey and a review of previous documentation, the following non-friable asbestos-containing materials were identified in the project areas:
 - Brown firestop caulking at wall penetrations located within the project area was found to contain 10% Chrysotile asbestos. The upcoming project does not reportedly include the manipulation of this material; however, contractors should be made aware of its presence. All brown firestop caulking within the project area was found to be in GOOD condition at the time of the survey.
 - Grey cementitious firestop caulking at wall penetrations located within the project area was found to contain 6.9% Chrysotile asbestos. The upcoming project does not reportedly include the manipulation of this material; however, contractors should be made aware of its presence. All grey cementitious firestop caulking within the project area was found to be in GOOD condition at the time of the survey.
 - Drywall Joint Compound within the project area (Telephone Room) was found to

contain 1% Chrysotile asbestos. The upcoming project does not reportedly include the manipulation of this material; however, contractors should be made aware of its presence. It is recommended that the drywall joint compound be sealed using primer and paint.

- Remnant brown adhesive pucks within the project area (Generator Room) was found to contain 1.28% Chrysotile asbestos. The upcoming project does not reportedly include the manipulation of this material; however, contractors should be made aware of its presence.
- Rope caulking within a bell-fitting was located within the project area and found to contain 34.95% Amosite asbestos. The upcoming project reportedly does not include the manipulation of this material; however, contractors should be made aware of its presence. All rope caulking within the project area was found to be in GOOD condition at the time of the survey.
- GEC, with the assistance of Carleton electric, accessed the interior of the Transformer switch gears within the electrical vault areas. A known asbestos-containing material, which is a cement product (Transite), was identified within the accessible transformers. No sampling was completed as GEC did not want to damage the Transite and also because water is required to sample such a material and the use of water was not practical in this instance. Each of the accessed transformer switch areas were identified to have the noted Transite present in Building 201 and Main Electrical Vault of the Central heating Plant.

2.1.4 **BENZENE:** Not Identified

2.1.5 **COKE OVEN EMISSIONS:** Not Identified

2.1.6 **ETHYLENE OXIDE:** Not Identified

2.1.7 **ISOCYANATES:** Not Identified

2.1.8 **LEAD: Identified**

Lead is a naturally occurring metal. It was used primarily in paint prior to the 1980s to increase the drying process. Lead in paint becomes a danger when it is old or damaged, as it creates lead dust and chips. Lead can also be found in

soldered joints installed on piping up to the mid-1990s and in older cast iron bell and spigot joints.

- According to the Canada Consumer Product Act's Surface Coating Materials Regulations SOR/2005-109, as amended, allowable concentration of lead of surface coatings is 0.009 percent by weight (weight of lead to weight of paint), which is equivalent to 90 parts per million (ppm)
- Even at very low concentrations, there may be potential for exposure to very high levels of lead depending on the activities performed that disturb the lead-containing materials. At low lead concentrations, conducting a risk assessment to assess the potential for exposure is required to determine the need to follow precautionary measures.
- Table 2 Summarizes the analytical results of building material samples collected from the project areas that were analyzed for asbestos content that were collected as part of previous assessments referenced in Part 1:

TABLE 2 – RESULTS OF LEAD ANALYSIS ELECTRICAL REPLACEMENT PROJECT AREA 3851 FALLOWFIELD ROAD, BUILDING 201, OTTAWA, ON		
Sample Description	Material Description	Results
TROW, 2003	Forest green paint on canvas of pipe insulation in Basement B001 Room	12 ppm
TROW, 2003	Lime green paint on canvas of pipe insulation in Basement B001 Room	15 ppm
TROW, 2003	Pink paint on canvas of pipe insulation in Basement B001 Room	12 ppm
TROW, 2003	Yellow-orange paint on canvas of pipe insulation in Basement B001 Room	6 ppm
TROW, 2003	Royal Blue paint on canvas of pipe insulation in Basement B001 Room	37 ppm
TROW, 2003	Orange paint on canvas of pipe insulation in Basement Biowaste Room	100 ppm
TROW, 2003	Red paint on canvas of pipe insulation in the B-wing Basement Corridor	3,070 ppm

GEC, DEC 2015	Grey Floor Paint, Electrical Room	1,900 ug/g
GEC, DEC 2015	Grey Transformer / Switch Gear Paint	1,040 ug/g

- Based on the analytical results listed in Table 2, all paint samples contain detectable concentrations of lead.

2.1.9 **MERCURY:** Not Identified

2.1.10 **SILICA:** Identified

Free crystalline silica is assumed present in concrete materials within the project area.

2.1.11 **VINYL CHLORIDE:** Not Identified.

2.2 RECOMMENDATIONS

1. ASBESTOS

PWGSC's Department Policy on Asbestos Management establishes roles and responsibilities and provides a code of practice for the management of and working with asbestos-containing materials. All work must be done in accordance with this directive, as well as all other applicable legislation. Disturbance of all asbestos (whether friable or non-friable) is regulated in Ontario by "Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations" O.Reg 278/05, as *amended*, which outlines the precautions required when performing work involving asbestos-containing materials. The regulation stipulates appropriate respiratory protection, work procedures and ventilation requirements that must be utilized during the disturbance of any asbestos-containing materials, or materials suspected to contain asbestos.

In the event of conflict between PWGSC and “Designated Substance – Asbestos on construction Projects and in Buildings and Repair Operations” O.Reg 278/05, as amended, the more stringent shall apply.

