



Public Works and Government Services Canada

Requisition No. EZ899-162116

DRAWINGS & SPECIFICATIONS
for:
NRCAN – Security System Upgrades
Pacific Forestry Centre
Victoria, B.C.


Project No.: R076291.001

APPROVED BY:



Regional Manager, AES

2015-12-23
Date



Construction Safety Coordinator

2015-12-23
Date

TENDER:



Project Manager

2015-12-23
Date

PROJECT NO. R.076291.001
NRCAN – SECURITY SYSTEM UPGRADES
PACIFIC FORESTRY CENTRE
VICTORIA, B.C.

Section 00 01 07
SEALS PAGE

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CONSULTANTS – SEAL & SIGNATURE

Electrical
Stantec Consulting Ltd.



(Professional's Seal and Signature)

Dec 21 2015

Date

END OF SEALS PAGE

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END OF PROJECT DRAWING LIST

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises the general construction, electrical construction, security construction and the provisions (supply & install) of the required door hardware to suit the Security System Upgrades project at the Pacific Forestry Centre Building, Victoria, B.C. The work is to include all active and passive hardware, equipment, devices, system software described herein and within the contract documents. The contractor is responsible for delivering the following complete and fully functioning systems: video surveillance (IP-CCTV), access control (ACS), and the stand-alone public address/paging (P/A). NOTE: The P/A scope is on-hold at the date of tender issue.

1.2 TIME OF COMPLETION OF THE WORK

- .1 The Contractor shall achieve the date of completion of the Work within 10 weeks:
 - .1 From the date of notification of award of contract.
 - .2 Schedule:
 - .1 Construction 8 Weeks;
 - .2 Equipment Installation 3 Weeks;
 - .3 Final Commissioning 1 Week;
 - .4 Work defined above to follow under the construction period from the project start date to the date of Substantial Performance.
- .2 The Contractor shall commence work immediately upon official notification of acceptance of offer.

1.3 CONTRACTOR AND SUBCONTRACTOR QUALIFICATIONS – Not Applicable

1.4 SPECIAL COORDINATION AND SCHEDULING

- .1 The Contractor's attention is specifically drawn to the following areas of the work with respect to coordination and scheduling:
 - .1 Work will proceed in one phase as described on the drawings. The drawings are a guide to the requirements for this project. The Contractor is required to provide detailed coordination scheduling of the work within each phase. Provide detailed schedules where the renovation will affect the operations of the facility.
 - .2 Procurement of all items required for the renovation and construction, installation and testing – The existing facility operates from **8:00am to 6:00 pm, 5 days a week** and therefore any disruptions caused by construction/renovation must be kept to a minimum, The Contractor is advised that prior to commencement of work in the areas to be renovated all products, materials and supplies must be procured, and available for installation and testing. This must be scheduled, logged and verified to the Departmental Representative. All work must be scheduled in detail; reviewed with the Departmental Representative and the Pacific Forestry Centre and agreed to.
 - .3 Coordination of Division 26, 27 & 28.
 - .4 Commissioning of systems, commissioning with other trades, access and egress.
 - .5 Construction, Review and Acceptance by the Departmental Representative and National Research Council (NRC).
 - .1 As renovation/construction proceeds and as areas of the work is commissioned provide a detailed process acceptable to NRC.
 - .6 Commissioning of systems, commissioning with other trades, access and egress.
 - .7 Procurement of critical items: Division 27 & 28 items such as but not limited to commercial door hardware.

1.5 WORK AFFECTING THE EXISTING BUILDING

- .1 Work Sequence Requirements
 - .1 The Contractor's attention is specifically drawn to the following areas of the work with respect to coordination and scheduling:
 - .1 The work is to be completed as described on the drawings.
 - .2 Contractor is advised that work is required in all areas of the existing facility. For any and all work required on the existing roof and any area within the building, the Contractor must consult with the Departmental Representative and NRC prior to commencing work that portion of the work.
 - .3 A complete and detailed schedule of the work must be provided for approval by the Departmental Representative prior to commencing the work.

- .4 The Contractor must include all costs for the work affecting the existing building. The Contractor must factor in the overall project schedule the requirements for completing the work affecting the existing building. This includes sequencing the work to accommodate all operational requirements of the occupants of the existing building. NRC must be consulted.
- .2 Continued Occupancy
 - .1 The existing facility operates from **8:00 am to 6:00 pm, 5 days a week**. The existing operations and security of the building must be maintained at all times.
 - .2 The Contractor must include in the contract all temporary measures required and with the approval of NRC to facilitate the requirements for new construction/renovation work.
- .3 Alteration Project Procedures
 - .1 No services may be disrupted at any time that affect the operation of the existing building or the occupants.
 - .2 If existing services are affected to accomplish installation of new work consult with NRC regarding procedures. This must be shown in the project schedule. All costs must be included, no exceptions or additional costs will be considered.

1.6 HEALTH AND SAFETY OF BUILDING OCCUPANTS

- .1 Refer to Section 01 35 33 Health and Safety.
- .2 The Contractor is to provide contingencies in the Health and Safety Plan should the air in the Work area affect the building occupants.
- .3 The Contractor is to provide detailed scheduling and planning for construction noise generating activities. In general noise generating activities that affect operations will not be tolerated.

1.7 CONTRACTOR USE OF PREMISES

- .1 Hours of Work:
 - .1 Work in the facility on weekdays: **7:00 am to 9:00 pm, 5 days a week**.
 - .2 Weekends or extended hours during the week:
 - .1 A notice to the Departmental Representative must be given.
 - .2 Approval must be obtained from the Departmental Representative & NRC.
 - .3 The services of Commissionaires will be required.
- .2 Contractor shall limit use of premises for Work, for storage, and for access, to allow:
 - .1 Work by other Contractors.
 - .2 Contractor's laydown area will be designated by NRC. All material, tools, product etc. must be in stored in secure containers after hours.
- .3 Coordinate use of premises under direction of Departmental Representative.

- .4 Obtain and pay for use of additional storage or work areas, if needed for operations under this Contract.

1.8 RESPONSIBILITIES

- .1 Departmental Representative Responsibilities:
 - .1 No additional responsibilities except as described in the specifications.
- .2 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Departmental Representative notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .3 Receive and unload products at site.
 - .4 Inspect deliveries jointly with Departmental Representative; record shortages, and damaged or defective items.
 - .5 Handle products at site, including uncrating and storage.
 - .6 Protect products from damage, and from exposure to elements.
 - .7 Assemble, install, connect, adjust, and finish products.
 - .8 Provide installation inspections required by public authorities.
 - .9 Repair or replace items damaged by Contractor or subcontractor on site under his control.

1.9 MINIMUM STANDARDS

- .1 Unless specified otherwise, perform work in accordance with the minimum standards set forth in the National Building Code of Canada, the requirements of the British Columbia Building Code & the Canadian Electrical Code, current editions.

1.10 DRAWINGS AND SPECIFICATIONS

- .1 The Departmental Representative will provide the Contractor with 5 copies of drawings and specifications. The number of copies will be determined by the Departmental Representative.

1.11 GENERAL

- .1 The Contractor shall provide and apply its skill, judgement, expertise and experience as reasonably required to complete the Work and ensure that the Work is performed in a good, proper and workmanlike manner and not less than the accepted construction industry practice of a competent contractor experienced in work similar to the Work to be performed.
- .2 The Contractor and each Subcontractor affirmatively represents that they are skilled and experienced in the performance of the Work as required by this Project and in the use and interpretation of drawings and specifications such as those included in the Contract

Documents; that they have carefully reviewed the drawings and specifications of this Project and that their Contract is based solely on these Documents, not relying in any way on any explanations or interpretations - oral or written - from any other source. The Contractor agrees that it has exercised its aforementioned skill and experience and found the drawings and specifications sufficient and free from ambiguities, errors, or omissions for the purpose of determining its Contract for the performance of the Work in conformity with the drawings, specifications, and all other Contract Documents.

- .3 The Contractor shall report any error, inconsistency or omission in the Contract Documents it might discover, such review to be to the best of the Contractor's knowledge, information and belief.
- .4 The Contractor shall provide sufficient and adequate labour, materials and construction equipment necessary to properly correlate all phases of the Work to the end that the approved Construction Schedule can be maintained and the date of Substantial Performance of the Work be met. Each Contractor is responsible for all necessary development of the Work to fulfill the intent of the Contract Documents for a complete and/or functioning system whether totally defined by the drawings and specifications or not.
- .5 Each Contractor is responsible for all necessary development of the Work to fulfill the intent of the Contract Documents for a complete and/or functioning system whether totally defined by the drawings and specifications or not. In no case shall the Contractor or any of its Subcontractors proceed with work in uncertainty. The Contractor shall submit a Request For Information for items requiring direction or further clarity. Refer to the subsection herein.

1.12 PROJECT INFORMATION AND COMMUNICATION

- .1 Information and communication required to carry out the Work of the project issued by the Departmental Representative or the Contractors shall be in electronic form. This Information and communication may be but is not limited to the following:
 - .1 Project Drawings and Specifications
 - .2 Contractor submittals
 - .3 Requests for Information.
 - .4 Other forms of project communication.
- .2 The Departmental Representative requires that the contractor set up an internet site organized to accommodate the required project information and communication.
- .3 The Contractor shall manage the site and ensure that the information is up to date. The Contractor shall notify the appropriate parties of information that is uploaded and updated onto the site.
- .4 The Departmental Representative, Contractor, other contractors and subcontractors must have rights to access the site.

1.13 COORDINATION

- .1 Coordinate construction activities included in various sections of the specifications to assure efficient and orderly installation of each component. Coordinate construction

operations included under different sections that depend on each other for proper installation, connection and operation.

- .2 Where the installation of one component depends installation of other components before or after its own installation, schedule activities in the sequence required to obtain the best results.
- .3 Coordinate installation of different components to assure maximum accessibility for maintenance, service and repair.
- .4 Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- .5 Coordinate space requirements and installation of the electrical & security work which are indicated diagrammatically on drawings. Follow routing shown for ducts, and conduit, as closely as practicable; place runs parallel with line of building.
- .6 In finished areas except as otherwise indicated, conceal pipes, ducts and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- .7 Coordinate completion and clean-up of Work of separate sections in preparation for portions of the Work designated for the Departmental Representative's partial occupancy.
- .8 After Departmental Representative occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with the Contract Documents, to minimize disruption of Departmental Representative activities.

1.14 COORINATION OF ELECTRICAL AND SECURITY SERVICES WITHIN AND ABOVE CEILINGS

- .1 Before commencing installation of any electrical services and components within and above ceilings, prepare drawings showing proposed layouts for Departmental Representative's review and approval.
- .2 Electrical services include, but are not limited to conduit runs and junction boxes, speakers, detectors, and access doors and panels.
- .3 Include plan layouts and sections on drawings.
- .4 Do not commence with installation until layouts are reviewed and approved by the Departmental Representative.
- .5 Remove services installed before Departmental Representative's review and approval, and reinstalled in an acceptable manner, at no cost.
- .6 Comply with layouts approved by Departmental Representative. If changes to layouts are necessary, obtain Departmental Representative's approval of changes before proceeding with them.

1.15 DOCUMENT CROSS-CHECK

- .1 The Contractor and their Subcontractors shall review all current drawings and relevant specifications. Should specifications conflict with drawings, request clarification from the Departmental Representative before proceeding.

- .2 Electrical & Security Subcontractors shall review and become familiar with the drawings for the required work.
- .3 Work affecting the existing structural members must be identified and approvals received prior to commencement of the work.
- .4 All costs resulting from work, including labour, materials, equipment, miscellaneous requirements related to work of other Subcontractors and/or required by coordination of other Subcontractors, is to be included. No additional costs will be considered.

1.16 REQUEST FOR INFORMATION

- .1 Maintain a Request For Information system for questions regarding clarifications. A Request For Information (RFI) will be a written document submitted in electronic form which includes, as a minimum, the following details: Hand-written RFI's will not be accepted.
 - .1 Date.
 - .2 References to drawings and/or specifications.
 - .3 Location of the work item in question.
 - .4 Complete description of the question.
 - .5 Affect this item will have on other work or the construction schedule.
 - .6 Suggested solution to resolve the question(s) - MANDATORY.
 - .7 Date that response information is required.
- .2 An RFI form is to be prepared with headings and spaces for this information to be filled in.
- .3 Allow 3 working days for response to a RFI.
- .4 The Departmental Representative's response does not authorize changes in the Contract Price or Contract Time (Construction Schedule).
- .5 RFI's are intended for clarification of drawings and specifications. RFI's shall not be used by the Contractor to identify potential errors or omissions in the Contract Documents, communicate directly with the Departmental Representative for clarification in this case.

1.17 DOCUMENTS

- .1 The Contractor is responsible for requesting any additional instructions or clarifications that may be required from the Departmental Representative which are needed for the performance of the Work and shall request such instructions or clarifications in time to avoid any delay in the Work.
- .2 Notwithstanding the foregoing, inconsistencies and omissions shall not include lack of reference on the drawings or in the specifications to labour or Products that are required or normally recognized within respective trade practices as being necessary for the complete execution of the Work.

- .3 Where “Notes” are included on the drawings, such work shall be included in the Contract Price. It is the Contractor’s and Subcontractor’s responsibility to review all “Notes” and include all related costs in the Work to perform the work identified in the “Notes”. If the bidders require clarification of the scope of a “ Note” such clarification shall be made prior to the tender closing, no additional costs will be considered by the Departmental Representative for bidder’s failure to include all work associated with the “Notes”.
- .4 Where typical is noted on the drawings, the requirements of the work apply to all conditions whether or not shown for each specific condition. The typical conditions apply to all subtrades work. It is the Contractor’s and Subcontractor’s responsibility to review the requirements and include all costs, no additional costs will be considered by the Departmental Representative for bidder’s failure to include all work considered to be typical.
- .5 The Project consists of Products and assemblies that may require the work of more than one trade to complete. The Contractor, its Suppliers, manufacturers, architectural trades, mechanical trades, electrical trades and specialty trades are advised that all materials, products, cutting, fitting, patching, scheduling, coordination, and site conditions must be taken into account for the completion of the work and included in the Contract Price, no claims for additional costs will be considered by the Departmental Representative for failure to do so.

1.18 SPECIFICATION

- .1 The specifications and drawings are arranged in a manner to indicate the content of the Work. These sections do not however obligate the Departmental Representative to establish limits or limit the responsibility of any Subcontractor or Supplier. The onus for defining the extent of the Subcontractor's work remains with the Contractor to interpret all documents as a whole, and who will ensure that when awarding subcontracts, the area or scope of responsibility of any particular Subcontractor or Supplier is set out in full detail.
- .2 Division 1 of the specification specifies Work that is the direct responsibility of the General Contractor, administrative procedures and general requirements applying to all Subcontractors. Division 1 shall not be interpreted as defining limits of responsibility between the Contractor and its Subcontractors.
- .3 Ensure that Subcontractors understand that the General Conditions of the Contract and Division 1 apply to sections of the specification governing their Work.
- .4 Wherever in the Contract Documents the words "approval", "approved", "direction", "directed", "selection", "selected", "request", "requested", "report", "reviewed" and similar words are used, such approvals, directions, selections, requests and reports shall be given by the Departmental Representative unless specifically stated otherwise.
- .5 Wherever in the Contract Documents the word "provide" is used in any form, it shall mean that the Work concerned shall include both supply and installation of the products required for the completion of that part of the Work.
- .6 Wherever in the Contract Documents the word "supply" is used in any form, it shall mean that the Work specified to be supplied includes delivery to site and unloading at location directed.

- .7 Wherever in the Contract Documents the word "installed" issued in any form, it shall mean Work specified for installation includes receiving, uncrating, unpacking; moving from stored location to place of installation; and installing to meet specified requirements.
- .8 Wherever in the Contract Documents it is specified that Work is to proceed or to meet approval, direction, selection or request of jurisdictional authorities or others, such approval, direction, selection or request shall be in writing.
- .9 Wherever in the Contract Documents or as directed by the Departmental Representative it is specified that Work is to be repaired, made good or replaced, perform the work without any additional cost to the Contract.
- .10 Wherever in the specifications the term "Related Sections" is used, it shall be taken to mean Work that is directly related to the section but not specified therein. The purpose of this clause is to redirect the reader to other sections of the specification for Work related to this section. This clause shall not be construed as a definition of trade responsibility, nor is it exhaustive in its description of related Sections and is included for convenience only.
- .11 Except where a reference standard is specifically dated in the specifications, references to standards will be taken to mean the latest edition in effect at the date of award of this Contract. In the case of standards (dated or not) which appear in the specifications and which are referenced in either the National Building Code or the British Columbia Building Code, the specific edition of the standard referenced in the code shall govern.
- .12 Where a standard is revised, supplemented or amended after award of the Contract, carry out the Work in accordance with latest edition of such standards. If the revision to the standard is such that a revision to the Contract Price is necessary, submit claims to the Departmental Representative in accordance with provisions of the Contract Documents.

1.19 DRAWINGS

- .1 Refer to Section 01 78 00 Close Out Submittals, for requirement to maintain a system of current drawings at all times.
- .2 Drawings are in part diagrammatic and are intended to convey the content of the Work required and, as such, indicate general and approximate location, arrangement and sizes of materials, elements, fixtures, equipment and outlets. Obtain more accurate information about locations, arrangement and sizes by studying, familiarizing with and correlating the Contract Documents, including coordination with the shop drawings, and becoming totally familiar with conditions and spaces affecting these matters before proceeding with the Work. Where job conditions require reasonable adjustments in the indicated locations and arrangements, make the necessary modifications at no additional cost to the Contract. Similarly, where existing conditions interfere with new installation and required location, include such relocation in the Work of this Contract. Install and arrange fixtures and equipment in such a way as to conserve as much headroom clearance and space as possible.
- .3 The Contractor is responsible for coordination of metric dimensions as shown on the drawings and as specified.

1.20 DOCUMENTS ON SITE

- .1 Maintain at the job site one copy of each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings, product data and samples.
 - .5 Change orders.
 - .6 Other modifications to Contract.
 - .7 Field test reports.
 - .8 National Building Code, the British Columbia Building Code & the Canadian Electrical Code.
 - .9 Copy of all permits from Authorities Having Jurisdiction.
 - .10 Permit drawings.
 - .11 Industrial Health and Safety Regulations of WorkSafeBC.
 - .12 Contractor's Safety Program.
 - .13 Construction schedule.
 - .14 Record drawings.
 - .15 Fire Safety Program.
 - .16 Site reports.
 - .17 Site instructions.
 - .18 WHMIS brochures.

END OF SECTION

Part 1 General

1.1 PURPOSE

- .1 To ensure that both the construction project and the Pacific Forestry Centre's operations may proceed without undue disruption or hindrance and that the security of the Pacific Forestry Centre is maintained at all times.