The removal or disturbance of one square metre or less of friable asbestos containing materials must be conducted using a minimum of Type 2 asbestos work procedures. The removal or disturbance of more than one square metre of friable asbestos-containing materials must be conducted using Type-3 asbestos work procedure. Type-3 asbestos abatement operations performed in occupied buildings require daily asbestos air monitoring outside each asbestos work area as per PWGSC DP.

The removal or disturbance of non-friable asbestos containing materials must be conducted using a minimum of Type 1 asbestos work procedures and possible Type 2, depending on abatement operation.

The “General – Waste Management” O.Reg 347/90 as amended, governs the disposal of waste containing asbestos. The waste must be disposed at a licensed waste disposal site.

2. LEAD

If lead-containing materials are disturbed then proper precautions, as outlined under “Designated Substances” O.Reg 490/09, as amended, of the Occupational Health and Safety Act, must be followed.

Under Ontario Regulation 490/09, as amended of the Occupational Health and Safety Act, regulatory limits have been established for occupational exposure limits to airborne lead that may be present in a workplace. The Time Weighted Average Exposure Values to airborne lead

dust or fumes should not exceed the Ministry of Labour's 0.05 milligram per cubic metre (mg/m³) limit during the removal of paints and products containing any concentration of lead. The TWAEV represents the time-weighted average concentration for a conventional 8-hour workday and a 40-hour work week, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects.

Contractors performing work that requires disturbance of lead-containing materials are responsible to ensure that the workers are not exposed to airborne lead dust levels in excess of the time-weighted average and Maximum Exposure Concentration for lead-containing paints.

Ontario Ministry of Labour (MoL) has published the document entitled "Guideline: Lead on Construction Projects". This document classifies all disturbances of lead-containing materials as Type 1, Type 2a, Type 2b, Type 3a or Type 3b work based on presumed airborne concentrations of lead generated during the work each of which will have defined work practices. Although this document is not a regulation, Ministry of Labour Inspectors use it as guidance during site inspections. Where there is conflict with the exposure limits and respiratory protection required by "Designated Substances" Regulation 490/09 as amended, the most stringent requirements of Regulation 490/09 must apply.

The disposal of construction waste containing lead is controlled by "General – Waste Management" O.Reg 347/90, as amended, under the *Ontario Environmental Protection Act*. The classification of the waste is dependent upon the result(s) of the leachate test(s). The waste can be classified as "hazardous", "non-hazardous" or "registerable

solid waste”, depending on the results of the leachate test.

Prior to disposal, the concentration of leachable lead must be determined for waste materials with elevated lead contents following the Toxicity Characteristic Leaching Procedure (TCLP)

3. SILICA

Silica occurs as crystalline material in cement, plaster, drywall, ceiling tiles, brick and mortar, stone and mortar. Crystalline silica is regulated under “Designated Substances” O.Reg 490/09, as amended, of the *Occupational Health and Safety Act* as a Designated Substance.

Silica dust can be generated through such processes as blasting, grinding, crushing, and sandblasting silica-containing material. Since silica is presumed present in concrete materials within the project area, appropriate respiratory protection and ventilation must be donned during the demolition, and modifications of these structures.

The Occupational Health and Safety Branch of the MoL has published the document entitled “*Guideline: Silica on Construction Projects*”. This document classifies the disturbance of materials containing silica as Type 1, Type 2 or Type 3 work, and assigns different levels of respiratory protection and work procedures for each classification. These work procedures should be followed when performing work involving the disturbance of silica-containing materials.

4. CONTRACTORS DUTIES

The contractor must review the designated substances report and take the necessary precautions to protect the

health and safety of the workers and the environment. As per Section 30(4) of the *Ontario Occupational Health and Safety Act*, the party hiring the contractor (i.e., Departmental Representative) shall ensure that the contractor and subcontractor (if any) for the project has received a copy of the designated substance report prior to entering a binding contract for the supply of work on the project. As per Section 27(2) (a,b and c) of the Ontario Occupational Health and Safety Act, while onsite, the contractor supervisor shall exercise every reasonable precaution for the protection of a worker. If you have any questions about the designated substance report, please contact the Departmental Representative.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to the Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify the Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario of Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 10 days for Departmental Representative review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Ontario
 - .1 Occupational Health and Safety Act and Ontario Regulation 213/91 for Construction Projects, R.S.O. – Updated: 96/11.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit as specified Health and Safety Plan: Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit one copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction daily.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
Submit WHMIS MSDS - Material Safety Data Sheets
Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within five days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within five days after receipt of comments from Departmental Representative.
- .6 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .7 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .8 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.

- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award. Contractor to submit written acknowledgement to CSST along with Ouverture de Chantier Notice.
- .3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with Regulatory Requirements.

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Refer to Designated Substances Report - Section 01 14 25

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 Contractor shall be the Principal Contractor Respecting Health and Safety code for the Construction for only their scope and areas of work as defined and described this project specification.
- .4 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Act, R.S.O. 96/11, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.
- .2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.
- .3 Comply with Occupational Health and Safety Regulations, 1996.
- .4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .5 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of Registered Occupational Hygienist, Certified Industrial Hygienist, and site supervisor.

1.13 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 BLASTING

- .1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.

1.16 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.17 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.2 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials on solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.3 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.4 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.5 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.6 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.7 CONCEALMENT

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.8 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.9 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.10 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.11 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.12 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Departmental Representative or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Clear snow and ice from access to building, bank/pile snow in designated areas only or remove from site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Dispose of waste materials and debris off site.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Departmental Representative or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .18 Clean roofs, downspouts, and drainage systems.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .20 Remove snow and ice from access to building.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Departmental Representative:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements and manufacturer's installation instructions.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative one final copy of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 X 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.

- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Contractor to obtain from Departmental Representative at commencement of work, one complete set of white prints or electronic CAD drawing file of Drawings to be used for purpose of recording the as-built changes and deviations to work.
- .2 These prints and/or CAD files to be kept by Contractor in Job Office and made available to all Subcontractors so that all changes and deviations to be recorded by respective trades promptly as they occur by marking in black ink. Deviations and changes to mechanical and electrical systems must be recorded on these Drawings.
- .3 Upon completion of work, return these Drawings and CAD files in complete and good condition to Departmental Representative in order that Departmental Representative will have record of exact location of all services and equipment.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .2 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Field changes of dimension and detail.
 - .2 Changes made by change orders.
 - .3 Details not on original Contract Drawings.
 - .4 References to related shop drawings and modifications.

- .3 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .4 Other Documents: maintain manufacturer's certifications, inspection certifications and field test records required by individual specifications sections.
- .5 Provide digital photos, if requested, for site records.

1.7 FINAL SURVEY

- .1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Include manufacturer's printed operation and maintenance instructions.
- .7 Include sequence of operation by controls manufacturer.
- .8 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .9 Provide installed control diagrams by controls manufacturer.

1.9 MATERIALS AND FINISHES

- .1 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .2 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

1.10 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
- .2 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.12 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Provide list for each warranted equipment, item, and feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .3 Procedure and status of tagging of equipment covered by extended warranties.
 - .4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

- .11 Remedy any defects due to faulty materials or workmanship appearing within period of one year from date of final acceptance of work and to pay for any damage to other work resulting therefrom which appears within such period and neither final certificate nor payment thereunder to relieve Contractor from this responsibility. Departmental Representative to give notice of observed defects promptly. Any work requiring excessive service during warranty period to be considered defective and to be replaced at no additional cost to Departmental Representative.

1.13 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of final inspection.
- .2 Departmental Representative: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 Electrical System: 4 hours of instruction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Departmental Representative's personnel.

- .2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This section shall be read in conjunction with specification Section 26 05 00 – Electrical General Requirements, all electrical sections, and all other disciplines related to the project.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C9-02, Dry-Type Transformers.
 - .2 CSA C22.1-15, Canadian Electrical Code, Part I (23rd edition), Safety Standard for Electrical Installations.
 - .3 CSA C22.2 No. 0.4-04(R2013), Bonding of Electrical Equipment.

1.3 INTENT

- .1 This section specifies general requirements common to all start-up and performance verification of electrical components, equipment and systems specified elsewhere in Division 26 and must be read in conjunction with said specifications. The testing, verification, & commissioning indicated in Division 26 Specifications forms part of commissioning requirements.

1.4 TIMING

- .1 Except where otherwise specified, complete all start-up and testing prior to acceptance and hand-over of the project.

1.5 SCHEDULING

- .1 Provide start-up schedule in detail upon receipt of contract includes entire project start to completion activities
- .2 Provide equipment delivery schedule
- .3 Provide installation schedule of new equipment
- .4 Provide each electrical shutdown schedule with method of procedures minimum two weeks in advance of shutdown for review by Departmental Representative. Shutdown schedule should list all activities with time and duration.

1.6 STARTING & TESTING - GENERAL

- .1 Cleanliness:
 - .1 Before start-up, clean all electrical equipment and systems and verify same to be free from all contaminants.
 - .2 After testing, protect equipment and systems from construction activities.
- .2 Conceal equipment & systems only after inspection, testing is completed and approved by Departmental Representative.

- .3 Assume all liabilities and costs for starting, testing, commissioning and adjusting, including supply of testing equipment.
- .4 Witnessing of starting and testing:
 - .1 Prior to start-up, prepare schedule for specified testing and review with Departmental Representative.
 - .2 Provide sufficient notice at least 7 days prior to commencement.
 - .3 Departmental Representative may witness all or any and testing at his discretion.
 - .4 Contractor to be present at all tests performed by sub-trades, suppliers, equipment manufacturers and at tests of other relevant Divisions, namely mechanical & controls Divisions.

1.7 QUALITY ASSURANCE

- .1 Starting, testing procedures to be in accordance with:
 - .1 These specifications and drawings
 - .2 Requirements of authorities having jurisdiction.
 - .3 Manufacturers' instructions or recommendations.
 - .4 Applicable portions of relevant standards such as ASTM, CSA, EEMAC, IEEE, IPCEA, NEMA.

1.8 CONFLICTS

- .1 If requirements of this or other sections of construction or commissioning specifications conflict, report to Departmental Representative before start-up and obtain clarification.

1.9 MANUFACTURERS' INVOLVEMENT

- .1 Prior to start-up of equipment or systems, obtain manufacturer's installation, start-up and operation instructions and review with Departmental Representative:
 - .1 Compare installation with manufacturer's published data, record discrepancies and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer, before start-up.
- .2 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void any warranties.
- .3 Qualified manufacturer's representative to supervise start-up and testing as required by relevant section.
- .4 Manufacturer's personnel to be experienced in design, installation and operation of equipment and systems and be able to interpret results of readings and tests accurately and to report results in clear, concise, logical manner.

1.10 AUTHORITIES JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate authority's having verification requirements, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction. Provide copies to Departmental Representative with commissioning report.

1.11 INSTRUMENTATION

- .1 Instruments installed under Contract may be used for performance verification if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.