1.2 DEFINITIONS

- .1 "Contraband" means:
 - .1 an intoxicant, including alcoholic beverages, drugs and narcotics;
 - .2 a weapon or a component thereof;
 - .3 an explosive or a bomb or a component thereof;
 - .4 currency over any applicable prescribed limit, \$500.00, and;
 - .5 any item not described in paragraphs (.1) to (.4) that could jeopardize the security or the safety of persons, when that item is possessed without prior authorization.
- .2 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .3 "NRC" means National Research Council (Canada).
- .4 "PFC" means Pacific Forestry Centre.
- .5 "Manager" means site governance manager of the Pacific Forestry Centre, as applicable.
- .6 "Construction employees" means persons working for the general Contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.
- .8 "Perimeter" means the fenced & parking compound areas of the Pacific Forestry Centre site.
- .9 "Construction limits" means the area, as indicated in the contract documents, that the Contractor will be allowed to work". This area may or may not be isolated from the laboratory areas of the Pacific Forestry Centre. Limits to be confirmed at construction start-up meeting.

1.3 PRELIMINARY PROCEEDINGS

- .1 At construction start-up meeting:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the Pacific Forestry Centre's particular requirements.
- .2 .2 The Contractor's responsibilities:
 - .1 Ensure that all construction employees are aware of the security requirements;
 - .2 Co-operate with Pacific Forestry Centre's personnel in ensuring that security requirements are observed by all construction employees.

1.4 CONSTRUCTION EMPLOYEES

- .1 Entry to Pacific Forestry Centre's property will be refused to any person there may be reason to believe may be a health or security risk.
- .2 Any person employed on the construction site will be subject to immediate dismissal from NRC property if they:
 - .1 appear to be under the influence of alcohol, drugs or narcotics;
 - .2 behave in an unusual or disorderly manner;
 - .3 are in possession of contraband.

1.5 VEHICLES

- .1 All unattended vehicles on NRC property must have windows closed, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle in the event the vehicle is required to be moved.
- .2 The Manager may limit at any time the number and type of vehicles allowed on the premises.
- .3 Drivers of delivery vehicles for material required by the project will be allowed on the premises to coordinate the delivery with the Contractor. Upon delivery they will be required to move their vehicles.
- .4 Where PFC allows trailers to be left inside the site perimeter, the trailer doors must be locked at all times. All windows must be securely locked bars when left unoccupied.

1.6 PARKING

- .1 The parking area(s) to be used by construction employees will be designated by the Pacific Forestry Centre. Parking in other locations will be prohibited and vehicles may be subject to removal.

1.7 SHIPMENTS

- .1 To avoid confusion with the facility's own shipments, address all shipments of project material, equipment and tools in the Contractors name and have a representative on site to receive any deliveries or shipments. PFC or PWGSC staff will **NOT** accept receipt of deliveries or shipments of any material equipment or tools.

1.8 TELEPHONES

- .1 The installation of telephones, facsimile machines and computers with internet connections is not permitted within the facility unless approved by the Manager.
- .2 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, telephone used as 2-way radios are permitted within the facility.
- .3 The Manager may limit the use of 2-way radios, where a disruption to PFC staff should occur.

1.9 WORK HOURS

- .1 Conform to Section 01 11 00.
- .2 A minimum of 72 hours advance notice will be required to obtain permission for work on weekends. In case of emergencies or other special circumstances, this advance notice may be waived by the Manager.

1.10 OVERTIME WORK

- .1 Conform to Section 01 11 00.
- .2 Provide 48 hours advance notice to Manager for all work to be performed after normal working hours of the facility. Notify the Manager immediately if emergency work is required, such as to complete remediation's or make the construction site safe and secure.

1.11 ESCORT (COMMISSIONAIRE)

- .1 General
 - .1 Contractor may require a qualified escort (Commissionaire) during certain times of the work. The Contractor is responsible for providing an estimate of the services (in hours) to be included in their tender submission.
 - .2 The commissionaire will be provided by PWGSC but all related costs for the services of the commissionaire are to be carried by the Contractor in the tender.
- .2 Allowance
 - .1 The Contractor shall allow the following rates for the commissionaire services:
 - .1 Hourly rate of \$29.00 per hour for commissionaire services up to 8 hours per day.
 - .2 Overtime rate of \$43.50 per hour shall apply for services of the commissionaire in excess of 8 hours per day.
 - .3 The Contractor shall review the contract documents, and submit at the time of tender, an estimate of what they regard as the required time needed for the afterhours commissionaire services. This value shall be submitted as a separate line item, with hours and total cost.
- .3 Schedule
 - .1 The Contractor shall provide to the Departmental Representative a minimum of 48 hour notice in advance of when the commissionaire services will be required.
- .4 Payment
 - .1 The cost for the commissionaire will be assessed towards the contract by change order.

1.12 TOOLS AND EQUIPMENT

- .1 Where requested maintain a complete list of all tools and equipment to be used during the construction project.
- .2 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .3 Store all tools and equipment in approved locations.
- .4 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the Contractor. Secure and lock scaffolding when not erected and when erected secure in a manner agreed upon with the Manager.

1.13 SECURITY HARDWARE

- .1 Turn-over all removed door hardware to the Manager for disposal, or for safekeeping until required for re-installation.

1.14 SMOKING RESTRICTIONS

- .1 Smoking is not permitted inside the facility or outdoors within the perimeter of the facility.
- .2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist may be directed to leave the site.
- .3 Smoking is permitted outside the perimeter of the facility in an area designated by the Manager.

1.15 CONTRABAND

- .1 Weapons, explosives, alcoholic beverages, drugs and narcotics are prohibited on NRC property.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Manager.
- .3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in dismissal of the affected employee.

1.16 ACCESS TO AND REMOVAL OF FACILITY PROPERTY

- .1 Construction personnel and commercial vehicles will not be admitted to the facility after normal working hours, unless arranged and approved by the Manager.

1.17 STOPPAGE OF WORK

- .1 The Manager may request at any time that the Contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the facility. The Contractor's site supervisor shall note the name of the PFC member making the request and the time of the request and obey the order as quickly as possible.
- .2 The Contractor shall advise the Departmental Representative within 24 hours of this delay to the progress of the work.

END OF SECTION

Part 1 General

1.1 SCHEDULING PROJECT SCOPE

- .1 Refer to Section 01 11 00 Summary of Work.
- .2 Refer to Section 01 14 10 Security Requirements.
- .3 Review the Time of Completion of the Work and confirm to the Departmental Representative that the work will be completed within the time allotted.
- .4 The contractor must provide detailed schedules of the work as it affects the operations of the facility.

1.2 SYSTEM DESCRIPTION

- .1 Project Time Management: describes processes required to ensure timely completion of Project. These processes ensure that various elements of Project are properly coordinated. It consists of planning, time estimating, scheduling, progress monitoring and control.
- .2 Planning: this is most basic function of management, that of determining presentation of action and is essential.
 - .1 It involves focusing on an objective consideration of future, and integrating forward thinking with analysis; therefore, in planning, implicit assumptions are made about future so that action can be taken today.
 - .2 Planning and scheduling facilitates accomplishment of objectives and should be considered a continuous interactive process involving planning, review, scheduling, analysis, monitoring and reporting.
- .3 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made. This implies progressively more reliability of scheduling data. Detail Project schedule is used for analysis and progress monitoring.
- .4 Ensure project schedule efficiencies through monitoring.
 - .1 When activities begin on time and are performed according to estimated durations without interruptions, original Critical Path will remain accurate. Changes and delays will however, create an essential need for continual monitoring of Project activities.
 - .2 Monitor progress of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that have started but are not yet completed.
 - .3 Monitoring should be done sufficiently often so that causes of delays are immediately identified and removed if possible.
- .5 Project monitoring and reporting: as Project progresses, keep team aware of changes to schedule, and possible consequences. In addition to CPM networks, use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.
 - .1 Narrative reporting begins with statement on general status of Project followed by a summarization of delays, potential problems, corrective measures and Project status criticality.

1.3 SUBMITTALS

- .1 Prepare submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include costs for execution, preparation and reproduction of schedule submittals in bid documents, failure to comply with each required submission, may result in progress payment being withheld.
- .3 Submit letter ensuring that schedule has been prepared in co-ordination with major subcontractors.
- .4 Submit Project planning, monitoring and control system data as required by Departmental Representative in following form:
 - .1 CD files in original scheduling software containing schedule information, clearly labelled with data date, specific update, and person responsible for update.
 - .2 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.
 - .3 Criticality report listing activities and milestones with up to 5 days total float used as first sort for ready identification of critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.
 - .4 Provide listing for each trade, activities due to start, to be underway, and finished. Provide list activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.
- .5 Submit monthly schedule updates and written reports.
- .6 Maintain a submittal log.

1.4 QUALITY ASSURANCE

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including commissioning.

1.5 PROJECT MEETING

- .1 Meet with Departmental Representative within 5 working days of Award of Contract date, to establish scope of Work and approach to project construction operations.

1.6 DETAIL SCHEDULE

- .1 Provide detailed project schedule (CPM logic diagram) within 5 working days of Award of Contract date showing activity sequencing, interdependencies and duration estimates. Include listed activities as follows:
 - .1 Work that affects facility operations.
 - .2 Shop drawings.
 - .3 Procurement.
 - .4 Construction.
 - .5 Installation.
 - .6 Site works.
 - .7 Testing.
 - .8 Commissioning and acceptance.
- .2 Clearly show sequence and interdependence of construction activities and indicate:

- .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
- .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
 - .1 Time for submittals, re-submittals and review.
 - .2 Time for fabrication and delivery of manufactured products for Work.
 - .3 Interdependence of procurement and construction activities.
- .3 Include sufficient detail to assure adequate planning and execution of Work. Activities should generally range in duration from 3 to 15 workdays each.
- .3 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow coordination and control of project activities. Show continuous flow from left to right.
- .4 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as an indication of increased risk.

1.7 REVIEW OF THE CPM SCHEDULE

- .1 Allow 5 work days for review by Departmental Representative of proposed schedule.
- .2 Upon receipt of reviewed schedule, make necessary revisions and resubmit to Departmental Representative for review within 3 work days.
- .3 Promptly provide additional information to validate practicability of schedule as required by Departmental Representative.
- .4 Submittal of schedule indicates that it meets Contract requirements and will be executed generally in sequence.

1.8 COMPLIANCE WITH CPM SCHEDULE

- .1 Comply with reviewed schedule.
- .2 Proceed with significant changes and deviations from scheduled sequence of activities which cause delay, only after review by Departmental Representative.
- .3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.
 - .1 Corrective measures may include:
 - .1 An increase of personnel on site for effected activities or work package.
 - .2 An increase in materials and equipment.
 - .3 Additional work shifts.

1.9 PROGRESS MONITORING AND REPORTING

- .1 On an ongoing basis, schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers; as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Departmental Representative at least once monthly to establish progress on each current activity shown on applicable networks.
- .2 Maintain a daily log of progress of the work.

- .3 Perform schedule update monthly status dated on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.
- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Requirements for monthly progress monitoring and reporting are basis for progress payment request.
- .6 Submit monthly schedule updates with the progress payment request.
- .7 Submit monthly written report based on schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:
 - .1 Description of progress made.
 - .2 Pending items and status of: permits, shop drawings, samples, mock-ups, deliveries, Change Orders, possible time extensions.
 - .3 Status of Contract completion date and milestones.
 - .4 Current and anticipated problem areas, potential delays and corrective measures.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 91 41 - Demonstration and Training.
- .2 Section 01 78 00 - Closeout Submittals.

1.2 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Substitutions must be submitted in accordance with the requirements specified in section 01 61 00. Substitutions will not be reviewed until approval from the Departmental Representative is obtained.
- .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5 Where items or information is not produced in SI Metric units converted values are acceptable.
- .6 Review submittals prior to submission to 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 shall be considered rejected.
- .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .11 Keep one reviewed copy of each submission on site.
- .12 Maintain a submittal log.

1.3 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 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 coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .3 Allow 5 working days for Departmental Representative's review of each submission.
- .4 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.
- .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.
- .6 Accompany submissions with transmittal letter, in duplicate, 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.
- .7 Submissions shall 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.

- .8 After Departmental Representative's review, distribute copies.
- .9 Submit one electronic copy of shop drawings for each requirement requested in specification Sections and as consultant may reasonably request.
- .10 Submit one electronic copy 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. Notwithstanding the foregoing, submit full shop drawings including but not limited to the following items: toilet partitions, washroom accessories (provide layout drawing), detention and commercial doors and frames, detention windows, and chain link fencing.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 Shop drawings will be reviewed by the Departmental Representative for general conformance with the design concept of the project and general compliance with information given in the Contract Documents. The Departmental Representative will signify the status of the review by stamping and dating the electronic copy accordingly, in one of the following manners:
 - .1 Reviewed
 - .2 Reviewed as Noted.
 - .3 Revise and Resubmit
 - .4 Not Reviewed

The Departmental Representative will return the electronic copy to the Contractor for their use and for copying for record keeping purposes and for distribution to Subcontractors and to suppliers.
- .14 The Contractor shall distribute copies of the returned shop drawings by the Departmental Representative as **“Reviewed”**, **“Reviewed as Noted”** to the Site Office and to the offices of Subcontractors, and suppliers.
- .15 Shop drawings stamped **“Revise and Resubmit”** or **“Not Reviewed”** will be returned and shall be corrected and resubmitted to the Departmental Representative following the requirements stated above.
- .16 Only shop drawings stamped **“Reviewed”** and **“Reviewed as Noted”** shall be used on the site and used for fabrication and installation of work. All other shop drawings shall be considered as being not reviewed and shall not be used on site or for fabrication and installation of work.
- .17 Conform to review comments and stamped instructions of each shop drawing reviewed.
- .18 Only drawings noted for revision and re-submission need be resubmitted. Include revisions required by previous reviews before re-submission of shop drawings.
- .19 No new details or information shall be added to shop drawings after they have been fully reviewed.
- .20 No work dependent on shop drawing information shall proceed until review is given and verification received from the Consultant. Be responsible for work performed prior to

- receipt of reviewed shop drawings. No review comments shall be construed as authorization for Changes in the Work.
- .21 Each subcontractor or supplier shall fabricate work exactly as shown on shop drawings and if shop practice dictates revision, shall revise shop drawings and resubmit.
 - .22 File one copy of each finally revised and corrected shop drawing on site.
 - .23 Consider this article the minimum requirement. Further instruction contained in any particular specification section governs for that section of the Work.
 - .24 Shop drawings must be in Metric measurement.
 - .25 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general concept. This review shall not mean that PWGSC 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 all requirements of construction and Contract Documents. 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 all sub-trades.
 - .26 The Contractor will have a system in place to allow the Departmental Representative, Contractor and its Subcontractors to have electronic access to the project submittals, shop drawings, project communication and latest drawings on file through an internet site. The Contractor and its Subcontractors are required to access the system to obtain the latest drawings on which their shop drawings will be based. If shop drawings are submitted based on out dated drawings shop drawings will be returned without further action. The users of the electronic system, once entered into the system, will be informed electronically of updated drawings available to them on the system. Photo copies of the Departmental Representatives design drawings will not be accepted.
 - .27 The Departmental Representative's CAD files shall not be used by the Contractor, its Subcontractors or Suppliers for use in preparing shop drawings.
 - .28 A copy of final reviewed shop drawings in electronic format shall be included in operating and maintenance manuals specified under Section 01 78 00.

1.4 CERTIFICATIONS

- .1 When specified in individual specification sections, submit certification by manufacturer to the Departmental Representative to indicate material or product conforms to or exceeds specified requirements.
- .2 Certificates may be recent or previous test results on material or product, but must be acceptable to the Departmental Representative.

1.5 MANUFACTURER'S FIELD REPORTS

- .1 Submit reports for the Departmental Representative's benefit as contract administrator.
- .2 Submit reports in duplicate within 5 days of observation, to the Departmental Representative for information.

- .3 Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the Contract Documents.

1.6 PROGRESS DIARY

- .1 Keep a permanent, written record on the site of the progress of the Work. Keep record open to the inspection of the Departmental Representative, and copies shall be furnished to the Departmental Representative upon request.
- .2 The diary shall record all pertinent data such as:
 - .1 Commencement, progress and completion of various portions of the Work.
 - .2 Dates of all site meetings.
 - .3 Dates of visits or inspections by government authorities, inspectors, utility companies and any other visitors to the site.
 - .4 Record of work force employed.
 - .5 Information required by Contractor or Subcontractor. Clarifications requested and answers received.
 - .6 Materials causing delay.
 - .7 Actions or events causing delay.
- .3 Record of all quality control inspections and fire safety inspections including corrective actions taken.

1.7 PHOTOGRAPHS

- .1 Provide a digital photographic record/history of the progress of the Work. The record to include electronic files and hard copies of each photograph taken.
- .2 Take a minimum of 25 digital photographs monthly showing the progress of the Work for each system showing progression of the work.
- .3 Upon completion of the Work submit a labelled compact disk(s) containing the record of all photographs.

1.8 CERTIFICATES AND TRANSCRIPTS

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Government of Canada:
 - .1 Canada Labour Code – Part II
 - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA):
 - .1 CSA S269.1, Falsework for Construction Purposes.
 - .2 CSA Z797-2009 Code of Practice for Access Scaffold.
 - .3 CSA-S350, Code of Practice for Safety in Demolition of Structures.
- .4 Fire Protection Engineering Services, HRSDC:
 - .1 FCC No. 301, Standard for Construction Operations.
 - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia:
 - .1 Workers Compensation Act Part 3 Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation.

1.2 RELATED SECTIONS

- .1 Refer to the following current NMS sections as required:
 - .1 Project Management and Coordination: Section 01 31 00
 - .2 Submittal Procedures: Section 01 33 00
 - .3 Security Requirements Section 01 14 00
 - .4 Temporary Utilities: Section 01 51 00
 - .5 Construction Facilities: Section 01 52 00
 - .6 Temporary Barriers and Enclosures: Section 01 56 00

1.3 WORKSAFEBC COVERAGE

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.
- .2 Maintain WorksafeBC coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

- .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations

1.5 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Work affected by the submittals shall not proceed until the review is complete.
- .3 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by federal and provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .5 Emergency procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within five working days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative for review upon request.
- .5 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.
- .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative.
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
 - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 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.

- .3 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

1.7 HEALTH AND SAFETY COORDINATOR

- .1 The Health and Safety Coordinator must:
 - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
 - .2 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.
 - .3 Be on site during execution of work.

1.8 GENERAL CONDITIONS

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
 - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
 - .2 Secure site a night time or provide security guard as deemed necessary to protect site against entry.

1.9 REGULATORY REQUIREMENTS

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.10 WORK PERMITS

- .1 Obtain specialty trade permits related to project before start of work.

1.11 FILING OF NOTICE

- .1 The General Contractor is to complete and submit a Notice of Project as required by provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

1.12 HEALTH AND SAFETY PLAN

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/Representative procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and recordkeeping procedures.
 - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
 - .3 List hazardous materials to be brought on site as required by work.
 - .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
 - .5 Identify personal protective equipment (PPE) to be used by workers.
 - .6 Identify personnel and alternates responsible for site safety and health.
 - .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.13 EMERGENCY PROCEDURES

- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
 - .1 Designated personnel from own company.
 - .2 Regulatory agencies applicable to work and as per legislated regulations.
 - .3 Local emergency resources.
 - .4 Departmental Representative site staff.

- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative site staff.
 - .7 Follow the direction of the PFC manager.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Underground work.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.14 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during “off hours” when tenants have left the building.
 - .3 Provide adequate means of ventilation in accordance with Section 01 51 00.

1.15 ELECTRICAL SAFETY REQUIREMENTS

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
 - .1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

- .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.16 ELECTRICAL LOCKOUT

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a logbook for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.17 OVERLOADING

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.18 FALSEWORK

- .1 Design and construct falsework in accordance with CSA S269.1.

1.19 SCAFFOLDING

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 Code of Practice for Access Scaffold and B.C. Occupational Health and Safety Regulations.

1.20 CONFINED SPACES

- .1 Carry out work in confined spaces in accordance with provincial regulations.

1.21 POWDER-ACTUATED DEVICES

- .1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

1.22 FIRE SAFETY AND HOT WORK

- .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.23 FIRE SAFETY REQUIREMENTS

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.24 FIRE PROTECTION AND ALARM SYSTEM

- .1 Fire protection and alarm systems shall not be:
 - .1 Obstructed.
 - .2 Shut-off.
 - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.25 UNFORESEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

1.26 SITE AND FACILITY EMERGENCY EGRESS

- .1 Existing site and or facility exits or paths of egress to exits shall not be impeded by the Contractors' work during the course of construction.

1.27 CONTRACTOR SITE PLAN DRAWING

- .1 Submit a contractor site plan drawing for review by the Department Representative, showing project layout, locations of the first-aid station, evacuation route and marshalling station, contractor fencing, contractor hoarding, site office(s), contractor toilet facilities, emergency transportation provisions, as well as the site and facility exiting.

1.28 POSTED DOCUMENTS

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Contractor site plan drawing(s)
 - .5 Notice of Project.
 - .6 Floor plans
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
 - .9 Material Safety Data Sheets (MSDS).
 - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.29 MEETINGS

- .1 Attendance is imperative at health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.30 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a “stop work order” if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a “stop work order”.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBCC); the British Columbia Building Code (BCBC) and the Canadian Electrical Code (CEC), current editions, including all amendments and other codes of provincial or local application provided, up to tender closing date. In the event of conflict or discrepancy, the more stringent requirements will apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 SECURITY REQUIREMENTS

- .1 Comply with the requirements in section 01 14 10 Security Requirements.
- .2 Comply with any additional operational requirements established by NRC - Pacific Forestry Centre.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.
- .2 Smoking is permitted on the site outside the perimeter fence in a designated area defined by NRC Pacific Forestry Centre.

END OF SECTION

Part 1 General

1.1 ASSOCIATIONS

- .1 AA - Aluminum Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006
URL <http://www.aluminum.org>
- .2 AASHTO - American Association of State Highway and Transportation Officials, 444 N
Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL
<http://www.aashto.org>
- .3 ACEC Association of Consulting Engineers of Canada, 130 Albert Street, Suite 616,
Ottawa, ON. K1P 5G4 URL <http://www.acec.ca>
- .4 AHA - American Hardboard Association, 1210W Northwest Hwy., Palatine, Illinois,
U.S.A. 60067 URL : <http://www.hardboard.org>
- .5 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140,
Englewood, Colorado, U.S.A. 80112 URL <http://www.aitc-glulam.org>
- .6 AMCA - Air Movement and Control Association Inc., 30 West University Drive,
Arlington Heights, Illinois, U.S.A. 60004-1893 URL <http://www.amca.org>
- .7 ANSI - American National Standards Institute, 25 West 43rd Street, 4th Floor, New
York, New York, U.S.A. 10036 URL <http://www.ansi.org>
- .8 APA - The Engineered Wood Association, P.O. Box 11700, Tacoma, Washington,
U.S.A. 98411-0700 URL <http://www.apawood.org>
- .9 API - American Petroleum Institute, 1220 L St. Northwest, Washington, D.C., U.S.A.
20005-4070 URL <http://www.api.org>
- .10 ARI - Air Conditioning and Refrigeration Institute, 4100 N Fairfax Drive, Suite 200,
Arlington, Virginia, U.S.A. 22203 URL <http://www.ari.org>
- .11 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers,
1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL <http://www.ashrae.org>
- .12 ASME - American Society of Mechanical Engineers, ASME Headquarters, 3 Park
Avenue, New York, New York, U.S.A. 10016-5990 URL <http://www.asme.org>
- .13 ISAP - International Society for Asphalt Paving, 400 Selby Avenue, Suite 1, St. Paul,
MN 55102 U.S.A. URL <http://www.asphalt.org>
- .14 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West,
Conshohocken, Pennsylvania 19428-2959 URL <http://www.astm.org>
- .15 AWCI - Association of the Wall and Ceiling Industries International, 803 West Broad
Street, Suite 600, Falls Church, VA, U.S.A. 22046 URL <http://www.awci.org>
- .16 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516-4 Street
West, High River, Alberta T1V 1B6 URL <http://www.awmac.com>. Alexandria, VA
U.S.A. 22314-1757 URL <http://www.awpa.org>
- .17 AWPA - American Wood Preservers' Association, P.O. Box 5690, Granbury Texas,
U.S.A. 76049-0690 URL <http://www.awpa.com>

- .18 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 URL <http://www.amweld.org>
- .19 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 URL <http://www.awwa.org>
- .20 CCA Canadian Construction Association, 75 Albert St., Suite 400 Ottawa, Ontario, K1P 5E7 URL <http://www.cca-acc.com>
- .21 CCDC Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC
- .22 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL <http://www.cga.ca>
- .23 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 0S5 URL <http://w3.pwgsc.gc.ca/cgsb>
- .24 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8 URL <http://www.cisc-icca.ca>
- .25 CLA - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, Ontario, K1N 8C7 URL <http://www.cla-ca.ca>
- .26 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL <http://www.canadanursery.com>
- .27 CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 1300, Ottawa, Ontario K1P 6L1 URL <http://www.roofingcanada.com>
- .28 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL <http://www.csa-international.org>
- .29 CSC - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, Ontario M5A 4K2 URL <http://www.csc-dcc.ca>
- .30 CSDMA - Canadian Steel Door Manufacturers Association, One Yonge Street, Suite 1801, Toronto, Ontario M5E 1W7
- .31 CSPI - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cspi.ca>
- .32 CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, Ontario N3H 4V6 URL <http://www.cssbi.ca>
- .33 CUFCA Canadian Urethane Foam Contractor's Association, Box 3214, Winnipeg, Manitoba, R3C 4E7 URL <http://www.cufca.ca>
- .34 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 URL <http://www.cwc.ca>
- .35 EC - Environment Canada, Conservation and Protection, Inquiry Centre, 351 St. Joseph Blvd, Hull, Québec KIA 0H3 URL <http://www.ec.gc.ca>
- .36 EFC - Electro Federation of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL <http://www.electrofed.com>
- .37 EIMA EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, Georgia U.S.A. 30260 URL <http://www.eima.com>

- .38 FCC - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull, Quebec K1A 0J2 <http://info.load-otea.hrhc-drhc.gc.ca/fire-prevention/standards/commissioner.shtml>
- .39 Federal Halocarbon regulation 2003
- .40 HRSDC Fire Protection - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull, Quebec K1A 0J2 <http://info.load-otea.hrhc-drhc.gc.ca/fire-prevention/standards/commissioner.shtml>
- .41 IEEE - Institute of Electrical and Electronics Engineers, IEE Corporate Office, 3 Park Avenue, 17th Floor, New York, New York U.S.A. 10016-5997 URL <http://www.ieee.org>
- .42 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL <http://www.paintinfo.com>
- .43 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A. 22180-4602 URL <http://www.mss-hq.com>
- .44 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 URL <http://www.naamm.org>
- .45 NABA - National Air Barrier Association, PO Box 2747, Winnipeg, Manitoba R3C 4E7 URL <http://www.naba.ca>
- .46 NEMA - National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL <http://www.nema.org>
- .47 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101 Quincy, Massachusetts, U.S.A. 02269-9101 URL <http://www.nfpa.org>
- .48 NFSA - National Fire Sprinkler Association, P.O. Box 1000, Patterson, New York, U.S.A. 12563 URL <http://www.nfsa.org>
- .49 NHLA - National Hardwood Lumber Association, 6830 Raleigh-La Grange Road, Memphis, TN, U.S.A 38184-0518 URL <http://www.natlhardwood.org>
- .50 NLGA - National Lumber Grades Authority, 406-First Capital Place, 960 Quayside Drive, New Westminster, B.C. V3M 6G2
- .51 NRC - National Research Council, Building M-58, 1200 Montreal Road, Ottawa, Ontario K1A 0R6 URL <http://www.nrc.gc.ca>
- .52 NSPE National Society of Professional Engineers, 1420 King Street, Alexandria, VA U.S.A. 22314-2794 URL <http://www.nspe.org>
- .53 PCI - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, Illinois, U.S.A. 60606-6938 URL <http://www.pci.org>
- .54 PEI - Porcelain Enamel Institute, PO Box 920220, Norcross, GA U.S.A. 30010 URL <http://www.porecelainenamel.com>
- .55 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL <http://www.pwgsc.gc.ca/cgsb>

- .56 RAIC Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, Ontario, K1N 5M3 URL <http://www.raic.org>
- .57 SCC - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL <http://www.scc.ca>
- .58 SSPC - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, Pennsylvania 15222-4656 URL <http://www.sspc.org>
- .59 TPI - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI, U.S.A. 53719 URL <http://www.tpinst.org>
- .60 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062-2096 URL <http://www.ul.com>
- .61 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL <http://www.ulc.ca>

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 56 00 - Temporary Barriers and Enclosures.
- .2 Section 01 35 33 – Health and Safety

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1-GP-189-2000, Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59-2000, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN3-A23.1-/A23.2-2000, Concrete Materials and Methods for Concrete Construction/Method of Test for Concrete.
 - .2 CSA-0121-M1978 (R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-Z321-96, Signs and Symbols for the Occupational Environment.

1.3 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 WORK IN EXISTING BUILDING

- .1 Where required for building security & occupant safety, provide temporary hoarding as directed by PFC and the Departmental Representative. Temporary hoarding must be reviewed and approved by PFC, if the manager requests changes, make changes as requested.
- .2 Where noise and dust making activities are carried out, provide temporary hoarding as directed by PFC and the Departmental Representative. Temporary hoarding must be reviewed and approved by PFC, if the manager requests changes, make changes as requested.

1.5 SCAFFOLDING

- .1 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs, as required for performance of the Work.

1.6 HOISTING

- .1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with subcontractors for use thereof.

- .2 Hoists and cranes shall only be operated by qualified operator.

1.7 SITE ACCESS AND CONTRACTOR LAYDOWN AREA

- .1 The work of this contract is within the perimeter of the existing facility.
- .2 PFC/ & the Departmental Representative will designate a contractor laydown area for this project, if required. The contractor will be required to use this area only for construction operations. Note obtain and follow all rules and regulations.
- .3 Material and equipment deliveries will be through the existing loading area of the facility, without causing interruptions to the regular operation of the facility.
- .4 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .5 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.
- .6 Refer to Section 01 14 10 for additional security requirements.
- .7 Refer to Section 01 35 33 regarding contractor site plan drawing requirements

1.8 CONSTRUCTION PARKING

- .1 Parking will be permitted in areas designated by PFC/ & the Departmental Representative.
- .2 Provide and maintain adequate access to project site.
- .3 Provisions for equipment necessary for the Work of the project to be established when contractor moves on site.
- .4 Contractors' requirements and restrictions to be established when contractor moves on site.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials, where required.
- .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.10 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances, where otherwise advised by PFC/ & the Departmental Representative.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.
- .2 Section 01 35 33 – Health and Safety

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.189M-84, Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978, Douglas Fir Plywood.

1.3 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.4 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs in accordance with WorksafeBC regulations.

1.5 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.6 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public and staff operations. Requirements will be provided when the contractor moves on site.

1.7 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles. Detailed requirements will be provided when the contractor moves on site.
- .2 Refer to Section 01 35 33 regarding Contractor site plan drawing requirements.

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect immediate adjoining site areas, surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.9 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 42 00 - References.
- .2 Section 01 73 00 - Execution.

1.2 REFERENCE STANDARDS

- .1 Within text of specification sections, reference may be made to reference standards. List of standards reference writing organizations is contained in Section 01 42 00 - References.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.3 ACCEPTABLE PRODUCTS

- .1 Materials and products specified by "Prescriptive" or "Performance" specifications: select any material meeting or exceeding specifications.
- .2 Materials specified by reference standard: select any material meeting or exceeding the specified standard.
- .3 Materials specified under "Acceptable Materials" or "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications.
- .4 When materials are specified by a reference standard or by a Prescriptive of Performance specification, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the material or equipment meets or exceeds the specified requirements.

1.4 SUBSTITUTION AFTER CONTRACT AWARD

- .1 No substitutions will be permitted without prior written approval of the Departmental Representative.
- .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
- .3 Proposals will be considered by Departmental Representative if:
 - .1 Materials selected by tenderer from those specified, are not available;
 - .2 Delivery date of materials selected from those materials specified would unduly delay completion of Contract; or

- .3 Alternative material to that specified which is brought to the attention of and considered by Departmental Representative as equivalent to the material specified, and will result in a credit to the Contract amount, or, an increase of value to the project.

1.5 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 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.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 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.

1.6 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.7 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 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .5 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.8 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.

1.9 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 may 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.

1.10 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.

1.11 CO-ORDINATION

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

1.12 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.

1.13 REMEDIAL WORK

- .1 Refer to Section 01 73 00 - Execution.
- .2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .3 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.14 LOCATION OF FIXTURES

- .1 Consider location of security and electrical items indicated as approximate. Ensure camera positions match the intent of the desired field of view.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.15 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.

1.16 PROTECTION OF WORK IN PROGRESS

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

1.17 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.
- .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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 Individual product Sections: cutting and patching incidental to work of section. Advance notification to other sections required.

1.2 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Departmental Representative or separate contractor.
- .2 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Departmental Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.3 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

- .5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of security and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.
- .13 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
- .14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .2 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .3 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .5 Reuse: Repeated use of product in same form but not necessarily for same purpose.
Reuse includes:
 - .1 Salvaging reusable materials from re-modeling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .6 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .7 Separate Condition: Refers to waste sorted into individual types.
- .8 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.
- .9 Waste Audit (WA): Detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction. Indicates quantities of reuse, recycling and landfill.
- .10 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials.

1.2 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit.
 - .2 Waste Reduction Workplan.
 - .3 Material Source Separation Plan.

1.3 MATERIALS SOURCE SEPARATION

- .1 Before project start-up prepare Materials Source Separation Program (MSSP) and provide containers to deposit re-usable and/or recyclable materials of the following:
 - .1 Wood.

- .2 Cardboard.
- .3 Plastics
- .4 Other materials as indicated in technical sections.
- .2 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form:
 - .1 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
 - .2 For each material reused, sold or recycled from project, include amount and the destination.
 - .3 For each material land filled or incinerated from project, include amount of material and identity of landfill, incinerator or transfer station.
- .3 Implement Materials Source Separation Program (MSSP) for waste generated on project in compliance with methods as approved by Departmental Representative.
- .4 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .5 Provide inventory of quantities of demolition materials to be salvaged for reuse, recycling, or disposal.

1.4 DIVERSION OF MATERIALS

- .1 Create a list of materials for separation from the general waste stream and stockpiled in separate containers, in compliance with fire regulations and to Departmental Representative's approval.
- .2 Mark containers and provide instruction on disposal practices.

1.5 STORAGE, HANDLING AND APPLICATION

- .1 Conform to Waste Reduction Work Plan.
- .2 Handle waste materials not being reused, salvaged or recycled in accordance with authority having jurisdiction and fire regulations.
- .3 Collect, handle, store on site and transport off-site, all materials in separated condition, to an approved and authorized recycling facility.
- .4 Provide Departmental Representative with receipts indicating quantity of material delivered to landfill.
- .5 Except as specified otherwise, materials removed from the site become the contractor's responsibility.
- .6 On-site sale of salvaged/recycled material is not permitted.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 RELATED SECTIONS

- .1 Section 01 78 00 - Closeout Submittals.
- .2 Section 01 91 13 - Commissioning.

1.3 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested and adjusted, and are fully operational.
 - .4 Certificates required by Authorities Having Jurisdiction.
 - .5 Commissioning of the systems: Final commissioning reports have been submitted to the Departmental Representative.
 - .6 Operations of systems have been demonstrated to PFC personnel.
 - .7 Work is complete and ready for Final Inspection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 77 00 - Closeout Procedures.
- .2 Section 01 91 13 - Commissioning.
- .3 Section 01 91 41 - Demonstration and Training.

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Interim Completion of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
 - .1 An electronic (soft) copy of the Operating and Maintenance Manual System is required as specified under clause 1.3. Provide 4 sets of the Electronic Operating and Maintenance Manual System to the Departmental Representative.
 - .2 Printed (hard) copies of the Operating and Maintenance Manual System are required as specified under clause 1.4. Provide 4 printed sets of the Operating and Maintenance Manual System to the Departmental Representative.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.3 OPERATING AND MAINTENANCE MANUAL SYSTEM

- .1 In addition to the printed copies, submit provide an Operating and Maintenance Manual System as specified herein.
- .2 System Description and Requirements
 - .1 All as constructed drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format for viewing using the Adobe Acrobat Reader.
 - .2 O&M data and as constructed drawings shall be classified by their corresponding disciplines, including:
 - .1 Electrical
 - .2 BSCS
 - .3 Under each discipline, data shall be grouped into the following four major categories:
 - .1 Basic Documents
 - .1 'Basic Documents' shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M

manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the user. In general the following shall be included unless specifically excluded by the Departmental Representative:

- .1 Introduction
 - .2 Consultant/Contractor/Suppliers List
 - .3 System Description
 - .4 Testing and Commissioning (T&C) Reports
 - .5 Specifications
 - .6 Others as stipulated by the Departmental Representative
- .2 'As-Constructed' Drawings
 - .1 'As-Constructed' drawings shall be converted from the original electronic design files, such as CAD, into PDF format. If only the hard copies of the 'as constructed' drawings are available, they shall be scanned and saved in PDF format. PDF files of the 'As-Constructed' drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:
 - .1 Drawing Number and Title
 - .2 Drawing Notes
 - .3 Major Equipment Locations
 - .3 Equipment Data
 - .1 Equipment data shall be classified into the following categories:
 - .1 Equipment submittals
 - .2 Maintenance Data

1.4 PRINTED COPY MANUALS

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, ceralux bound, 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. 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 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. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD.

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 date of submission;

- .2 names, addresses, and telephone and fax numbers of Contractor, Subcontractors, Suppliers with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
 - .4 copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.
 - .5 all extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification.
 - .6 complete set of all final reviewed shop drawings.
 - .7 certificates of inspection by authorities having jurisdiction.
 - .8 test reports and certificates as applicable.
 - .9 complete set of as constructed drawings.
- .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 clearly 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.
 - .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
 - .6 Training: Refer to Section 01 91 41 - Demonstration and Training.