1.12 DEFICIENCIES

- .1 Correct deficiencies found during start-up and testing to satisfaction of Departmental Representative.

1.13 COMPLIANCE PROCEDURES

- .1 Failure to follow specified start-up procedures may result in re-evaluation of equipment with Specified by independent testing agency selected by Departmental Representative.
- .2 Should results reveal that equipment start-up was not in accordance with specified requirements, equipment may be rejected and must immediately thereafter be removed from site and replaced with new which will also be subject to specified start-up procedures.

1.14 DEPARTMENTAL REPRESENTATIVE'S PERFORMANCE TESTING

- .1 Performance testing of any equipment or system by Departmental Representative shall not relieve Contractor from compliance with specified start-up and testing procedures.

1.15 CO-ORDINATION

- .1 Co-ordinate work and manpower requirements of sub-trades, suppliers, manufacturers, specialist, disciplines as required to ensure that all work is properly organized prior to start-up and testing.
- .2 Co-ordinate starting of electrical equipment and systems with testing, demonstration, training of equipment and systems specified in all Divisions.
- .3 Where equipment or systems require testing prior to start-up, ensure that such work is completed and approved prior to start-up of equipment of systems.

1.16 TESTING INSTRUMENTS

- .1 Provide 2-way radios, ladders, other equipment as required to complete work. Provide measuring instruments as required.
- .2 Provide safety equipment for start-up and testing personnel.

- .3 Provide list of equipment and instruments to be used in start-up, testing for review and approval by Departmental Representative.

1.17 PROCEDURES

- .1 Document all tests on approved performance verification forms.
- .2 Start-up and testing to be in the following distinct phases:
 - .1 Delivery and installation: Includes:
 - .1 Verification of conformity to specification, approved shop drawings, product information report forms.
 - .2 Start-up: Includes start-up procedures.
 - .3 Operational testing: Includes equipment run-in.
 - .4 Pre-substantial performance verification: Includes repetition of tests after correction of deficiencies, final cleaning, and maintenance.
 - .5 Post-substantial performance verification: Includes fine-tuning.
- .3 After each distinct phase has been completed, correct deficiencies and obtain approval of Departmental Representative before commencing the next phase.
- .4 Perform load balance, power factor and voltage testing during integrated system testing and fine-tuning of facility.

1.18 CONTROL SCHEMATICS

- .1 To be "as-built" as specified Division 01 and Division 26.
- .2 Include:
 - .1 Update of terminal numbers, wire numbers, circuits, etc.
 - .2 Record of terminal numbers at connection points to equipment by other Divisions.
 - .3 All additional junction boxes and terminal strips that are provided.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 SHORT-CIRCUIT ANALYSIS, EQUIPMENT EVALUATION, AND COORDINATION STUDIES

- .1 Engage the services of a recognized independent testing agency or independent, electrical consulting firm to perform a complete short-circuit study, equipment interrupting or withstand evaluation, and a protection device coordination study for the electrical distribution system.

- .2 The Division 26 contractor shall retain and pay for the services of an Independent Testing Organization (ITO) to provide System Co-ordination Study, Verification and On-Site Commissioning Service in accordance with the details specified herein.
- .3 In order to ensure the requirement for independence, the ITO must be retained directly by the Division 26 contractor. The ITO must not be retained by an equipment manufacturer or their distributor as part of an equipment package.
- .4 The Division 26 Contractor shall include in the Bid Amount the cost for the services of tradesmen to handle equipment, make temporary connections, operate equipment and make repairs and adjustments and assist the testing organization's on-site specialists during the on-site pre-service inspection, testing, calibration, on-site witness testing and supplementary Commissioning phase of the work and as required by the Departmental Representative until the equipment and systems are accepted by the Departmental Representative.
- .5 The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly covered in the study.
 - .1 Short-Circuit Study
 - .1 The study shall be in accordance with applicable ANSI and IEEE Standards.
 - .2 The study input data shall include the utility company's short-circuit single- and three-phase contribution, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
 - .3 Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
 - .2 Equipment Evaluation Study
 - .1 An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the available fault currents. Any problem areas or inadequacies in the equipment shall be promptly brought to the Departmental Representative attention, and corrected by the Division 26 contractor.
 - .3 Protective Device Coordination Study
 - .1 A protective device coordination study shall be performed to select or to check the selections of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings.
 - .2 The coordination study shall include all voltage classes of equipment from the utility's incoming line protective device down to and including each motor control centre and/or panelboard. The phase and ground

overcurrent protection shall be included, as well as settings for all other adjustable protective devices.

- .3 The time-current characteristics of the specified protective devices shall be plotted on appropriate log-log paper. The plots shall include complete titles, representative one-line diagram and legends, associated power company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low-voltage circuit breaker trip curves, and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current Electrical Code shall be adhered to. Reasonable coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protection devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate the coordination achieved to utility main breaker, primary feeder breaker, unit substation primary protective device, main and tie secondary breakers, substation feeder breakers, and load protective device. There shall be a maximum of eight protective devices per plot.

- .4 The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended selections shall be provided. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Departmental Representative's attention.

.4 Study Report

- .1 The results of the power system study shall be summarized in a final report.
- .2 One bound copy of the final report shall be submitted to the Departmental Representative.
 - .1 The report shall include the following sections:
 - .2 Description, purpose, basis, written scope, and a single-line diagram of the portion of the power system which is included within the scope of study.
 - .3 Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties, and commentary regarding same.
 - .4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 - .5 Fault current tabulations including a definition of terms and a guide for interpretation.
 - .6 Tabulation of appropriate tap settings for relay seal-in units.