1.6 'AS CONSTRUCTED' DRAWINGS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .6 Provide an electronic copy of as constructed drawings.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly 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.
- .5 Specifications: legibly 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.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.8 EQUIPMENT AND SYSTEMS

- .1 Each item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. 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 Maintenance Requirements: include routine procedures and checking instructions.
- .5 Include manufacturer's printed operation and maintenance instructions.
- .6 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .7 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .8 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .9 Include test reports as specified in 01 91 13 - Commissioning.
- .10 Additional requirements: As specified in individual specification sections.

1.9 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 location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in the Operating and Maintenance Manuals.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.11 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 location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.12 STORAGE, HANDLING AND PROTECTION

- .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 to satisfaction of Departmental Representative.

1.13 WARRANTIES AND BONDS

- .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 the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.

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Section 01 78 00
CLOSEOUT SUBMITTALS

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- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures

1.2 QUALITY ASSURANCE

- .1 Provide third-party commissioning agent(s) for electrical, building security and communication systems, if required by the manufacturer to maintain warranties, and where acceptable to the Departmental Representative. Provide costs of commissioning in tender price.

1.3 SUBMITTALS

- .1 Submit the names of a minimum three (3) commissioning agents proposed to perform commissioning and testing services, complete with references and resume of each member of the agency who will be doing the work for this project. Submit documentation to confirm agencies compliance with quality assurance provision.
- .2 Upon completion of commissioning services, prepare and submit preliminary report. Prepare final report with corrections and completed work requested, at time of turnover. Submit 3 copies and one electronic PDF file of final reports on approved forms.

1.4 PROCEDURES - GENERAL

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Notify Departmental Representative 3 days prior to beginning of operations.
- .3 Accurately record data for each step.
- .4 Report immediately to Departmental Representative any deficiencies or defects noted during performance of services.

1.5 FINAL REPORTS

- .1 Commissioning agent or the contractor to prepare final reports. Submit Operation and Maintenance manuals, testing results and reports to Commissioning Agent for final submission to Departmental Representative.
- .2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

1.6 COMMISSIONING AGENT'S RESPONSIBILITIES

- .1 Conduct testing and commissioning of the security equipment in accordance with manufacturer's recommendations.
- .2 Conduct electrical testing in accordance with electrical requirements in Division 26. Conduct BSCS testing in accordance with requirements in Division 27 and 28.

- .3 Conduct a room by room inspection and sign off on every detail in each room. Based on the requirements stipulated in the specification provide to the Departmental Representative a full schedule of items to be inspected.
- .4 Room by room inspections to include:
 - .1 Electrical equipment installation and operation.
 - .2 Building Security and Communication Systems installation and operation.
- .5 Conduct a complete inspection of all vertical and horizontal service spaces inside and out including:
 - .1 Electrical systems.
 - .2 Building Security and Communications Systems.
 - .3 Maintenance access.

1.7 PREPARATION

- .1 Provide instruments required for testing.
- .2 Make instruments available to Departmental Representative to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.
- .5 Verify lighting is turned on when lighting is included in cooling load.

1.8 EXECUTION

- .1 Conduct room to room inspection for electrical & BSCS items.
- .2 Test equipment and adjust as required.
- .3 For schedule of Electrical systems requiring testing, start up and verification refer to Division 26, 27 & 28, where it applies to the electrical systems and not the BSCS systems.
- .4 For schedule of Building Security and Communication systems requiring testing start up and verification refer to Division 27 and 28.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 91 13 - Commissioning.

1.2 DESCRIPTION

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of interim completion.
- .2 Departmental Representative will provide list of Pacific Forestry Centre (PFC) personnel to Contractor and coordinate dates and times.

1.3 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct PFC personnel, and provide written report that demonstration and instructions have been completed.

1.4 SUBMITTALS

- .1 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.
- .2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.5 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation.
- .2 Testing & adjusting has been performed in accordance with Section 01 91 13 - Commissioning and equipment and systems are fully operational.
- .3 Provide copies of completed Operation and Maintenance manuals for use in demonstrations and instructions.

1.6 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present.

1.7 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.

- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Fire stopping and smoke seals within electrical assemblies (i.e. inside cable trays, etc.) relating to Divisions 26, 27 and 28 respectively, where applicable.

1.2 REFERENCES

- .1 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Firestop Systems.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures, where required.
- .2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.
- .3 Show location of all seals covered under this section including numbered index of seals and applicable underwriter's listing design.

1.5 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

1.6 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing Products of this section with a minimum of three (3) years experience. Provide a manufacturer's direct technical representative to be on site during initial installation of fire stop systems to train personnel in proper selection and installation procedures. The technical representative shall carry out regular site inspections during the firestopping work to ensure that the installation is carried out in accordance with manufacturer's printed installation instructions and that deficiencies are corrected. Provide qualification documentation to the Departmental Representative when requested.
- .2 Applicator: Approved, certified, licensed or otherwise qualified by the manufacturer of firestopping materials with a minimum of three (3) years proven experience.

- .3 Product: Manufactured under an underwriter's followup program and bearing listing ULC or cUL label.
- .4 Pre-Installation Conference: Convene a meeting between related sections following award of contract to discuss firestopping requirements. Ensure that other sections are aware of the maximum and minimum clearance requirements to the penetration stipulated by the underwriter's design listing.
- .5 Equivalencies: For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgement derived from similar ULC or cUL system designs or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Waste Management and Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products

2.1 GENERAL

- .1 General: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire resistance rated systems.

2.2 MATERIALS

- .1 Firestopping Systems: Tested in accordance with ULC S-115 or CAN4-S115M, listed and certified by a third party testing agency, asbestos free, ULC or cUL labelled, and bearing the following rating:
 - .1 Firestop System Rating: In accordance with the National Building Code.
 - .2 Firestop system shall act as an effective smoke seal and have a flame spread rating less than 25.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

- .5 The fire protection rating of installed firestopping assembly in a non-rated floor or wall assembly shall not be less than twenty (20) minutes when tested in accordance with CAN4-S115M.
- .6 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .8 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .9 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .10 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .11 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 . Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

- .1 Notify Departmental Representative when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at exterior walls.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.

3.5 CLEAN UP

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS & SUMMARY

- .1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.
- .2 Reference to "Electrical Divisions" shall mean all related Electrical Sections and components including Divisions 26, 27, and 28 in the Master Format Specifications.
- .3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.
- .4 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, establishing orderly completion and the delivery of a fully commissioned installation.
- .5 The most stringent requirements of this and other electrical sections shall govern.
- .6 All work shall be in accordance with the Project Drawings and Specifications and their intents, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.
- .7 Provide seismic restraints for all required equipment, piping and ductwork.
- .8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories

1.2 REFERENCES

- .1 Install in accordance with CSA C22.1-15, except where specified otherwise.
- .2 Comply with CSA Electrical Bulletins and local by laws.

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235-83 (R2015).
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SCOPE OF WORK

- .1 Contractor shall supply, install, commission and provide warranty for a complete and fully documented electrical system as per contract drawings and specified herein. The

Work includes all hardware, and services necessary to provide fully functional and coordinated electrical system.

- .2 Component subsystems of the electrical system will include, but are not limited to the following:
 - .1 Demolition and disposal of existing CCTV and Access Control devices;
 - .2 Provide electrical power distribution systems for the new three systems;
 - .3 Provide receptacles and direct connections for all new equipment;
 - .4 Provide complete operational CCTV systems;
 - .5 Provide complete operational Access Control systems integrated with existing equipment;
 - .6 Provide complete operational Public Address Systems (P/A);
 - .7 Provide complete raceway for power, CCTV, Door Access, Paging Systems and communications systems.
- .3 Provide grounding/bonding equipment as per CEC or as indicated in the contract drawings and specifications.
- .4 Provide fire stopping as per code and standards.
- .5 Perform commissioning as per description below.
- .6 Record Drawings and Operations and Maintenance manuals.
- .7 Seismic restraint for all electrical equipment and installations.

1.6 SUBMITTALS

- .1 Submittals to be in accordance with Division 01.
- .2 Submit shop drawings, product data and samples in accordance with Division 01. The submission shall be reviewed, signed and processed as described in Division 01.
- .3 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .4 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.
- .5 Content
 - .1 Shop drawings submitted in accordance with Division 01.
 - .2 Data shall be specific and technical.
 - .3 Identify each piece of equipment.
 - .4 Information shall include all scheduled data.
 - .5 Advertising literature will be rejected.
 - .6 The project and equipment designations shall be identified on each document.
 - .7 Information shall be given in S.I. units
 - .8 The shop drawings/product data shall include:
 - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weight and mounting point loads.
 - .2 Mounting arrangements.
 - .3 Detailed drawings of bases, supports and anchor bolts.

- .4 Control explanation and internal wiring diagrams for packaged equipment.
- .5 A written description of control sequences relating to the schematic diagrams.
- .6 Format
 - .1 Black line prints 216 mm x 280 mm [8-1/2" x 11"] or 280 mm x 430 mm [11" x 17"].
 - .2 Larger drawings may be submitted on reproducible single sheet media (ie not bound) with space for stamps and signatures - master set plus one working copy.
 - .3 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.
- .7 No. of copies
 - .1 Provide number of copies indicated in Section Division 01 with a minimum of 2 copies to be retained by the Departmental Representative.
- .8 Coordination
 - .1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Departmental Representative.
- .9 Keep one [1] copy of shop drawings and product data, on site, available for reference.
- .10 Quality Control: in accordance with Division 01 - Quality Control
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, the electrical "load balance" report.
- .11 Permits and Fees:
 - .1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.
 - .2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.7 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 01 - Quality Control
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians in accordance with authorities having jurisdiction.
 - .1 Employees registered in apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

- .3 Site Meetings: in accordance with Division 01 - Construction Schedule
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - Health and Safety Requirements.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 4 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Division 01 Construction Waste Management and Disposal.

1.9 SYSTEM START-UP

- .1 Refer to Division 01, and as follows.
- .2 Instruct the Departmental Representative and operating personnel in the operation, care and maintenance of equipment.
- .3 Provide manufacturer's factory service engineer to fully commissioning the systems as per the manufacturer recommendations, inform the engineer of the commissioning date minimum 10 working days prior to the actual commissioning date. Provide commissioning formats reports as a part of the shop drawings submittal for approval.
- .4 Arrange and pay for services of manufacturer's factory service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components and fully commissioning the system.
- .5 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.10 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.11 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 - Construction Waste Management and Disposal.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

1.12 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.
- .2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where definite locations are not indicated.
- .3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.

1.13 PROJECT COORDINATION

- .1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Departmental Representative's written approval.
- .2 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.
- .3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Departmental Representative and all affected parties.
- .4 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.14 SPRINKLER PROOF REQUIREMENTS

- .1 In sprinklered rooms where electrical equipment is installed surface mounted, electrical equipment contained in these rooms to be protected by non-combustible driphoods, shields, and gasketed doors as applicable to inhibit water ingress into electrical equipment. Exposed conduits connected to equipment to utilize watertight connectors.

1.15 EQUIPMENT RESTRAINT

- .1 Related Section: 26 05 25 Seismic Restraint.
- .2 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

1.16 WARRANTY

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01.
- .2 Take note of any extended warranties specified.
- .3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance.
- .4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.17 TENDER INQUIRIES

- .1 All contractor queries during the tender period shall be made in writing to the Departmental Representative. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the Departmental Representative's office during tender. All tender queries may be faxed, mailed or couriered to the Departmental Representative's office. No telephone questions will be answered.

1.18 EXAMINATION

- .1 Visit the site before preparing the tender and examine all existing conditions are beneficial to the contractor. No extra cost will be considered for any misunderstanding of work to be done resulting from not visiting the site.
- .2 Examine the documents for details of work included. Obtain a written clarification in the event of conflict within the specification, between the specification and the drawing, or in the drawing. Obtain written clarification from the Departmental Representative if work affecting the installation is not clear. Where this is not done in advance, allow in the tender sum for providing the more costly alternative.

1.19 RESPONSIBILITIES

- .1 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.
- .2 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Departmental Representative during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.
- .3 Protect equipment and material from the weather, moisture, dust and physical damage.

- .4 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Owner.
- .5 Protect all existing services encountered. Obtain instructions from the Departmental Representative when existing services require relocation or modification.
- .6 Refinish damaged or marred factory finish to factory finish.
- .7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Departmental Representative.

1.20 EQUIPMENT LIST

- .1 Submit a completed Equipment List, showing the make of equipment and material included in the Tender, including the names of the subtrades, ten (10) days after the award of the Contract.
- .2 The equipment list shall be a full list of materials or systems intended for installation.

1.21 PROGRESS CLAIM AND CHANGE ORDER BREAKDOWNS

- .1 Ten (10) days after the award of contract, submit detailed price breakdowns for each division.
- .2 Progress claims will not be certified nor payment made beyond 90% of the overall Electrical contract until commissioning and verification of the systems are complete. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems are commissioned.

1.22 PROJECT CLOSE-OUT REQUIREMENTS

- .1 Refer to detailed specifications in each section for detailed requirements. Provide the following list of required substantial completion submissions.
 - .1 Access Control System, Video Surveillance and Public Address commissioning reports.
 - .2 Seismic engineer report and schedules.
 - .3 Final electrical inspector certificate.
 - .4 Record drawings.
 - .5 Operating and maintenance manual.
 - .6 Contractors letter of guarantee.
 - .7 Complete Demonstration of systems to staff.
- .2 Record drawings to be submitted to the Departmental Representative and all life safety systems must be operational, verified and tested and demonstrated to Departmental Representative prior to issuance of Schedule C.

1.23 SUBSTANTIAL PERFORMANCE REQUIREMENTS

- .1 Before the Departmental Representative is requested to make an inspection for substantial performance of the work:

- .1 Commission all systems and prove out all components, interlocks and safety devices.
 - .2 Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed.
 - .3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Departmental Representative, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.
- .2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:
- .1 All reported deficiencies have been corrected.
 - .2 Operating and Maintenance Manuals completed.
 - .3 "As Built" Record Drawings ready for review.
 - .4 Systems Commissioning has been completed and has been verified by Departmental Representative.
 - .5 All demonstrations to the owner have been completed.
 - .6 All documents required have been submitted.
- .3 Substantial Performance will not be granted until the following requirements have been met:
- .1 All items listed in .1 above have been completed or addressed.
 - .2 Certificate of Penetrations through separations have been sealed with certified fire stopping material.
 - .3 Provincial Electrical Inspection - Certificate of inspection.
 - .4 Seismic Engineers letter of Assurance and final inspection report.
 - .5 Certificate of Substantial Performance.
 - .6 Fire alarm verification.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 - Sustainable Requirements: Construction
- .2 Do verification requirements in accordance with Division 01 Sustainable Requirements: Contractor's Verification.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Division 01 and as follows.
- .2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.
- .3 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality available for the intended purpose.
- .4 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Provide all power and electrical system related control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.
- .2 Ground all motors to conduit system with separate grounding conductor in flexible conduit or bonding conductor in the flexible conduit.
- .3 Connections shall be made with watertight flexible conduit with watertight connectors.
- .4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Mechanical Divisions for scope of work and particular details.

2.4 WARNING SIGNS

- .1 Provide warning signs, as specified or to meet requirements of Inspection Department, Consultant and Architect.
- .2 Use decal signs, minimum 175 x 250 mm [7" x 10"] size

2.5 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify all electrical equipment including but not limited to starters, disconnects, remote ballasts and controls with nameplates and labels as follows:
- .2 Nameplates:

.1 Electrical Equipment:

COMPONENT	LABEL TYPE	INFORMATION
Main distribution centre	A	Year installed and name of facility Name of Electrical Engineer and Electrical Contractor
Main Breaker	A	Voltage, phase, amps
Sub-distribution panel	A	Name of panels it is feeding (i.e. Panel A, Panel B)
Panelboards	B	Panel designation (i.e. Panel A, Panel B)
Terminal Cabinet	B	System and Voltage
Disconnect switches	B	Indicate equipment controlled and voltage
Starters/contactors	B	Indicate equipment controlled and voltage
Motor control centre	B	Indicate equipment controlled and voltage
Transformer	B	Transformer designation Circuit and Panel designation

COMPONENT	LABEL TYPE	INFORMATION
Junction boxes, pull boxes	D	Circuit and panel designation
On/Off switches	C	If it is not obvious, then indicate area being served
Fire Alarm Devices (i.e. pull stations, bell, smoke detector, end-of –line)	C	Zone number and device number in that zone (i.e. Zone 1-#3, Zone 10-#7)
Receptacles	C	Circuit/panel designation
Special receptacles	C	Circuit/panel designation and voltage, phase, amps

.2 Label Type:

	LETTER HEIGHT	TYPE	COLOUR
Label Type A	9.5 mm	Lamacoid	White lettering/black background
Label Type B	6.0 mm	Lamacoid	White lettering/black background
Label Type C	3.0 mm	Lamacoid	White lettering/black background
Label Type D	3.0 mm	Adhesive label	As specified

.3 Adhesive Labels:

- .1 Good quality vinyl, self-laminating label as T & B E-Z Code WSL, Dymo Letratag or Brother P-Touch equivalent printable markers. Embossed Dymo or any labels with edges and corners that are prone to lift will be rejected.
- .2 Or as otherwise specified herein.

- .4 Provide plastic covered panel directory with circuits and areas served print in, and mounted on inside of door. Directory shall conform to Record Drawings.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT, CABLE AND PULLBOX IDENTIFICATION

- .1 All junction boxes, pull boxes and their cover shall be painted according to the colour coding schedule.
- .2 All entries to panels, junction boxes, pull boxes and device boxes.

- .3 Code with 25 mm plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.
- .4 Colour coding to be as follows unless otherwise specified:

COMPONENT	RACEWAY AND JUNCTION BOXES	RECEPTACLES AND OTHER
Normal 120/208, 240 volt	Gray	White
Normal 347/600 volt	Sand	White
Emergency 120/208, 240 volt	Green with red bands	Red
Emergency 347/600 volt	Sand with red bands	n/a
Fire Alarm	Red	Strobe (red)
Low voltage		
-switching/controls	Black	
-emergency/exit lighting	Black with red bands	
-security	Black with blue bands	Strobe (blue)
-mechanical alarms	Black with yellow bands	Strobe (amber)

2.9 FINISHES

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.
- .3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.

2.10 ACCESS PANELS (DOORS)

- .1 Unless otherwise noted, access doors shall be minimum: 450mmx450mm [18"x18"] for body entry; 300mmx300mm [12"x 12"] for hand entry.
- .2 Access doors in fire separations of 3/4 hour rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, keyed and self closing.
- .3 Minimum Requirements:
 - .1 180 degree door swing, mitred rounded safety corners flush welded, concealed hinges, screwdriver latches, and anchor straps or lugs to suit construction, all steel prime coated.
 - .2 Plaster or wet wall construction: 14 gauge bonderized steel flush with wall or ceiling type with concealed flange.
 - .3 Masonry or drywall construction: 16 gauge for 400 mm [16"] x 400 mm [16"] and smaller, 14 gauge for 450 mm [18"] x 450 mm [18"] and larger bonderized steel face of wall type with exposed flange.
 - .4 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: 14 gauge stainless steel flush with wall or ceiling type with concealed flange.
 - .5 Acoustical tile ceiling and similar block materials: 14 gauge bonderized steel recessed ceiling type.

- .6 Feature wall construction: Recessed wall type that is selected to complement and conform with the architectural module, treatment, or panelling. The size shall conform to adjacent finishes.
- .7 Access panels in fire separations and fire walls shall have a compatible fire rating and ULC label. (i.e. Acudor Fire Rated FW-5050 or FB-5060).

2.11 FASTENING TO BUILDING STRUCTURE

- .1 General:
 - .1 Do not use inserts in base material with a compressive strength less than 13.79 MPa [2000 psi].
 - .2 All inserts supporting conduit racks shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.
- .2 Types:
 - .1 Cast-in-place type:
 - .1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.
 - .2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to 200 mm [8"] pipe size.
 - .3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm [8"] pipe size.
 - .2 Drilled, mechanical expansion type:
 - .1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa [2840 psi].
 - .2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).
 - .3 Hilti HDI or UCAN IPA drop-in anchor for concrete.
 - .4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.
 - .5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.
 - .3 Drilled, adhesive type:
 - .1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.
 - .2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.
 - .3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.
 - .4 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.
- .3 Note:
 - .1 Before any floor drilling, confirm location of under floor heating equipment with mechanical Division.

- .2 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.
- .3 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.
- .4 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

2.12 EQUIPMENT SUPPORTS

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.
- .3 Concrete bases shall be a minimum of 100 mm [4"] thick, or as noted and shall project at least 150 mm [6"] outside the equipment base, unless otherwise directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.
- .4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25mm [1"] above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embeco or In-Pakt.
- .5 Construct equipment supports of structural steel. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.
- .6 Support ceiling hung equipment with rod hangers and/or structural steel.

2.13 MISCELLANEOUS METAL

- .1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:
 - .1 Support of equipment.
 - .2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.
 - .3 Earthquake restraint devices - refer also to "Seismic Restraint" sections
 - .4 Bridle rings - secure to structure or steel supports.
- .2 All steel work shall be prime and undercoat painted ready for finish under the related Division.

2.14 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into maintenance manual specified in Division 01 and as follows.
- .2 Include in operations and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

- .3 Wiring and schematic diagrams.
- .4 Names and addresses of local suppliers for items included in maintenance manuals.
- .3 Include in the manual the following major sections:
 - .1 Title page (in plastic cover).
 - .2 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.
 - .3 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and trouble shooting instructions.
 - .4 Local source of supply for each item of equipment.
 - .5 Wiring and control diagrams.
 - .6 Spare parts list.
 - .7 Copies of guarantees and certificates.
 - .8 Manufacturer's maintenance brochures and shop drawings.
- .4 The manual information shall be bound in a three "D-ring" hard back reinforced vinyl covered ("bar lock" post type where more than 50mm [2"] rings required) binder c/w index tab separators to divide the different sections. The binder cover shall be black with white lettering. Printing of the binder cover shall be completed before the binder is manufactured and the wording shall be approved by the Consultant before printing.
- .5 Submit a draft copy to the Consultant for approval thirty (30) days prior to start up of the systems and equipment.
- .6 Submit three (3) copies in the final approved form.
- .7 Submit three (3) CD-R's containing all record as-build drawings and maintenance manual in PDF format.

2.15 PROJECT RECORD DRAWINGS

- .1 Provide project record documents as specified in Division 01 as further called for in this Division.
- .2 During the construction period, keep on Site a clean set of drawings marked up to reflect the "As-Built" state, for examination by the Departmental Representative on a regular basis. Include elevations and detailed locations of buried services, empty conduit systems and junction and pull boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.
- .3 Comply with CSA Electrical Bulletins and local by laws.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm [2"].
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation.
- .4 All cables and conduits to be installed concealed in finished areas.

3.4 LOCATION OF OUTLETS

- .1 Refer to detailed drawings for exact locations.
- .2 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm [16"] horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 300mm [10"- 0"] and information is given before installation.
- .4 Locate light switches on latch side of doors unless otherwise indicated.
- .5 Locate disconnect devices in mechanical and elevator machine rooms on latch side of doors.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor/grade to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated verify before proceeding with installation. Confirm the height of devices in handicapped facilities before installation.
- .3 Refer to detail on the drawings for specific mounting heights, confirm with the engineer before mounting where mounting heights are not indicated.
- .4 In the absence of a drawing detail or drawing note, confirm with the owner and the engineer before rough-in and mounting.

3.6 DELIVERY AND STORAGE

- .1 Store all electrical equipment and devices other than conduits, fittings, boxes, and ducts in a heated and ventilated space, and protect from construction damage. Include in the tender price all costs related to such storage.
- .2 Conduits, fittings, boxes, and ducts may be stored outside if properly protected against the weather.
- .3 Ship and store floor mounted equipment in upright position.
- .4 Ship equipment in adequate containers to assure it arrives undamaged at the site.
- .5 Keep equipment doors locked. Protect equipment from damage and dust.

- .6 Block moving parts when necessary to prevent damage during movement and shipment of equipment.
- .7 Remove from the site, and replace with new, all materials showing evidence of damage or rust.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Coordinate and pay for all tests specified herein including further tests as required by authorities having jurisdiction.
- .2 All testing shall be performed after each system installation has been completed. Prior to commissioning, all motors, transformers and switchgear shall be meggered for insulation integrity and the results recorded prior to the systems being put into operation.
- .3 Perform the testing, adjusting, and balancing only when conditions are commensurate with actual operating conditions for the given system.
- .4 Advise the Departmental Representative 48 hours in advance of each test. Carry out tests in the presence of Departmental Representative.
- .5 Submit detailed printed test reports in duplicate to the Departmental Representative within 7 days after the completion of each test. Include all test reports in the Maintenance Manuals. Each test shall clearly indicated, in a line-by-line format, that the components (not as a group) have been tested, test results, and whether test results are within acceptable limits. Each test report shall be accompanied by a front cover sheet briefly outlining what the test report is for and clearly summarizing all items that have failed the tests. The cover sheet shall indicate names of individuals who conducted the tests and their signatures.

3.8 FIELD QUALITY CONTROL

- .1 Load and Balance:
 - .1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Conduct and pay for the following tests:
 - .1 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .2 Systems: fire alarm system, communications systems.
 - .3 Main ground resistance (at all grounding locations).
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .4 Reports:
 - .1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

3.9 DEMONSTRATION

- .1 Demonstrate to and instruct the Owner's representative on operating and maintenance procedures for all electrical systems using the assistance of specialist sub-trades and manufacturer's representatives for instruction and include all costs in the tender. Systems to be demonstrated shall include, but not be limited to, the following:
 - .1 Routing and installation of major feeders, duct banks and manholes, grounding and cable trays.
 - .2 Arrange an acceptable time with the Owner and the Departmental Representative and submit a program of instruction and demonstration for the Departmental Representative's approval. Assume that the Owner's representative is not familiar with any of the special equipment and/or systems installed.
 - .3 Submit to the Departmental Representative, at the time of Substantial Performance inspection, a complete list of systems stating for each system:
 - .1 Date instructions were given to the Owner's staff.
 - .2 Duration of instruction.
 - .3 Name of persons instructed.
 - .4 Other parties present (manufacturer's representative, Departmental Representative, etc.).
 - .5 Signature of the Owner's staff stating that they properly understood the system installation, operation, and maintenance requirements and identifying any systems or equipment which were not demonstrated to their satisfaction and which must be re-demonstrated.

3.10 CLEANING

- .1 Do final cleaning in accordance with Division 01.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Division 09.

3.11 WORKMANSHIP

- .1 Workmanship shall be in accordance with well established practice and standards accepted and recognized by the Departmental Representative and the Trade.
- .2 The Departmental Representative shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.
- .3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Departmental Representative.

3.12 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 - Waste Management and Disposal.

- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

3.13 PROTECTION OF WORK

- .1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.
- .2 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.
- .3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.
- .4 Refinish damaged or marred factory finish.

3.14 PROTECTION ELECTRICAL EQUIPMENT

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts, e.g. "LIVE xxx VOLTS".
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

3.15 CONCEALMENT

- .1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.
- .2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

3.16 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

- .1 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building code in effect.
- .2 The scope includes new services which pass through existing rated separations and also all existing services which pass through a new rated separation or existing separations whose rating has been upgraded.
- .3 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings. Where this is not indicated assume a minimum of one hour for walls and two hours for floors.
- .4 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system as detailed above.
- .5 Contractors are expected to submit system information detailing firestopping product, backing, penetration, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number.
- .6 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be re-penetrated.
- .7 All penetrations shall be firestopped using EZ Path System (Specified Technologies Inc - STI) only.

- .8 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks.
- .9 Provide split systems where existing cables are involved.
- .10 Submit a letter certifying that all work is complete and in accordance with this specification. Electrical Form EF130 in Section 26 06 02 should be used for this purpose.

3.17 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

- .1 Provide metal sleeves for all cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

3.18 CONDUIT SLEEVES

- .1 Provide conduit sleeves for all conduit and wiring passing through rated and non-rated walls and floors. Sleeves shall be concentric with conduit or wiring.
- .2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.
- .3 Conduit sleeves shall extend 50 mm [2"] above floors in unfinished areas and wet areas and 6 mm [1/4"] above floors in finished areas.
- .4 Conduit sleeves shall extend 25 mm [1"] on each side of walls in unfinished areas and 6 mm [1/4"] in finished areas.
- .5 Conduit sleeves shall extend 25mm [1"] beyond exterior face of building. Caulk with flexible caulking compound.
- .6 Sleeve Size: 12 mm [1/2"] clearance all around, between sleeve and conduit or wiring.
- .7 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.
- .8 Packing of Sleeves:
 - .1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.
 - .2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

3.19 ACCESSIBILITY AND ACCESS PANELS

- .1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.
- .2 Provide access panels where required in building surfaces. Do not locate access panels in panelled or special finish walls, without prior approval of the Departmental Representative.
- .3 Access panels in U.L.C. fire separations and fire walls shall have a compatible fire rating and U.L.C. label. Acquire approval in writing from the local fire authority if required.
- .4 Access panels shall be painted with a primer coat if applicable and then with a finish coat, colour and type to the Departmental Representative's approval.
- .5 Locate equipment and junction boxes in service areas wherever possible.

3.20 EQUIPMENT INSTALLATION

- .1 Provide means of access for servicing equipment.
- .2 CSA identification and equipment labels to be clearly visible after installation.

3.21 CUTTING, PATCHING, DIGGING, CANNING , CORING & CONCRETE

- .1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.
- .2 Be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.
- .3 Openings through structural members of the building shall not be made without the approval of the Departmental Representative.
- .4 Openings in Concrete:
 - .1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.
 - .2 All openings shall be core drilled or diamond saw cut.
 - .3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.
 - .4 Refer to structural drawings for locations of steel reinforcing.
 - .5 Be responsible for repairing any damage to steel reinforcing.
- .5 Openings in building surfaces other than concrete:
 - .1 Lay out all openings required and coordinate with the General Contractor prior to the execution of work.
- .6 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.
- .7 Precast concrete items such as transformer pad bases and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.
- .8 Excavation and backfilling will be provided by other Divisions. This division to superintend the work and provide all layouts and parameters.

3.22 PAINTING

- .1 Clean exposed bare metal surfaces supplied under the Electrical Divisions removing all dirt, dust, grease and mill scale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.
- .2 Paint all hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.
- .3 Repaint all marred factory finished equipment supplied under the Electrical Divisions, to match the original factory finish.
- .4 Coordinate with General Contractor.
- .5 Finish painting of all equipment and materials, supplied under the Electrical Divisions, installed in Electrical Rooms of the building or exposed outside the building, is included under Division 09 of the Specification.

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Section 26 05 00
COMMON WORK

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END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Refer to specialty “Communication” Sections for particular wiring systems and types. e.g. CCTV, Door Access and Paging System

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .2 CSA C22.1-15, except where specified otherwise.
- .3 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 -Submittal procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 TERMS OF REFERENCE

- .1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.
- .2 TECK feeder cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, TECK wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type. TECK90 shall have a PVC jacket with FT-4 flame spread rating. Where TECK90 is run in ceiling or floor spaces used as a return air plenum, remove jacketing and provide cable type identification.
- .3 Armoured (AC-90) branch cable **may not be used in this project**. Where flexible connections are required provide wiring in flexible conduits. AC90 shall only be permitted for lighting drops less than 915mm from the lighting junction box to the luminaire.
- .4 Aluminium conductors are not permitted.
- .5 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.
- .6 Refer to Equipment Schedule(s) for detailed responsibilities.
- .7 Non-metallic sheathed wiring is not to be used on this project.

Part 2 Products

2.1 WIRING & CABLES – GENERAL

- .1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2 Insulation to be 600 Volt RW90 XLPE (X link) for the general building wiring in conduit.
- .3 Main feeders to be conduit and insulated copper wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.
- .4 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

2.2 TECK FEEDER CABLE

- .1 Conductors:
 - .1 Grounding conductor: copper
 - .2 Circuit conductors: copper, size as indicated.
- .2 Insulation: Chemically cross-linked thermosetting polyethylene, type RW90, rated 600 V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: interlocking aluminum.
- .5 Overall covering: polyvinyl chloride material FT-4 flame test rated.
- .6 Connectors: Watertight, approved for TECK cable installation.

2.3 LOW VOLTAGE CONTROL CABLES

- .1 Type LVT: soft annealed copper conductors, with thermoplastic insulation, outer covering of thermoplastic jacket. Minimum size #18 AWG.
- .2 Unless otherwise specified wiring to be multicore individually identified and colour coded with grey sheath enclosed in conduit or (EMT).

2.4 BUILDING WIRE AND CABLE

- .1 Unless otherwise directed, building wire and cable shall be copper conductors, sized as indicated.
- .2 Except where otherwise directed or required by Code or other applicable regulations, building wire and cable insulation shall be Type R90, cross-linked polyethylene insulated 600 volts rated for not less than 90°C.
- .3 All conductors within cable trays shall have FT4 type outer jacket to comply with all applicable regulations and bylaws.

2.5 WIRE AND BOX CONNECTORS AND MISCELLANEOUS MATERIALS

- .1 Connectors for wire and cable splices and taps: Unless otherwise directed, use 3M Co. 'Scotchlok,' Thomas & Betts PT Series, Buchanan 'B,' IDI Electric 'Super Nut,' (Standard of Acceptance) for conductors #8 AWG or smaller; Burndy 'Servit' Type KSU (Standard of Acceptance) for conductors #1/0 AWG and smaller; and Burndy 'OKlip' Type KVSU (Standard of Acceptance) for conductors 750 MCM or smaller.
- .2 Clamps, glanding connectors, or box connectors for armoured cable, and flexible conduit as required.
- .3 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
- .4 Plastic electrical insulation tape: Scotch #88 (Standard of Acceptance).

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Unless specifically indicated otherwise, all wiring shall be installed in conduit. Use flexible conduits for final connections to suspend light fixtures and vibrating equipment.
- .2 Use no wire smaller than #12 AWG, unless otherwise directed.
- .3 Control circuit conductors for motors and mechanical equipment controls shall be not less than #14 AWG except where specifically directed otherwise.
- .4 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.
- .5 Installation shall be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.
- .6 The number of splices in any circuit shall be kept to an absolute minimum consistent with available coil length and installation conditions.
- .7 Conductors for lighting, receptacle, appliance and equipment branch circuits shall have ampacity not less than the rating of the over-current device protecting the branch circuit and shall be sized for a maximum voltage drop of 2% from panelboard to the last outlet of a circuit. The length of the branch circuit shall be used in the determination of the required wire size shall be the combined vertical and horizontal distances from the panelboard to the last device in the circuit. In no case shall the wire sizes as determined above, be less than that indicated in the following table.

120 Volts, 1 Phase

15 Ampere Circuits
0-25 m - min. #12 AWG
Over 25 m - min. #10 AWG

20 Ampere Circuits
0-20 m - min. #12 AWG
0 m-30 m - min. #10 AWG
Over 30 m - min. #8 AWG

347 Volts, 1 Phase

15 Ampere Circuits
0-75 m - min. #12 AWG
Over 75 m - min. #10 AWG

20 Ampere Circuits
0-55 m - min. #12 AWG
Over 55 m - min. #10 AWG

- .8 Make final connections to recessed incandescent or gas-discharge lamp fixtures, and other heat-producing equipment with thermoplastic insulated, lacquered glass-braid-jacketed "equipment wire," except that where higher temperature rating of insulation or larger conductor size than #10 AWG is required, use wire specifically approved for the purpose.
- .9 Exercise care in stripping insulation from wire. Do not nick conductors.

3.2 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.

3.3 INSTALLATION OF TECK CABLE 0 - 750 V

- .1 Install cables.
- .2 Group cables wherever possible on channels.
- .3 Lay cable in cable troughs or cable trays.

3.4 IDENTIFICATION, CODING AND BALANCING

- .1 For branch circuit wiring, follow identification system shown on the drawings and as specified in Section 26 05 00 – Common Work Results.
- .2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on "record" drawings.
- .3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two wraps of 3M #471 plastic film tape 48 mm wide.
- .4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped on site.

3.5 TESTING

- .1 All power and control wiring shall be tested for insulation resistance value with a 1000 volt megger. Resistance values shall be as recommended by the cable manufacturer.
- .2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification shall be read, coordinated and implemented in conjunction with all other parts of the Contract Documents.

1.2 REGULATORY REQUIREMENTS

- .1 Restraints shall meet the requirements of the latest edition of the National Building Code and amendments.
- .2 The Seismic Engineer shall provide proof of professional insurance and the related practice credentials if requested by the Consultant.
- .3 The Contractor's Seismic Engineer shall submit original signed National Building Code of Canada "Letters of Assurance" "Schedules B, and C-B" to the Departmental Representative.
- .4 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.3 SCOPE OF WORK

- .1 The total electrical seismic restraint design and field review and inspection shall be by a BC registered professional structural engineer who specializes in the restraint of building elements. The contractor shall allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This Engineer herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.
- .2 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.
- .3 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.
- .4 Provide restraint on all new equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.
- .5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.
- .6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Departmental Representative. Copies of the shop drawings to be included in the final Operation & Maintenance manuals.
- .7 Provide seismic restraints on all new equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

- .8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.
- .9 Include all costs associated with the Seismic installation and certification in the base tender.

1.4 SHOP DRAWINGS & SUBMITTALS

- .1 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the seismic consultant.
- .2 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

Part 2 Execution

2.1 GENERAL

- .1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.
- .2 Ensure that seismic restraints do not adversely affect the proper functioning of any vibration isolation mounts or hangers.

2.2 CONDUITS

- .1 Provide restraint installation information and details on conduit and equipment as indicated below:
- .2 Vertical Conduit:
 - .1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.
 - .2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m [30 ft] o.c.
 - .3 Riser joints shall be braced or stabilized between floors.
- .3 Horizontal Conduits:
 - .1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.
 - .2 EMT tubing - tubing shall be supported at approximately 1.2 m [4 ft] intervals for tubing.
- .4 Provide transverse bracing at 12.2 m [40 ft] o.c. maximum unless otherwise noted. Provide bracing at all 90o bend assemblies, and pull box locations.
- .5 Provide longitudinal bracing at 24.4 m [80 ft] o.c. maximum unless otherwise noted.
- .6 Do not brace conduit runs against each other. Use separate support and restraint system.