.5 Implementation

- .1 The contractor shall ensure that the recommendations of the study are implemented as part of the Division 26 contract.

3.2 PERFORMANCE VERIFICATION FORMS (PV) AND PRODUCT INFORMATION FORMS (PI)

- .1 The Contractor shall provide the required shop drawing information and verify the correct installations and operation of each item on these forms. This to include information such as equipment code, location and nameplate data. The systems verification cannot take place before all related equipment has been verified as correct.
- .2 As a minimum, verification forms for the following systems are to be completed for this project.
- .1 Normal/Emergency Power Distribution System (below 750 V)
 - .1 Secondary switchgear including main breaker and metering.
 - .2 Moulded case breakers.
 - .3 Dry type transformers.
 - .4 Wiring/Power cables.
 - .5 Insulation resistance testing results.
 - .2 Normal Power Distribution System (Above 750 V)
 - .1 Primary switchgear load break switch including main breaker, protection and metering.
 - .2 Dynamic contact resistance of breaker
 - .3 DC Hi-Pot
 - .3 Emergency Power Distribution System
 - .1 Automatic Transfer switches (New)
 - .4 Power Factor Correction System
 - .1 Power factor capacitors
 - .5 Power Transformer
 - .1 Ratio, Polarity and phase angle test
 - .2 Heat run test
 - .3 Polarization index test results
 - .4 Additional tests results as per OEM, if any
 - .6 Protection relay and metering instruments throughout all components and systems
- .3 A report form is to be completed for each individual piece of equipment in a category requiring verification.
- .4 Where additional verification forms are required, develop appropriate verification forms and submit them to Departmental Representative for approval prior to use.
- .5 Submit completed test reports immediately after tests are performed.
- .1 Record all data gathered on site on approved verification forms.

- .2 Provide the Departmental Representative with original of each completed verification form.
- .3 Maintain one photocopy on site of all data taken during starting and testing period.
- .4 Maintain one copy of all final starting, testing, balancing and adjusting reports on site up to interim acceptance of the work for reference purposes.
- .6 All final verification forms are to be typewritten.
- .7 Submit to Departmental Representative for approval.
- .8 Make corrections and re-submit as requested by Departmental Representative.
- .9 Manufacturer's Reports:
 - .1 Arrange for manufacturer to submit copies of all production test records for production tests required by these specifications prior to shipping.
 - .2 Arrange for manufacturer to submit brief step-by-step description of entire starting procedure to allow Departmental Representative to repeat starting at any time.

3.3 WITNESSING OF STARTING AND TESTING

- .1 Prior to starting and testing of electrical equipment or systems, prepare a schedule for the required testing. Review schedule with Departmental Representative for acceptance.
- .2 Provide sufficient notice minimum seven days prior to commencing tests.
- .3 Departmental Representative may witness all or any portion of testing and starting procedures performed by the Contractor.
- .4 Contractor to be present for all tests of Division 26 systems, as well as related systems.

3.4 MANUFACTURER'S SERVICE ON SITE

- .1 Arrange and pay for qualified manufacturer's representatives to supervise starting and testing of the following electrical equipment and systems.
- .2 Manufacturer's personnel shall be experienced in the design and operation of equipment and systems being started, have the ability to interpret results of readings and tests and report results in a logical fashion.

3.5 GENERAL EQUIPMENT STARTING TESTING

- .1 Energizing Electrical Equipment:
 - .1 Prior to energizing equipment provided under other sections:
 - .1 Confirm equipment nameplate data with characteristics of power supply
 - .2 Verify supply voltage and phase rotation.
 - .3 Ensure all independent testing as specified in related sections has been completed and deficiencies have been corrected.
 - .4 Close and open all devices to ensure proper mechanical operation.
 - .5 Megger all feeders and record results on approved verification forms.

- .2 Load Balancing:
 - .1 Measure load balance on all feeders at distribution centres, motor control centres and panel boards with normal loads (lighting included) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 If load unbalance exceeds 15%, reconnect circuits to balance loads. Revise panel board directories and wiring identification accordingly.
 - .4 Submit, at completion of work, a report listing phase and neutral currents on panel boards, dry core transformers and motor control centres, operating under normal loads. State hour and date on which each load was measured and voltage at time of test.
- .3 Insulation Resistance Testing (Megger Test):
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Megger 13800 V circuits, feeders and equipment with a 10KV instrument.
 - .4 Check resistance to ground before energizing.
 - .5 Carry out tests in presence of Departmental Representative.
 - .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
 - .7 Submit test results for Departmental Representative's review.
- .4 Coordination of Protective Devices:
 - .1 Ensure circuit protective devices such as trip units, overcurrent trip relays, fuses are calibrated to design values and settings.
- .5 Voltage Testing and Adjusting:
 - .1 Test voltage at service entry point, motor control centres and secondary of transformers. Record voltages at interim acceptance.
 - .2 Adjust transformer tap settings to compensate for under-voltage or over-voltage conditions, if directed to do so by Departmental Representative.

3.6 HIGH VOLTAGE POWER DISTRIBUTION (ABOVE 750 V)

- .1 Primary Switchgear:
 - .1 Completely isolate switchgear enclosure to be tested and inspected from all sources of power and where applicable, temporary grounding leads installed for safety.
 - .2 Remove necessary access panels, doors and cover plates.
 - .3 Fill out inspection verification form. Note on verification form all data in reference to equipment.

- .4 Cleaning:
 - .1 Check for accumulations of dirt especially on insulating surfaces and clean all interiors of compartments thoroughly using a vacuum or blower.
 - .2 Use only clean, lint free cloth.
 - .3 Remove all filings caused by burnishing of contact.
- .5 Mechanical inspection:
 - .1 Check mechanical operation of all devices.
 - .2 Check physical appearance of all doors, devices, equipment and lubricate in accordance with manufacturer's instructions.
 - .3 Check condition of all contact.
 - .4 Check disconnects, starters, circuit breakers in accordance with inspection and test reports and procedures.
 - .5 Check condition of all bussing for moisture or other contamination, proper torque, and clearance to ground. Seal all bolted connections with red lacquer.
 - .6 Inspect all insulators and insulating surfaces for cleanliness, cracks, chips and tracking.
 - .7 Check and report all discovered unsafe conditions.
 - .8 Remove draw-out breakers and check draw-out equipment.
 - .9 Check cable and wiring condition, appearance, termination. Perform electrical tests as required.
 - .10 Inspect for proper grounding of equipment.
- .6 Electrical testing:
 - .1 Check electrical operation of all pilot devices, switches, meters, relays, auxiliary contacts, annunciator devices, flags, interlocks, cell switches, cubicle lighting. Visually inspect arrestors, C/T's and P/T's for signs of damage. Note data on test verification form.
 - .2 Megger test all insulators to ground.
 - .3 Megger test bussing phase to ground and phase to phase.
 - .4 DC hipot main bus, all phases to ground using the step voltage method as specified for cables with withstand levels held for one minute. Record decay curve, current versus time at end of withstand. Test levels shall be as follows:
 - .1 15 kV class, 28.5 kV DC.
- .7 Wiring checks
 - .1 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three line diagrams and project specifications.
 - .2 Test each circuit for continuity using a buzzer or similar device.
 - .3 All current circuits shall be injected, all voltage circuits shall be powered at 120 Volts, all devices functioned and checked against control schematic diagram.
 - .4 Check polarity and verify phase relationship on all three phase metering circuits.

- .5 Where errors are discovered and changes are required, mark up and note on vendor prints the corrective action required.
- .8 Metering and Instruments
 - .1 Test in accordance with manufacturer's recommendations and this section.
- .9 Upon completion of inspection and test, remove grounds, restore equipment to serviceable condition.
- .2 Load Break Switch to 15 kV:
 - .1 Procedures for high voltage switching operations must be strictly adhered to at all times.
 - .2 Load break switch to be worked on must be completely isolated from all power sources.
 - .3 Install temporary grounds.
 - .4 Record manufacturer, serial number, type and function of breaker, reading of operations counter, date of inspection, and signature of person responsible for inspection and signature of person responsible for inspection on verification form.
 - .5 Cleaning:
 - .1 Remove all accumulations of dirt from the insides of cubicles with vacuum cleaner and/or blower.
 - .2 All insulating surfaces should be brushed clean or wiped clean with lint free cloth.
 - .6 Mechanical inspection:
 - .1 Check the condition of primary contact clusters, control wiring plug-in contacts, moving and fixed main contacts and arcing contacts.
 - .2 Cracks or indications of tracking on insulators.
 - .3 Tracking or mechanical damage to interface barriers.
 - .4 Flaking or chipping of ceramics of arc chutes.
 - .5 Broken, damaged or missing springs on operating mechanism.
 - .6 Damage to operating linkage and that all clevis pins are securely retained in position.
 - .7 Correct alignment of operating mechanism and contacts.
 - .8 Evidence of corrosion and rusting of metals, and deterioration of painted surfaces.
 - .7 Torque all bolted connections and breaker components.
 - .8 Dress contact surfaces and check contact pressure.
 - .9 On completion of foregoing tasks, lightly lubricate all bearing points in the operating linkage with manufacturer's specified lubricant. Operate breaker several times to ensure smoothness of mechanical operation.
 - .10 Electrical tests:
 - .1 Contact resistance tests across closed line-load contacts. Record results.
 - .2 Clean contacts using appropriate tools to get lowest contact resistance reading possible.

- .3 Insulation resistance test: All phases to others and ground.
- .3 Metering and Switchboard Instruments:
 - .1 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.
 - .2 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.
 - .3 Perform tests to obtain correct calibration.
 - .4 Do not dismantle meters or instruments.
 - .5 Submit test report documenting successful test results and settings.
- .4 Interlock System:
 - .1 Verify sequencing and operation.
 - .2 Verify kirk key operation for ATS-Bypass scheme
- .5 Primary Transformer:
 - .1 Visual Inspection and Cleaning:
 - .1 Record nameplate data.
 - .2 Check all bushings and insulators for chips or cracks.
 - .3 Verify proper liquid level in all tanks, and check for leaks.
 - .4 Check tap changer for connection and proper mechanical and electrical operation.
 - .5 Check operation of temperature, and alarm devices through simulation test.
 - .6 Verify wiring is in accordance with manufacturer's schematic diagram.
 - .7 Check all connections (including ground and tap changer links) for tightness.
 - .8 Torque to proper value in accordance with manufacturer's recommended values and seal with red lacquer.
 - .9 Cleaning:
 - .1 If accumulations of dirt are evident on inspection, these should be removed with particular attention being given to the top and bottom of winding assemblies and ventilation ducts.
 - .2 Clean winding by using a vacuum cleaner and/or blower or compressed air.
 - .3 Lead or cable supports, tap changers, bushings and other insulating surfaces should be brushed clean or wiped clean with a lint free cloth.
 - .2 Insulation power factor test:
 - .1 Using capacitance bridge instrument, check insulation power factor of:
 - .1 Primary/secondary and ground.
 - .2 Secondary/primary and ground.
 - .2 Record capacitance values, dissipation factor and insulation power factor and compare field test results to manufacturer's factory test results.