- .7 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.
- .8 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.
- .9 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.
- .10 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.
- .11 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic consultant and submit shop drawings to the Consultant for his reference.

2.3 FLOOR MOUNTED EQUIPMENT

- .1 Bolt all equipment, e.g. transformers, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.
- .2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

2.4 CEILING MOUNTED EQUIPMENT

- .1 Devices in suspended ceilings shall be hung independently of the ceiling system. Devices shall be secured to concrete or structural deck above by at least two taugt cables which are connected to the fixture at diagonal points.
- .2 Surface and recessed style devices shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by taugt cables.
- .3 Cables shall be corrosion resistant and approved for the application.
- .4 Devices which are rod hung shall have seismic ball alignment fittings at the ceiling and device.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International);
- .2 CSA C22.1-12, except where specified otherwise;
- .3 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE);
- .4 Transformer grounding shall comply with CSA C22.2 No.41-M87 (R99);
- .5 All grounding conductors to be stranded soft annealed copper unless otherwise noted.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Grounding equipment to: CSA C22.2 No.41-M87 (R99).

2.2 EQUIPMENT

- .1 Clamps for grounding of conductor, size as required.
- .2 Copper conductor at least 6m [20'] long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated. If not indicated, use #3/0 AWG which is the maximum in the CEC.
- .3 Rod electrodes, copper clad steel 20mm [3/4"] dia by 3m [10'] long as indicated.
- .4 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified shall be GREEN.
- .5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

- .6 Non-corroding accessories necessary for grounding system, type, size material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings;
 - .2 Protective type clamps;
 - .3 Bolted type conductor connectors;
 - .4 Compression type conductor connectors;
 - .5 Bonding jumpers, straps;
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.
- .2 Provide separate, insulated, copper bonding conductor in EVERY conduit used for power, lighting, fire alarm and every low tension system required in the building. Where wire size is not indicated, provide minimum size per applicable CEC tables.
- .3 Install connectors in accordance with manufacturer's instructions.
- .4 Protect exposed grounding conductors from mechanical injury.
- .5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by compression process or permanent mechanical connectors approved for the use.
- .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .7 Soldered joints not permitted.
- .8 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit. Provide a ground conductor in all flexible conduit and secure to system grounding lugs at both the equipment and source.
- .9 Install separate ground conductor to each outdoor lighting standard.
- .10 Connect building structural steel and metal siding to ground by mechanical connection suited for copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.
- .13 Ground secondary service pedestals in raised computer floors.
- .14 Coordinate ground rod installation with local soil conditions to assure proper grounding system.
- .15 Test grounding system for continuity.

3.2 GROUNDING BUSSES

- .1 Provide an isolated communications ground bus in the LAN/Telecom/BSCS rooms using 305mm [12"] x 52mm [2"] copper buss bar and stand-off assembly. Provide #3/0 AWG to the main building ground.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as indicated on the drawings.
- .3 Copper or bronze lugs required for termination of all copper conductors at ground busses.

3.3 EQUIPMENT GROUNDING AND BONDING

- .1 Install bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, starters, UPS, control panels, building steel work, raised floor systems, generators, distribution panels and outdoor lighting.
- .2 Provide grounding conductor(s) from all major switchgear to solidly ground the secondary system. This includes equipment located in the main electrical room as well as each sub-electrical room. Grounding conductors to be sized to Canadian Electrical Code and switchgear manufacturer's requirements.

3.4 MECHANICAL EQUIPMENT BONDING

- .1 Ground wires to be installed in all conduit serving motor feeder circuits and to extend to ground screws on junction and outlet boxes for bonding.

3.5 LOW TENSION SYSTEMS GROUNDING

- .1 Install home run a #6 AWG insulated bonding conductor in conduit from the local ground bus to the:
 - .1 BSCS/Security cabinets
 - .2 Data LAN racks/cabinets
 - .3 Raised floor system pedestals
 - .4 Cable trays
 - .5 Voice system
 - .6 Radio system

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions.
- .3 For High voltage installations (greater than 750V to ground), measure ground grid resistance with earth test megohmmeter and install additional ground rods and conductors as required until resistance to ground complies with Code requirements and is less than 1 Ω . Submit test results to Department Representative.
- .4 For Low voltage installations (less than 600V to ground), measure ground grid resistance with earth test megohmmeter and install additional ground rods and conductors as required until resistance to ground complies with Code requirements and is less than 25 Ω . Submit test results to Department Representative.

- .5 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Departmental Representative. Include all associated costs.
- .6 Ensure test results are satisfactory before energizing the electrical system.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 Supply and install all hangers, supports and inserts for the installation shown on the drawings and specified herein, as necessary to fasten electrical equipment securely to the building structure.

1.2 RELATED WORK

- .1 Section 26 05 00 - Common Work.
- .2 Section 26 05 25 - Seismic Restraints.

Part 2 Product

2.1 FRAMING AND SUPPORT SYSTEM

- .1 Materials:
 - .1 Intermediate duty supporting structures shall employ P1000 Unistrut or equal together with the manufactures connecting components and fasteners for a complete system.
 - .2 Heavy duty supporting structures to be fabricated and welded from steel structural members and prime painted before installation.
- .2 Finishes:
 - .1 Outdoors, wet locations: Hot dipped galvanized.
 - .2 Indoors, dry locations: Galvanized when available, prime painted if not available.
 - .3 Nuts, bolts, machine screws: Cadmium plated.
- .3 Unistrut:
 - .1 Section P1000 or as required for load and span, with mounting screws. P1000 (Standard of Acceptance) is a minimum standard for supporting conduits 50mm and larger.

2.2 CONCRETE AND MASONRY ANCHORS

- .1 Materials: Hardened steel inserts, zinc plated for corrosion resistance. All anchor bolts must be galvanized.
- .2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.
- .3 Manufacturer: Hilti (Canada) Limited (Standard of Acceptance).

2.3 NON-METALLIC ANCHORS

- .1 Material: Plastic anchors for sheet metal screws.
- .2 Manufacturer: Fischer (Standard of Acceptance).

2.4 CONDUIT SUPPORTS

- .1 General: Malleable iron two-hole conduit straps where exposed to weather. Stamped steel two-hole straps indoors.
- .2 Structural Steel: Crouse-Hinds “Wedgetite” supports or equivalent manufactured by Appleton.
- .3 Masonry, concrete, stone, etc.: Plastic or lead Anchors, suitable for the weight loads.
- .4 Drywall: Toggle bolts.
- .5 Metal studs, ceiling hangers, etc.: “Caddy-Clips”.
- .6 Unistrut: Conduit clamps.

2.5 CABLE SUPPORTS AND CLAMPS

- .1 General: As per conduit supports, except that for single conductor cables, suitable non-ferrous or approved stainless steel or aluminum clamps shall be used.

Part 3 Execution

3.1 GENERAL

- .1 Do not cut or drill beams, joists or structural steel unless written permission of the Engineer is obtained.
- .2 Distance between conduit or cable supports not to exceed code requirements.
- .3 Supports to be suitable for the real loads imposed by equipment.
- .4 Supports to be securely fastened, free from vibration and excessive deflection or rotation. Maximum deflections are 4 mm over a 1 meter span and 8 mm over a 2 meter span.
- .5 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer’s installation recommendations.
- .6 Provide conduit rack with 25% spare capacity for multiple runs.
- .7 Provide channel support with fittings for vertical runs of conduit and cables.

3.2 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole malleable iron or steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .5 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.
- .6 Shot driven pins may only be used with written approval of the structural engineer.
- .7 Use round or pan head screws for fastening straps, boxes, etc.
- .8 Do not support heavy loads from the bottom chord of open web steel joists.
- .9 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes. Support surface mounted panel tubs with a minimum of four 6 mm fasteners.
- .10 For surface mounting of two or more conduits use channels at 1.5 m oc spacing.
- .11 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .12 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .13 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of the other trades and the approval of the Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Provide a complete system of splitters boxes and cabinets for the installation of wiring and equipment.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION BOXES AND PULL BOXES, INDOOR DRY LOCATIONS

- .1 Materials:
 - .1 Code gauge sheet steel, welded construction, phosphatised and/or galvanized.
- .2 Components:
 - .1 For flush mounting, covers to overlap box by 25mm minimum all around with flush head cover retaining screws.
 - .2 Use rolled edges for surface boxes.
 - .3 Size shall be in accordance with the CEC for the given conduit sizes and arrangement and number of conductors and splices in the boxes.
 - .4 Surface or flush with trim and hinged door, latch and lock and two keys and keyed to match panelboard keys.
 - .5 Backboards: 19mm G1S Fir Plywood backboard.
- .3 Junction boxes mounted in exterior walls shall be complete with box vapour barriers.

2.3 CABINETS

- .1 Materials:
 - .1 Cabinets: Code gauge sheet steel, welded construction, phosphatised and factory paint finish, suitable for field painting.
 - .2 Locks: to match panelboards.
 - .3 Backboards: 19 mm G1S fir plywood, one piece per cabinet, covering entire cabinet interior.
- .2 Components:
 - .1 With hinged door and return flange overlapping sides, with handle, lock and catch for surface mounting, size as indicated or to suit.
 - .2 Surface or flush with trim and hinged door, latch and lock and two keys, size as indicated or to Canadian Electrical Code for the given conduit sizes and arrangement and number of conductors and splices in the boxes. Keyed to match panelboard keys.

Part 3 Execution

3.1 INSTALLATION

- .1 Junction Boxes and Pull Boxes:
 - .1 Supply all pull boxes and junction boxes shown on the drawings or required for the installation.
 - .2 Boxes installed in party walls to be offset by a minimum of one stud space.
 - .3 Install in inconspicuous but accessible locations, above removable ceilings or in electrical rooms, utility rooms or storage areas.
 - .4 Identify with system name and circuit designation as applicable.
 - .5 Size in accordance with the CEC.
- .2 Cabinets:
 - .1 Mount cabinets with top not greater than 1980 mm above finished floor, coordinated with masonry, panelboards, fire hose cabinets and similar items. Securely fasten backboards to cabinet interiors.
 - .2 Install terminal block where indicated.
- .3 Identification
 - .1 Provide equipment identification in accordance with drawings.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work.

1.3 REFERENCES

- .1 CSA C22.1-15, except where specified otherwise.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices, barriered where required.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 OUTLET BOXES FOR METAL CONDUIT

- .1 Materials:
 - .1 Surface or recessed concealed type: Die formed steel, hot dip galvanized, 350 g/m² minimum zinc coating.
 - .2 Surface mounting exposed: Cast ferrous for threaded conduit, with attached lugs, corrosion resistant two coats finish.

2.3 JUNCTION & PULL BOXES

- .1 Electro-galvanized sheet steel type boxes for flush mount in walls with matching extension and plaster rings as required.
- .2 Install pull boxes in inconspicuous but accessible locations.
- .3 Install pull boxes after cumulative bend total of 270 degrees between boxes.
- .4 Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

2.4 CONDUIT BOXES

- .1 Cast FS or electro-galvanized sheet steel boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.5 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.
- .4 Provide correct size of openings in boxes for conduit, and armoured cable connections. Reducing washers are not allowed.
- .5 Install all outlets flush and surface mounted as required for the installation.
- .6 Surface mount above suspended ceilings, or in unfinished areas.
- .7 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes.
- .8 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.
- .9 Use plaster rings to correct depth. Use 30mm on concrete block.
- .10 Do not use sectional boxes.

- .11 Provide boxes sized as required by the Canadian Electrical Code.
- .12 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.
- .13 Outlets installed in partition walls to be offset by a minimum of one stud space.
- .14 Ceiling outlet boxes shall be provided for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.
- .15 Primary bushings in termination box for cable connection.
- .16 Secondary bushings in termination box for bus duct connection.
- .17 For telecom raceways provide a pull box where: (1) the length is over 30m and (2) where there are more than two 90 degree bends.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work.

1.3 REFERENCES

- .1 CSA C22.1-15, except where specified otherwise;
- .2 Canadian Standards Association (CSA) .CAN/CSA C22.2.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 SCOPE OF WORK

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.
- .2 Conceal all conduits in finished areas where possible. Conduits may be surface mounted either only where indicated or in service areas accessible only to authorized personnel.
- .3 Note particular requirements for routing of conduits where detailed.
- .4 Provide polypropylene pull cord in all “empty” conduits and for conduits that have spare capacity for future.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No.45 Galvanized Steel.
- .2 Electrical Metallic Tubing (EMT): to CSA C22.2 No.83.
- .3 Flexible conduits: to CSA C22.2 No. 56.
- .4 Minimum conduit size in the project shall be 21mm [3/4"] diameter (for power as well as low tension services).

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 27mm and smaller. Use two hole steel straps to conduits larger than 27mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 10 mm [3/8"] threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings manufactured for use with conduits specified. Coating same as conduit.
- .2 Provide factory "ells" where 90 degree bends are required for 35mm [1.25"] and larger conduits.
- .3 EMT couplings and connectors shall be steel, or Regal Die-cast zinc alloy. Couplings used on conduit containing fire-rated cable shall be steel. Regular die-cast alloy fittings and couplings are not acceptable. Provide plastic bushings (insulated throat) for all connectors unless there is no chance of burrs. Provide water-tight connectors in damp or wet locations and for surface equipment (e.g. Panelboards, MCC's, etc.) in rooms that are fire sprinkler protected.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion.
- .2 Water-tight expansion fittings: with integral bonding jumper, suitable for linear expansion and 19 mm [3/4"] deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

2.5 RIGID P.V.C. CONDUIT

- .1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured by C.G.E. "Sceptre" Schedule 40.
- .2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.
- .3 Solvent: as recommended by conduit manufacturer.

2.6 OUTLET AND CONDUIT BOXES IN GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102mm [4"] square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.
- .6 Bushing and connectors with nylon insulated throats.
- .7 Knock-out fillers to prevent entry of foreign materials.
- .8 Conduit outlet bodies for conduit up to 35mm [1.25"]. Use pull boxes for larger conduits.

- .9 Double locknuts and insulated bushings on sheet metal boxes.

2.7 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 76mm x 50mm x 38mm [3" x 2" x 1.5"] or as indicated. Larger 102mm square x 54mm deep [4"x 2"] outlet boxes (No. 52151 or 52171) to be used when more than one conduit enters one side. Provide extension and plaster rings as required.
- .2 For larger boxes use GSB solid type as required.
- .3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.
- .4 102 mm [4"] square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

2.8 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi-gang type MDB boxes for devices flush mounted in exposed block walls.

2.9 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.10 FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with faceplate. Device mounting plate to accommodate short or long ear receptacles. Minimum depth: 28mm [1.1"] for receptacles; 73mm [2.9"] for communication equipment.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16mm [0.5"] and 21mm [0.75"] conduit. Minimum size: 73mm [2.9"] deep

2.11 SURFACE CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

Part 3 Execution

3.1 CONDUIT - GENERAL

- .1 Generally use electrical metallic tubing (EMT) in the building interior and in above grade slabs except where subject to mechanical injury or where otherwise indicated.
- .2 Install all conduit and wiring concealed, unless otherwise shown on the drawings. Do not recess conduit in columns, except as noted, without permission.
- .3 Use existing conduits where possible and where it meets current codes and standards. Allow for repair where required in the bid price.
- .4 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.

- .5 At all recessed panels cap 4 - 27mm empty conduits from panel into ceiling above for future use.
- .6 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Set out the work and coordinate with other services prior to installation. Maintain access to junction and pull boxes.
- .7 Any conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.
- .8 All conduit ends to be reamed to ensure a smooth interior finish that will not damage the insulation of the wiring.
- .9 Ensure grounding continuity in all conduit systems.
- .10 Use rigid galvanized steel (RGS) threaded conduit where the installation is subject to mechanical injury. In any event, use RGS conduit for surface installations up to 1.5m [5'] above the finished floor.
- .11 Field threads on rigid conduit shall be sufficient length to draw conduits ends together.
- .12 Unless otherwise noted and where practical, all conduits to be routed through the ceiling space rather than in, or below, slabs or floor structures to facilitate future changes.
- .13 Conduits in walls should typically drop (or loop) vertically from above to better facilitate future renovations. Generally conduits from below and horizontal conduits in walls and concrete structures should be avoided unless indicated.
- .14 Generally use Rigid PVC conduits in or below ground level slab unless otherwise noted. Transition to RGS conduit in exposed locations: e.g. where conduits emerge from ground level slab.
- .15 Conduits are not permitted in terrazzo or concrete toppings.
- .16 Cap turned up conduits to prevent the entrance of dirt or moisture during construction.
- .17 Locate conduits more than 75 mm [3"] parallel to steam or hot water lines with a minimum of 25mm [1"] at crossovers.
- .18 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Conduits bent more than this or kinked to be replaced.
- .19 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.
- .20 Where conduits become blocked, the use of corrosive agents is prohibited. Remove and replace blocked section.
- .21 Damaged conduits to be repaired or replaced.
- .22 Dry conduits out thoroughly before installing wiring. Swab out conduit and thoroughly clean internally before wires and cables are pulled.
- .23 Conduits shall not pass through structural members except as indicated.
- .24 Conduit sizes indicated on drawings are minimum only. Increase sizes as required to suit alternative wiring types or to comply with Code.
- .25 Conduits and ducts crossing building expansion joints shall have approved conduit expansion fittings to suit the type of conduit used.
- .26 Seal conduits with approved sealant where conduits are run between heated and unheated areas.

- .27 Seal openings with approved sealant where conduits, cables, or cable trays pierce fire separations.
- .28 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits shown on the drawings are installed, wall openings shall be closed with material compatible with the wall construction and/or to meet any fire separation integrity.
- .29 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.
- .30 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of standard boxes where box support is not provided.
- .31 Provide necessary roof jacks or flashing where conduits pass through roof or watertight membranes. Apply approved sealant to maintain membrane integrity.
- .32 Use flexible metal conduit for connection to recessed incandescent fixtures without a prewired outlet box and connection to recessed fluorescent fixtures.
- .33 Use liquid tight flexible metal conduit for connection to motors, and other vibrating equipment and transformers.
- .34 Use explosion proof flexible connection for connection to explosion proof motors.
- .35 Install conduit-sealing fittings in hazardous areas, isolation rooms and clean rooms. Fill with compound.

3.2 SURFACE CONDUITS

- .1 Surface conduits are acceptable in mechanical and electrical service rooms and in unfinished areas or where indicated. Confirm exact locations and obtain approval from the owner prior to commence in any surface mount work.
- .2 Run parallel or perpendicular to building lines.
- .3 Locate conduits behind infrared or gas fired heaters with minimum 1.5 m [5'] clearance.
- .4 Conduits to be run in flanged portion of structural steel.
- .5 Group conduits wherever possible on suspended and/or surface channels.
- .6 Surface conduits will not be accepted in finished areas unless detailed.

3.3 SPARE CONDUITS

- .1 Provide spare conduits as indicated.
- .2 Provide 4x 27mm [1"] spare conduits up to ceiling space and 4x 27 mm [1"] spare conduits down to ceiling space below from each flush panel. Terminate the conduits in 150mm x150mm x100mm [6"x6"x4"] junction boxes in ceiling spaces or in case of an exposed concrete slab, terminate each conduit in a flush concrete box. Provide coverplates for all junction boxes.