- .3 Ratio test:
 - .1 Carry out ratio test of windings in all tap positions to ensure accuracy to within 0.001 percent.
 - .2 Compare test data to factory test results.
- .4 Insulation resistance:
 - .1 Using suitably sized megger, measure resistance between:
 - .1 Primary and secondary.
 - .2 Primary/secondary and ground.
 - .3 Secondary/primary and ground.
 - .2 Compare test results to factory test data.
- .5 Dielectric strength:
 - .1 DC hipot test utilizing the voltage step method as specified under "High voltage power cables (above 1000 V)" in this section. The maximum test levels to be considered as the withstand and held for one minute. The maximum test levels to be related to transformer BIL and voltage class as follows but shall not exceed the AC test level as specified in CSA C9-02:
 - .1 15 kV class 95 kV BIL maximum test level 28.5 kV DC.
- .6 Sample insulating liquid for:
 - .1 Dielectric breakdown voltage.
 - .2 Acid neutralization number.
 - .3 Interfacial tension.
 - .4 Visual condition.
 - .5 Water content.
- .7 Core ground test:
 - .1 Remove ground strap between laminated core and ground.
 - .2 Megger test using 250 Volt megger (or size as recommended by manufacturer) between core and ground to ensure no other grounds exist between core and ground.
 - .3 Compare values to factory test values.
 - .4 Reconnect ground strap.
- .8 Operational test:
 - .1 Energize transformers and apply incremental loads and document test results.
 - .1 At each load change, check temperature, ambient, enclosure, ventilation air, windings.
- .6 Grounding:
 - .1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Department Representative and Inspection Authority.
 - .2 Perform tests before energizing electrical distribution.
 - .3 Provide test report documenting successful test results.

.7 High Voltage Wiring & Cables:

.1 General

- .1 Test conductors at distribution centres and panel boards for insulation resistance to ground (megger test).
- .2 Test service grounding conductors for ground resistance.
- .3 Provide Department Representative with list of test results on approved verification form showing location at which each test was made, circuit tested and results of each test.
- .4 Remove and replace entire length of cable if cable fails to meet any of the test criteria.

.2 High Voltage Power Cables (Above 1000 V):

- .1 Cables shall be complete with all terminations and lugs and disconnected from equipment at both ends prior to hipot test.
- .2 Perform continuity and phasing test prior to hipot test.
- .3 Dielectric strength, DC hipot test:
 - .1 Test electric strength of cables using the "step voltage" test method.
 - .2 Provide a safety person in addition to the testing technician.
 - .3 All tests to be applied between conductors and ground.
 - .4 Initial test level: 2 kV DC held for two minutes (megger stabilization level).
 - .5 Second level: 5 kV DC held for five minutes (polarization level).
 - .6 All subsequent test levels: 5 kV DC increments for one minute at each level.
 - .7 Record current leakage values at each step.
 - .8 Final test level: to withstand level and held at constant voltage for 15 minutes. Record decay current at five minute intervals during this period. Plot decay curve - current versus time.
- .4 Test data sheet to include the following:
 - .1 Table showing leakage current at each test level.
 - .2 Graph of applied test voltage versus leakage current.
 - .3 Cable data.
 - .4 Sketch of the part of the system in which cable is connected.
 - .5 Ambient conditions such as humidity and temperature.
 - .6 Date of test and signature of test technician.
- .5 15 kV cable DC test levels:
 - .1 2 kV megger 2 minutes
 - .2 5 kV polarization 5 minutes
 - .3 10 kV 1 minute
 - .4 15 kV 1 minute
 - .5 20 kV 1 minute

- .6 25 kV 1 minute
- .7 30 kV 1 minute
- .6 Perform additional tests as required by the Local Utility and or Inspection Authority.

3.7 LOW VOLTAGE POWER DISTRIBUTION (BELOW 750 V)

- .1 Low Voltage Distribution Switchgear
 - .1 Enclosure:
 - .1 Visual inspection.
 - .2 Torque all bus connections to manufacturer's requirements and seal with red lacquer.
 - .3 Megger test main bus at 1000 V.
 - .4 Check phasing and continuity of horizontal and vertical bus.
 - .2 Wiring checks:
 - .1 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three line diagrams and project specifications.
 - .2 Test each circuit for continuity using a buzzer or similar device.
 - .3 All current circuits shall be injected, all voltage circuits shall be powered at 120 Volts, all devices functioned and checked against control schematic diagram.
 - .4 Check polarity and verify phase relationship on all three phase metering circuits.
 - .5 Where errors are discovered and changes are required, mark up and note on vendor prints the corrective action required.
 - .3 Instrumentation:
 - .1 Test and calibrate all digital metering units in accordance with manufacturer's bulletins and this section.
 - .2 Check calibration on all ammeters using 5 Amp secondary injection test.
 - .3 Perform wiring checks as listed above.
 - .4 Breakers:
 - .1 Industrial Air Circuit Breakers:
 - .1 Inspection and testing per this specification section.
 - .2 Moulded case breakers 150 Amp frame and larger:
 - .1 Inspection and testing per this specification section.
- .2 Circuit Breaker:
 - .1 Breakers - Moulded case breakers to 150 Amp:
 - .1 Visual inspection.
 - .2 Mechanical function test.
 - .3 Set all units with adjustable magnetic trip units.
 - .2 Breakers - Moulded case breakers 150 Amp frame and larger:
 - .1 Visual inspection.

- .2 Megger test.
- .3 Mechanical function test.
- .4 Set all units with adjustable magnetic trip units.
- .5 Where solid state protection is provided with larger breakers, test units as follows:
 - .1 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.
 - .2 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instruction.
 - .3 If the manufacturer's tester is not available, use an approved relay tester unit with the proper test data and test accessories.
 - .4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of the relay circuit to test the trip operation.
 - .5 Check C/T and P/T ratios and compare to coordination data.
- .3 Air Circuit Breakers:
 - .1 Visual inspection.
 - .2 Clean and lubricate.
 - .3 Contact resistance (doctor) test and adjust contacts.
 - .4 Insulation resistance (megger) test.
 - .5 Mechanical function test.
 - .6 Electrical function test.
 - .7 Test and calibrate, to settings provided, all elements of solid state trip unit as described in the Protective Relaying clause.
- .3 Protective Relaying:
 - .1 Installation and testing per High Voltage Power Distribution defined in this section.
- .4 Dry Type Transformer:
 - .1 General
 - .1 Complete verification form for each transformer.
 - .2 Energize transformers and apply incremental loads and document test results.
- .5 Wiring & Cables:
 - .1 General
 - .1 Test conductors at distribution centres and panel boards for insulation resistance to ground (megger test).
 - .2 Test service grounding conductors for ground resistance.
 - .3 Provide Department Representative with list of test results on approved verification form showing location at which each test was made, circuit tested and results of each test.

- .4 Remove and replace entire length of cable if cable fails to meet any of the test criteria.
- .6 Grounding:
 - .1 Perform ground continuity and resistance test using method appropriate to site conditions and to approval of Department Representative and local authority having jurisdiction over installation.
 - .2 Perform tests before energizing electrical distribution.
 - .3 Disconnect ground fault indicator during tests.
 - .4 Provide test report documenting successful test results.
- .7 Metering and Switchboard Instruments:
 - .1 Inspection and testing per High Voltage Power Distribution as defined in this section.
- .8 Miscellaneous Equipment:
 - .1 Complete equipment verification forms.
 - .2 Conduct visual inspection.
 - .3 Perform operational check.

3.8 EMERGENCY POWER DISTRIBUTION

- .1 Automatic Transfer Switch:
 - .1 Torque test all bus joints and cable termination and seal with red lacquer.
 - .2 Conduct megger test.
 - .3 Power up control circuits, simulate loss of normal power and function all devices including timers.
 - .4 Apply device settings as specified.
 - .5 Wiring checks:
 - .1 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three line diagrams and project specifications.
 - .2 Test each circuit for continuity using a buzzer or similar device.
 - .3 All current circuits shall be injected, all voltage circuits shall be powered at 120V, all devices functioned and checked against control schematic diagram.
 - .4 Check polarity and verify phase relationships on all three phase metering circuits.
 - .5 Where errors are discovered and changes required, mark-up vendor prints describing corrective action required.
 - .6 Demonstrate to Department Representative the following tests:
 - .1 CDP-E2B and CDP-E1A circuit breaker feeding to ATS-4 MCC-EH through ATS-4 will be normally closed all time in Auto position.

- .2 Preferred source is CDP-E2B circuit breaker feeding to ATS-4 and non-preferred source is CDP-E1A circuit breaker feeding to ATS-4 for MCC-EH load.
- .3 Set selector switch in "test" position to ensure preferred source CDP-E2B is feeding MCC-EH through ATS-4 will transfer to non-preferred source side CDP-E1A side and feeding to MCC-EH through ATS-4. Conduct retransfer test also.
- .4 Set selector switch in "manual" position and check to ensure proper performance of transfer switch
- .5 Set selector switch in "auto" position and open CDP-E2B circuit breaker feeding to ATS-4 supports MCC-EH load. Transfer switch will transfer to non-preferred source CDP-E1A side and now CDP-E1A circuit breaker feeding to ATS-4 supports MCC-EH. Repeat reverse procedure and ensure ATS-4 will retransfer from non-preferred source to preferred source side to support MCC-EH load.
- .6 Provide test report documenting test results. Report to include transfer and retransfer preferred to non-preferred source times.

3.9 SYSTEMS DEMONSTRATIONS

- .1 Primary Switchgear and Normal Power System
 - .1 Circuit breaker operation
 - .2 Transformer operation
 - .3 Ground fault protection
 - .4 Solid state circuit breaker setting
 - .5 Operation of digital metering
- .2 Secondary Switchgear and Normal Power System
 - .1 Circuit breaker operation
 - .2 Transformer operation
 - .3 Ground fault protection
 - .4 Solid state circuit breaker setting
 - .5 Operation of digital metering
- .3 Power Factor Capacitor System
 - .1 Power factor control panel operation and setting
- .4 Automatic transfer switch System
 - .1 Transfer switch operation and setting

3.10 INSTRUCTION SEMINARS

- .1 Provide instruction seminars for the following systems:
 - .1 Primary Switchgear and metering
 - .2 Secondary switchgear and metering
 - .3 Power distribution units (PDUs)

- .4 Power Factor Capacitor
- .5 Emergency power system and transfer scheme
- .2 For these instruction seminars, give operations and maintenance instructions on each system. Use qualified representatives of manufacturers and sub-trade representatives who are familiar with the systems and provide complete and accurate information.

END OF SECTION