3.4 BOXES INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Ceiling outlet boxes to be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.

- .3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material. Remove upon completion of work.
- .4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm [0.25"] of opening.
- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not to be used.
- .6 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.
- .7 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.
- .8 No sectional or handy boxes to be installed.
- .9 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.
- .10 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.
- .11 Outlets installed back to back in party stud walls to be off-set by one stud space.
- .12 Refer to wiring device and communication specification sections and to architectural layouts for mounting heights of outlet boxes.
- .13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.
- .14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.
- .15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Single-Phase Uninterruptible Power Systems (UPS)
- .3 Contract drawings

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 26 05 00 - Common Work.
- .5 Section 26 05 25 – Seismic Restraints.

1.3 REFERENCES

- .1 UPS, battery, battery breaker, manual bypass, UPS distribution, and all related system accessories designed, manufactured, and tested in accordance with all requirements of latest editions of:
 - .1 CSA C22.1-15, except where specified otherwise and B.C. amendments and Bulletins
 - .2 CSA requirements for protection of equipment installed in sprinklered electrical rooms
 - .3 UL/cUL approved (1778)
 - .4 Canadian Standards Association (CSA), or equivalent certified testing/certification agencies, which are acceptable to CSA and local Authorities. Provide CSA labels on UPS, battery cabinet, battery breaker panel, manual bypass cabinet, UPS distribution panel
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C813.1-01, Performance Test Method for Uninterruptible Power Supplies

1.4 DESCRIPTION OF SYSTEM

- .1 True on-line double conversion UPS system to consist of:
 - .1 Rectifier
 - .2 Inverter
 - .3 Battery
 - .4 External “maintenance” bypass switch
 - .5 Static bypass switch
 - .6 Controls and meters
 - .7 All components in multiple units
 - .8 Unit to be rack mounted including batteries

- .2 System to use normal power supply mains and battery to provide continuous, regulated AC power to isolated load
- .3 Equipment to operate continuously and unattended
- .4 Ensure that UPS is compatible with equipment that it feeds

1.5 REQUIREMENTS

- .1 Provide one 6000VA, split single phase, 4-wire input, 120/208 volt input. 1 phase, 120/208 Volt output, 60 Hz static uninterruptible power supply (UPS) system. Provide all equipment and installation materials necessary to make a complete functional system when installed as indicated on the drawings.
- .2 System shall include:
 - .1 UPS equipment cabinets configured as one self-contained assembly. If cabinets or components require separation or removal for shipment or installation, the supplier shall include on-site reassembly and retesting by factory-qualified service personnel. UPS equipment cabinets shall include the following general equipment or equivalents as required to meet the specified performance requirements:
 - .2 Input/output connections for external battery including protection fuses.
 - .3 Make-before-break manual service bypass switch with appropriate interlocks to inverter output/status switch.
 - .3 Dry relay contacts for interface to remote status equipment. These will be connected to the Building Management System in the future.
 - .4 UPS battery capacity shall be 60 minutes at 50% of UPS rating.
 - .5 Manuals and documentation.
 - .6 Delivery to site.
 - .7 Installation.

1.6 SHOP DRAWINGS

- .1 Submit shop drawings and product data which are appropriate for the specific equipment/accessories being supplied. Drawings or data pertaining to a variety of similar products or containing irrelevant information will be rejected without review. Incomplete submissions will be rejected without review.
- .2 Include:
 - .1 Outline sketch showing arrangement of units, meters, controls, battery rack, battery arrangement and dimensions
 - .2 Shipping weight
- .3 Schematic diagram showing interconnection of rectifier, inverter, battery, bypass switch, meters, controls and indicating lamps
- .4 Description of system operation, referenced to schematic diagram, for:
 - .1 Manual control during initial start- up and load transfer to bypass and back to inverter output
 - .2 Inverter
 - .3 Bypass

- .4 Battery
- .5 System performance and reliability:
 - .1 Consider any deviation from the required output power waveform as a failure in the UPS and include an estimate, with supporting calculations, of the Mean Time Between Failures (MTBF) expressed in hours
 - .2 Provide an estimate with supporting data for the Mean Time to Repair factor (MTTR)
- .6 Certification that UPS system equipment will comply with specified performance requirements. In the event that there are deviations to specified requirements, these must be clearly identified and may be cause for rejection of equipment for non-compliance with requirements. In the absence of clearly defined performance deviations the specification requirements shall be the standard of acceptance for all performance testing.
- .7 Full load kVA and kW output at unity power factor.
- .8 Efficiency of system at 25%, 50%, 75% and 100% rated load.
- .9 Type of ventilation: natural or forced.
- .10 Typical operation and maintenance manual

1.7 CLOSEOUT SUBMITTALS

- .1 Provide data for incorporation into operation and maintenance manual specified in Sections 01 78 00 - Closeout Submittals
- .2 Submit interim, draft final, and final O & M manual. Final manual approved by Departmental Representative. Submit interim copies to Departmental Representative prior to notification of factory test date
- .3 Operation and Maintenance Manual to include:
 - .1 Operation and maintenance instructions concerning design elements, construction features, component functions and maintenance requirements to permit effective operations maintenance and repair
 - .2 Technical data:
 - .1 Approved shop drawings
 - .2 Characteristic curves for automatic circuit breakers and protective devices.
 - .3 Project data
 - .4 Technical description of components
 - .5 Parts lists with names and addresses of suppliers
- .4 Three copies of final manual

1.8 OPERATION AND MAINTENANCE DATA

- .1 Arrange with Departmental Representative:
- .2 Advise on:
 - .1 Expected failure rate of equipment
 - .2 Type of expected failures
 - .3 Estimated time between major overhauls based on 10 year equipment life

1.9 INSTALLATION DATA

- .1 Provide, in addition to drawings in manuals, one complete set of as-built physical, schematic, and wiring diagrams and complete installation instructions, in a separate binder located in a specific purpose, on-unit storage compartment. These drawings and instructions are provided for the Contractor's use and reference during installation. Identify binder "Record Drawings and Instructions for Installation."

1.10 SOURCE QUALITY CONTROL

- .1 Provide UPS system which is manufactured and tested under a manufacturer's Quality Assurance Program which complies with the intent of CSA CAN3-Z299.3 or ISO 9001. Provide a copy of the manufacturer's Quality Assurance Procedures Manual upon request.
- .2 Factory test complete UPS, fully connected with its mating input filter, battery breaker panel, external manual bypass cabinet, and all unit accessories.
- .3 Test configuration:
 - .1 UPS filter cabinets fully connected in actual operational configuration. Provide separate, protected input sources for UPS and bypass input.
 - .2 Actual project battery disconnect/meter panel connected.
 - .3 Actual project manual bypass cabinet connected. A power source to the bypass breaker is not required.
 - .4 A test battery with minimum 2 minute at full load capacity, all fully connected. Where practical, the project batteries may be used for factory test.
 - .5 Test load bank connected to manual/bypass panel load output.
- .4 Prepare factory test record sheets with space to record data. Provide copy of proposed test records to Consultant (7) days after tests. Test records shall indicate:
 - .1 Date.
 - .2 UPS: Make, Model, Serial Number.
 - .3 UPS rated output V, A at 100%, 125%, and 150% rated load. Indicate rated duration of overload conditions.
 - .4 UPS rated input V, A at above output loads under conditions of maximum recharge and normal float charge.
- .5 Provide test results to department representative for review and approval prior to shipment. If the department representative's review discloses test/record deficiencies or performance deficiencies, repeat applicable portions or complete tests as directed by department representative.
- .6 Non-running tests and checks: Perform and record the following before starting the unit:
 - .1 Verify that all quality control checklists have been properly completed. Verify proper connection of UPS and equipment for testing.
 - .2 Verify proper safety grounding of all equipment and test load bank when installed in the test configuration.
 - .3 Verify electrical and mechanical safety guards secure and in place.
 - .4 Adjustments properly made.
 - .5 All normal and special test instrumentation installed and operational.

- .7 Conduct functional and load tests to verify conformance with Specifications, Codes, and performance requirements. Record results including chart recordings where appropriate.
- .8 Submit certified copy of test results to the department representative for review and approval before shipment to site.
- .9 Include certified copy of test results in Operation manual.

1.11 STORAGE AND DELIVERY

- .1 Store all UPS system equipment in an indoor, dry, heated (to 15°C minimum) location until scheduled delivery to site.
- .2 Coordinate site delivery schedule with site contractor. Do not ship until equipment can be off-loaded and immediately placed in its installed location in the completed building.

1.12 WARRANTY

- .1 Provide a written warranty stating that the UPS equipment and accessories, including batteries, are warranted by the manufacturer against defects in material and workmanship for a period of one (1) year from the date of on-site commissioning and final acceptance for automatic service. Include copy of warranty in Operation Manuals. Warranty shall include 100% on site parts and labour for repair of defects.

Part 2 Products

2.1 RATING AND PERFORMANCE REQUIREMENTS

- .1 UPS and related equipment shall comply with the following minimum rating and performance requirements:
 - .1 UPS continuous Output Rating (100% load): 6 kVA at 120/208 V, 1-phase, 4-wire input, 60 Hz when serving up to 100% non-linear loads having peak current up to 2.2 times fundamental RMS current [i.e. Crest Factor (CF) = 2.2].
 - .2 UPS inverter output conditions when operating on either rectifier output or variable voltage battery power at 100% load:
 - .1 Frequency: $\pm 1\%$ when synchronized to bypass; $\pm 0.1\%$ when free-running on battery or operating without bypass source available.
 - .2 Steady-state voltage regulation: $\pm 1\%$ with balanced load; $\pm 3\%$ with 100% unbalanced load.
 - .3 Transient voltage: $\pm 5\%$ for 100% step load change with recovery initiated within 8 ms and recovery to steady state bandwidth within 50 ms.
 - .4 Phase displacement: less than 1° with balanced load; less than 3° with 50% unbalanced load; less than 5° with 100% unbalanced load.
 - .5 Output voltage distortion: less than 2% at any single harmonic; less than 4% THD for linear load.
 - .3 UPS inverter output overload capability:
 - .1 125% rated kW/kVA for 15 minutes with all steady state output parameters remaining within 125% of full load conditions.
 - .2 Single-phase line-to-neutral short circuit capability: 220% rated current for 30 seconds; 300% rated current for 20 ms.

- .4 UPS output to be automatically transferred to bypass via internal static bypass switch (SBS) when overload conditions exceed inverter output capability, or when bypass operation is selected by the UPS controls or operator interface. Transfer to bypass to be in phase and without interruption/disturbance of load voltage and current under all load conditions.
 - .5 UPS output to be transferred from static bypass to internal maintenance bypass via manual operation of internal make-before-break maintenance bypass switch (MBS). Interlocks shall prevent operation of the MBS unless the UPS output load is being served by the SBS.
 - .6 Input source inrush current at initial energization limited to 1000% of the 100% rated load current at float charge conditions. Following initial energization, control rectifier to ramp input power to rated conditions over a nominal 10-second ramp period.
 - .7 EMI suppression to FCC Part 15, Subpart J, Class A.
 - .8 Input source surge withstand capability to ANSI C62.41 (IEEE 587) Categories A and B.
- .2 UPS and related equipment shall comply with the rating and performance requirements when operated under conditions of:
- .1 Rectifier input power source: 208 V, 1-phase, 3-wire, +10% to -15%.
 - .2 Bypass input power source: 208 V, 1-phase, 3-wire, $\pm 10\%$. The bypass source shall be independent from the rectifier input source.
 - .3 Source frequency: 60 Hz $\pm 5\%$. Inverter synchronized to bypass source frequency for 60 Hz $\pm 1\%$.
 - .4 Source voltage distortion: 5% THD or less.
 - .5 UPS room ambient conditions of:
 - .1 Temperature up to 40°C at 150 m above sea level.
 - .2 Humidity up to 95%.
 - .6 UPS noise level at any load up to 100% rated load, float charge conditions shall not exceed 50 dBA measured at 1 meter from cabinet and 1.2 m above a reflective floor surface (e.g. concrete), and reading adjusted to free field conditions.
- .3 Overall UPS efficiency: minimum 90% at 100% rated load; minimum 88% at 50% rated load.
- .4 Manufacturer's published mean time before failure (MTBF) of not less than 50,000 hours with calculation based on IEEE-recommended practice for establishing equipment reliability/availability.
- .5 Batteries rated for:
- .1 Continuous float charging.
 - .2 5-year design life in float service.
- .6 External bypassing cabinet containing mechanically interlocked moulded case switches (non-automatic breakers) rated for minimum 125% UPS full load current. Cabinet configured, sized, and painted to match adjoining UPS distribution panel.

2.2

UPS CABINET

- .1 Provide cabinet sections assembled to form a single unit and contain:

- .1 Input source connections including cable terminals for:
 - .1 Rectifier input.
 - .2 Battery input/output.
- .2 Output connections including cable terminals.
- .3 Input source disconnect/backfeed contactor, isolation/voltage matching transformer and harmonic filter.
- .4 Rectifier and DC link filter.
- .5 Inverter.
- .6 Output isolation/voltage matching transformer and output filter.
- .7 Bypass source disconnect/backfeed contactor, and static bypass switch.
- .8 Monitoring and diagnostics system.
- .9 All cable lugs and terminal blocks for all power, control, grounding, and remote monitoring connections.

2.3 UPS STATIC BYPASS

- .1 Provide 100% continuous rated controlled thyristor static bypass switch to meet UPS performance requirements and provide uninterrupted transfer to bypass under the following conditions, and uninterrupted transfer back to inverter when signalled to do so:
 - .1 Inverter overload.
 - .2 Load short circuit as sensed by inverter voltage below 90%.
 - .3 Inverter fault.
 - .4 Inverter off signal.

2.4 UPS EXTERNAL MAINTENANCE BYPASS

- .1 Provide manually operated bypass switches to effect transfer of load from static bypass to maintenance bypass to external by-pass and vice-versa. Interlock switch to prevent operation unless inverter is off and load is being served by static bypass.
- .2 External Maintenance by-pass switch shall be in a separate enclosure which will facilitate full removal of the UPS for maintenance, testing or replacement.

2.5 UPS MONITORING AND DIAGNOSTICS

- .1 Provide an operator control, monitoring and diagnostics system consisting of an electronic panel which includes the following features.
- .2 LED display of UPS operating status configured for at-a-glance recognition of overall operating conditions.

2.6 UPS REMOTE DEVICES

- .1 Provide dry alarm contacts for interface to external equipment to monitor UPS status and alarms via the BMS.
- .2 Provide necessary interface contacts for:
 - .1 UPS "on normal"
 - .2 UPS "on battery"
 - .3 UPS "off-line" (manual or auto bypass)

- .4 UPS "warning" (sum of all alarms)
- .5 UPS "failed"
- .6 UPS "overheated" on a separate contact.

2.7 UPS BATTERIES

- .1 Provide totally sealed, valve regulated, lead acid battery sized and configured to meet UPS performance requirements.
- .2 Fill cells at manufacturer's factory on the basis of electrolyte weight to ensure proper quantity.
- .3 Provide self-sealing, removable, safety relief valve and flash arrester.
- .4 Provide solid copper cell posts. Cell terminals shall be rated for the cell's 1 minute discharge rate without overheating damage and with minimal voltage drop.
- .5 Provide cell containers constructed of high impact polypropylene. Material to be flame retardant and meet UL Standard 94V-0 and 28% limiting oxygen index. Container cover shall be sealed to the container with a leak-free seal.
- .6 Cell design suited for 2.25 vpc \pm 1% continuous float charge. Cell design shall not normally require equalize charge, but the cell shall be capable of equalize charging at 2.33 vpc \pm 1%.
- .7 Provide battery designed and rated for:
 - .1 For UPS – A:10-year expected life at continuous float charge at ambient temperatures of 25°C \pm 10°C.
- .8 Factory test each battery in accordance with IEEE-450 and with manufacturer's Quality Assurance program. Any individual battery shall have a minimum of 90% rated capacity, and the aggregate average of all batteries provided shall have a minimum aggregate average of 98% rated capacity.
- .9 Provide complete inter-battery connectors to suit the battery and cabinet configuration. Connectors shall be lead plated copper. Where configuration requires cable connections between batteries, provide factory manufactured cables and terminators to suit the configuration. Provide terminal connections for main cables at a safe, convenient location.

2.8 BATTERY DISCONNECT

- .1 Provide DC rated battery breaker or fused load break switch in wall-mount cabinet, with colour to match UPS. Alternately, DC breaker/switch may be included as an integral part of the UPS cabinet or the battery cabinet. DC rating of breaker/switch shall be based on minimum operating voltage of 2.33 vpc. Provide auxiliary contacts for UPS signalling.
- .2 Provide electrically operated disconnect means to allow UPS control of battery source. Reclose of battery disconnect shall be by manual means with operating handle accessible from the exterior of the cabinet.

2.9 EXTERNAL BYPASS

- .1 Provide wall-mount cabinet configured to match UPS distribution panel generally as indicated.
- .2 Cabinet shall contain:

- .1 Mechanically interlocked moulded-case switches rated for a minimum of 125% of UPS output rating. Mechanical interlocks shall be permanently attached to breaker frame, either as a "walking beam" interlock between breaker trip bars, or as a sliding bar interlock between operating handles. Provide auxiliary contacts for future use.

2.10 FACTORY TESTS

- .1 Factory assemble all equipment, except UPS battery, and test in accordance with Part 1 of this Section. If available, the actual project battery/cabinet assembly may be utilized for testing in lieu of a test battery.

2.11 SHIPPING AND DELIVERY

- .1 Prepare UPS and accessories for shipment. Perform all necessary blocking, tie-down, protection, and removal and storage of external extremities for safe loading, transit, unloading, lifting, and setting in place in the indicated UPS room.
- .2 Store UPS and coordinate shipping method and necessary crating/weather protection with Site Works Contractor as per Part 1 of this Section.

2.12 SITE COMMISSIONING AND ACCEPTANCE TESTING

- .1 Provide factory trained UPS technician to commission, test, and train operation/maintenance personnel. Provide test equipment and load bank as necessary to effect the testing.

2.13 ACCEPTABLE PRODUCTS

- .1 Subject to compliance with the requirements of these specifications, UPS systems from the following suppliers/manufacturers are acceptable (Standard of Acceptance):
 - .1 Eaton 5125 series;
 - .2 Schneider/ APC;
 - .3 Liebert.

Part 3 EXECUTION

3.1 INSTALLATION COORDINATION

- .1 Physical installation details shown on plans and defined in these Specifications are typical of equipment which would conform to Specifications for equipment supply.
- .2 Coordinate with actual UPS equipment supplier for all final installation dimensions, locations, connections, and miscellaneous installation materials.
- .3 Obtain approval from department representative for any significant changes in equipment location or connection.

3.2 UPS VENTILATION

- .1 Room ventilation system is existing, advise the owner if existing ventilation is not adequate before installation.

3.3 ELECTRICAL SYSTEM

- .1 Make all necessary electrical connections to UPS equipment and accessories as shown on electrical plans and suppliers' drawings.
- .2 All power and control wiring to be installed to comply with the requirements for sprinklered equipment rooms. As a minimum, this shall include O-ring or equivalent seals at all joints or entry into junction boxes, panels, switchboards, etc.

3.4 COMMISSIONING THE WORK

- .1 Following completion of installation, the UPS Equipment Supplier is required to provide a qualified representative for commissioning, testing, and training for UPS and associated equipment. Schedule and coordinate these activities with the UPS supplier.
- .2 Bypass supply and load side of external bypass panel may enter permanent service when connected to normal supply. Monitor initial service for trouble-free operation.
- .3 Ready UPS system for service. Check phase rotation of UPS output prior to switching loads.
- .4 Qualified personnel shall commission system for correct operation and suitability for service.
- .5 The department representative shall be notified and a date set for Site Acceptance test.

3.5 SITE ACCEPTANCE TESTING

- .1 Coordinate and conduct Site Acceptance testing in conjunction with the UPS Equipment Supplier. This testing will consist of:
 - .1 Commissioning and operational tests.
 - .2 Acceptance tests to be conducted after loads are connected to the new UPS distribution panel.
- .2 Demonstrate proper operation of: rectifier, inverter, filter, transfer-to-bypass, battery operation; automatic and manual start/stop; protective shutdown and alarm devices; manual bypass switch; UPS controller programming parameters; ventilation and thermostatic control system; UPS distribution panel; and overall system operation as required to determine proper operation and conformance with requirements.
- .3 For commissioning and operational tests, operate for 1 hour, running at available building load. Functional test all equipment and manual bypass switch. Conduct test and observe/record test data. Verify to the Consultant that commissioning tests were satisfactorily completed and equipment is ready for acceptance tests.
- .4 Acceptance tests will consist of 8-hour continuous load test conducted with maximum available site load plus the auxiliary load bank to provide loads up to 100% rated capacity.
- .5 Record demonstration results and load test operating conditions at 30-minute intervals.
- .6 The complete UPS equipment and related installation system shall perform continuously and without interruption for the test period. No servicing or adjustments shall be made during the test period. In the event of a UPS system failure of any kind, repeat the tests for 48 hours without a failure of any kind. In the event of a failure during the second 48-hour test, remove and replace the UPS system with the product of another acceptable manufacturer.

- .7 Following the load test, conduct a 45-minute battery discharge test at 3 kW_e output load. Battery voltage and DC current shall be recorded at 1-minute intervals during the test. Should the batteries fail to meet the specified requirements, replace the entire battery bank with all new batteries and repeat the tests until satisfactory.
- .8 Maintain test record sheets which record test conditions and logged data. Recordings and test record format shall be neat and readily legible. Provide copies for Consultant (1) and for inclusion in instruction manuals (3).
- .9 Following satisfactory completion of Site acceptance test, put equipment in permanent automatic service.

3.6 TRAINING

- .1 Conduct a familiarization and training session for Owner's operating personnel. Schedule training session to coordinate with shift schedules of operating personnel.
- .2 Training shall be conducted by a qualified UPS service technician who is familiar with both technical and operating/service characteristics of UPS systems.
- .3 Session to be conducted after equipment is installed and fully operational.
- .4 Include a minimum of the following items:
 - .1 Familiarization with instruction manual.
 - .2 Review of electrical schematics and controller logic ladder diagram - how to read them and how to use them to troubleshoot system function or control problem.
- .5 Physical check-over of equipment noting device locations and relationship to schematics.
 - .1 Equipment functional tests and checks.
 - .2 Equipment operating instructions, including tuning and adjusting for operation.
 - .3 Equipment routine service requirements.

- .4 Emergency troubleshooting instructions - define most likely problems, symptoms, and corrective actions.
- .5 Battery system safety, operation, and maintenance.

END OF SECTION

Part 1 General

1.1 GLOSSARY

- .1 AGC - Automatic Gain Control
- .2 ATP - Acceptance Testing Procedure/Plan
- .3 BSCS - Building Security & Communication Systems
- .4 CCD - Charged Couple Device
- .5 CCTV - Closed Circuit Television
- .6 CEC - Canadian Electrical Code
- .7 CSA - Canadian Standards Association
- .8 EIA - Electronic Industries Association
- .9 ES - Electronic Systems
- .10 FAT - Factory Acceptance Test
- .11 GFE - Government Furnished Equipment
- .12 GUI - Graphical User Interface
- .13 HMI - Human Machine Interface
- .14 I/O - Input/Output
- .15 KVM - Keyboard/Video/Mouse
- .16 LAN - Local Area Network
- .17 MM - Multi-mode
- .18 MTBF - Mean Time before Failure
- .19 OFC - Optical Fiber Cable
- .20 PDC - Power Distribution Centre
- .21 PWGSC - Public Works & Government Services Canada
- .22 PTT - Push-to-Talk
- .23 RU - Rack Units (1.75" vertical space in an EIA-310E standard equipment cabinet)
- .24 SAC - System Administration and Control
- .25 SM - Single-mode
- .26 SPEC - Specification
- .27 STD - Standard
- .28 T&E - Telecommunications and Electronics
- .29 TES - Telecommunications Equipment Space
- .30 UPS - Uninterruptible Power Supply
- .31 VAC - Volts, Alternating Current
- .32 VDC - Volts, Direct Current

1.2 RELATED SECTIONS

- .1 Division 01.

1.3 GENERAL

- .1 Documents
 - .1 View plans, visit Site, and check plans against existing conditions. Verify scale dimensions of Drawings in the field. Should any discrepancy exist, notify the Departmental Representative before the proposal is submitted; otherwise the most expensive method is implied.
 - .2 The word “provide” shall be taken to mean detailed design, supply, install, test, and commission.
 - .3 The acronym BSCS shall be taken to mean the Building Security and Communication Systems.

1.4 COORDINATION WITH OTHER DIVISIONS

- .1 The work of this Division is to be coordinated with the work of Divisions 01, 26 and existing equipment for connection to existing door access system, fire alarm systems and other electrical systems where applicable.
- .2 The work of this Division is to be coordinated with Division 26 for the conduit systems specified in Division 26.

1.5 SUMMARY OF WORK

- .1 General
 - .1 The intent of the Work of Division 27 & 28 (BSCS):
 - .1 Structured Cabling for Communications Systems related to the new work
 - .2 Public Address System (P/A) (FUTURE)
 - .3 Access Control System (ACS)
 - .4 Video Surveillance (CCTV)
 - .2 Refer to the contract drawings for additional information.
- .2 Spare Capacity
 - .1 These capacity requirements apply to each subsystem that forms part of these systems. Terminology used in this section is generic in nature and shall be transferred to specific terminology used for each subsystem
 - .2 Systems shall be of a modular design and it shall be possible at a future date to add more control terminals and associated equipment to the basic installed complement without changing the existing hardware or software
 - .3 The Systems shall be sized to accommodate all points as laid out in the specifications and drawings. Systems software and server hardware shall be provided with a 50% expansion capability. This requirement acknowledges that future expansion may require the addition of field hardware
 - .4 Field I/O shall be laid out and provided such that each piece of equipment at each location is only loaded to 80% of its capacity. The 20% spare points shall be installed by this contract and shall be available to the Departmental Representative, for the connection of future field devices. This requirement applies to inputs and outputs independently. The spare capacity called for must

be a minimum for each I/O type. For systems and components where distributed I/O techniques are used, the loading and spare capacity requirements shall apply to each location where equipment is installed

.3 Interim Use of Systems

- .1 The Departmental Representative and the Departmental Representative's operating personnel reserve the right to do trial usage of the Building new Systems or parts thereof for the purpose of testing and learning of the building new systems operational procedures
- .2 Cooperate with the Departmental Representative's during the trial usage and provide the services of qualified and knowledgeable personnel for assistance and guidance as necessary to avoid jeopardizing the safety of equipment and construction personnel. Include all costs of providing such services in the contract

1.6 CODES, STANDARDS, AND REGULATORY REQUIREMENTS

- .1 Any reference to Codes, Standards and Regulations in these Specifications shall be taken as the latest or the most current in effect at time of proposal submission.
- .2 Comply with all requirements of the National Building Code of Canada and the Canadian Electrical Code, CSA C22.1-15, except where specified otherwise, including all provincial and other amendments, Electrical Bulletins, and any local by-laws or rules regulating the installation of electrical equipment and its seismic restraint. In no instance, however, shall the standards established by the Contract Documents be reduced by any of these Codes or Regulations.
- .3 All materials shall bear the approval of the Canadian Standards Association and, where applicable, the Underwriters' Laboratories of Canada or, alternately, shall bear local approval from the Electrical Inspection Department having jurisdiction. Include in the submission all costs associated with obtaining local approvals.
- .4 Operating voltages to CSA Standard CAN3-C235.

1.7 QUALITY OF WORK

- .1 Unless otherwise indicated, all materials supplied shall be new and of the quality indicated in these Specifications. Otherwise, they shall be of the best industrial quality obtainable for the purpose.
- .2 Manufacturers' directions shall be followed in all cases where the manufacturers of equipment or materials used in this work furnish directions covering points not shown on the Drawings or Specifications.
- .3 Unless otherwise directed, all installed materials or equipment exposed to view shall be plumb, true, square, and/or level as the case directs and, where applicable, located symmetrically to the features of the building.
- .4 Unless otherwise indicated, all materials shall be suitable for commercial use. Samples of proposed materials and installation methods shall be submitted to the Departmental Representative for review prior to commencement of the Work. If the Departmental Representative does not approve of the materials and or methods of installation the Contractor shall replace same with a suitable material or method at no additional cost to the contract.

1.8 RESPONSIBILITY AND COORDINATION

- .1 Supply all labour, materials, equipment, tools, and incidentals necessary to provide a complete electrical installation as indicated on the Drawings and as set out in these Specifications.
- .2 The Drawings and Specifications complement each other and what is called for by one is binding as if called for by both. If there is any doubt as to the meaning or true intent due to a discrepancy between the Drawings and Specifications, obtain a ruling from the Departmental Representative prior to submitting the proposal. Failing this, the most expensive alternative is to be allowed for. In the proposal submission, a claim for additional charges will not be accepted.
- .3 Advise the Departmental Representative of any specified equipment, material, or installation of same which appears inadequate or unsuitable or which is in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction. Provide all labour and material which are obviously necessary or reasonably implied to be necessary to complete the work as if the work was shown on the Drawings and/or described in the Specifications.

Coordinate all work before fabricating or installing any material or equipment. It is incumbent on the Contractor to ensure that all materials and equipment fit into the allocated spaces and that all equipment can be properly inspected, serviced, and replaced if and when required. Advise the Departmental Representative of space problems before fabricating or installing any material or equipment. Demonstrate to the Departmental Representative on completion of his work that all equipment and material installed by him can be properly and safely serviced and replaced. Make no deviations from the intent of the design, or any involving additional cost, without the Departmental Representative's written direction.

1.9 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120VAC", or with appropriate voltage.

1.10 POWER SUPPLY

- .1 Power will be available in the telecom rooms. All BSCS systems shall run on UPS power in the event of a power failure and are to be connected to the UPS provided by Division 26.
- .2 Coordinate load details of all the BSCS system equipment with the Division 26 contractor to ensure the correct capacity and provisions are available on the UPS system.
- .3 The Division 27/28 Contractor shall provide the 120VAC/24VDC power supplies and their appropriately sized, lockable, enclosures as required for all electrified door hardware. Contractor will coordinate and provide all electrified door hardware.
- .4 The Division 27/28 Contractor shall provide all ancillary 120VAC branch circuit conduit and wiring to facilitate any misc. power requirements of the BSCS equipment.

1.11 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. Do not scale the Drawings.

- .2 The Drawings show approximate locations of outlets, equipment, and apparatus but the right is reserved to make such changes in location before installation of the work as may be necessary to meet the requirements of the existing building or construction in any way. No extra will be allowed and, conversely, no credit shall be expected for such changes unless for each item of work the distance moved exceeds 3 m (10') prior to final installation of same.
- .3 Take field measurements where equipment and material dimensions are dependent upon building dimensions.

1.12 CUTTING, CORING, AND PATCHING

- .1 Prior to cutting of walls or floors, review the proposed locations, sizes, and methods with the Departmental Representative's, the General Contractor & the Division 26 subcontractor. This includes notification when cutting or coring into any fire rated construction maybe required.
- .2 Arrange and pay for all patching to be done in such a manner as to return finishes to the same standard as surrounding finishes or to the original condition.

1.13 IDENTIFICATION

Identify all pieces of electrical equipment other than conduits and raceways with engraved laminated plastic nameplates having 3 mm (1/8") minimum height characters showing black on white for normal power and red on white for standby power and attach, unless otherwise directed, with silicone cement. For identification of major pieces of equipment, (for example, PLC cabinets, Power Supply Cabinets, etc.), use size 6 or 8 nameplates having 12 mm (1/2") minimum height characters.

- .1 Nameplate sizes shall be as follows:

Size 1	20 x 90 mm (3/4" x 3 1/2")	1 line	8 mm (1/2") high letters
Size 2	20 x 90 mm (3/4" x 3 1/2")	2 lines	5 mm (1/5") high letters
- .2 "Dymo" tape will not be permitted except where specified for device outlet identification.
- .3 Labeling of communication systems' cover plates shall be as specified in respective Specification Sections.
- .4 Provide identification (lamacoid nameplates), inclusive of and additional to the above, for:
 - .1 Each communication system cabinet, rack or console
 - .2 All other items where so detailed or noted on the Contract Documents
- .5 Nameplate wording shall be such as to indicate clearly the function of each piece of equipment so identified. Prior to manufacture of nameplates, obtain approval from PFC &/or the Departmental Representative for intended wording.
- .6 Nameplates shall be installed after all painting has been completed. Where surface requirements dictate provide screw-in place lamacoids for a permanent installation.
- .7 All junction and pull boxes for conduits, ducts, and other raceways in concealed ceiling spaces only shall be permanently marked using a black felt pen on the inside and outside of cover plate as follows:

- .8 For the BSCS systems, use letter identification as specified below.
 - .1 Clearly and conspicuously identify all new conduits, ducts, and other raceways with sprayed-on major and minor colour bands as set out below. Major bands to be not less than 100 mm (4") wide; minor bands not less than 50 mm (2") wide.
 - .2 Table of colours and letter identifications:

System	Major Band	Minor Band	Letter Identification
Public Address (FUTURE)	Dk. Green	Black	C
Access Control System	White	Black	A
CCTV	Br. Green	Black	T

- .9 Colour identification for conduits, ducts and other raceways shall be provided at all junction and pull boxes, all locations where a conduit enters or leaves a partition wall, all locations where a conduit terminates at a cable tray, at both sides of fire walls penetrating ceiling spaces, and where conduits enter or leave floor slabs. Additionally, each service shall be identified at intervals along its transit through the space such that each identification is visible from the next and not more than 10 metres (30') apart. This work shall be provided by Division 26, the Division 27/28 Contractor shall coordinate these requirements with the Division 26 Contractor.
- .10 Identification of junction boxes, pull boxes, conduits, ducts and other raceways shall be done on a continuous basis as the rough-in work progresses. Leaving the marking of conduits, raceways and boxes to the end of the rough-in stage will not be permitted.
- .11 All control and alarm conductors shall be identified at each terminal cabinet piece of equipment at both ends of the conductor, with Electrovert slip-on "Z" type markers having suitable identification markings, to match wiring diagram conductor identification.

1.14 EQUIPMENT LIST

- .1 Include an equipment list for all material proposed for the project. List to include quantity, item identification, manufacturer, catalogue numbers where applicable, custom features where applicable and the names of the installers if other than the prime sub-trade.

1.15 DELIVERY AND STORAGE

- .1 Store all electrical equipment and devices other than conduits, fittings, boxes, and ducts in a heated and ventilated space, and protect from construction damage. Include in the submission price all costs related to such storage.
- .2 Conduits, fittings, boxes, and ducts may be stored outside if properly protected against the weather.
- .3 Ship and store floor-mounted equipment in upright position.
- .4 Ship equipment in adequate containers to assure it arrives undamaged at the site.
- .5 Keep equipment doors locked. Protect equipment from damage and dust.
- .6 Block moving parts when necessary to prevent damage during movement and shipment of equipment.

- .7 Remove from the site, and replace with new, all materials showing evidence of damage or rust.

1.16 EQUIPMENT LOCKS

- .1 Fit locks on the cabinet doors of all equipment, where these are hinged. Including low voltage cabinets. All locks shall be identical. Turn over to the Departmental Representative, a total of six (6) keys and obtain a receipt for same.
- .2 BSCS equipment cabinet doors, must be keyed differently. Coordinate these requirements with Division 26.

1.17 TESTING AND ADJUSTING

- .1 Acceptance Test Plan
 - .1 Contractor shall prepare an acceptance plan and shall submit the plan for approval by the Departmental Representative. The acceptance test plan shall detail all testing procedures that will be used to confirm the installed system meets all requirements of these specifications. The acceptance test plan shall include the name of the person who will be responsible for the commissioning of the system i.e. executing the plan
- .2 General
 - .1 Coordinate and pay for all tests specified herein including further tests as required by authorities having jurisdiction
 - .2 All testing shall be performed after each system installation has been completed and prior to the system being put into continuous operation unless otherwise noted
 - .3 Perform the testing, adjusting, and balancing only when conditions are commensurate with actual operating conditions for the given system
 - .4 Advise the Departmental Representative 48 hours in advance of each test. Carry out tests in the presence of Departmental Representative
 - .5 Submit detailed typewritten test reports in duplicate to the Departmental Representative within 5 days after the completion of each test. Include all test reports in the Maintenance Manuals. Each test shall clearly indicate, in a line-by-line format, that the components (not as a group) have been tested, test results, and whether test results are within acceptable limits. Each test report shall be accompanied by a front cover sheet briefly outlining what the test report is for and clearly summarizing all items that have failed the tests. The cover sheet shall indicate names of individuals who conducted the tests and their signatures
 - .6 The Contractor shall not request a Substantial Performance Inspection until the total installation is complete and the system meets all of the manufacturer's recommendations. The manufacturer shall provide a certificate to the Departmental Representative, that the complete system is fully operational and ready for use
 - .7 The following item(s) shall be submitted 2 weeks prior to the first factory acceptance test date and again 2 weeks prior to the commencement of onsite commissioning:
 - .1 Detailed testing, integration, commissioning and acceptance plan

- .8 The Departmental Representative may retain a Commissioning Agent to witness all testing. If one is appointed, the Contractor shall cooperate fully with the commissioning agent at no additional cost to the contract
- .3 Testing by the Contractor
 - .1 The Contractor shall use his own forces and the forces of his suppliers and
 - .2 All subcontractors necessary for the testing the system
 - .3 Coordinate and pay for all tests and adjustments specified herein including tests required by authorities having jurisdiction
 - .4 All testing shall be performed after the system installation has been completed and prior to the system being put into continuous operation unless otherwise noted. Perform the testing, adjusting, and balancing only when conditions are commensurate with actual operating conditions for the given system
 - .5 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions
 - .6 Advise the Departmental Representative 48 hours in advance of each test
 - .7 The Departmental Representative may direct that a portion or all tests shall be conducted in the presence of the Departmental Representative
 - .8 Provide all equipment, labour, and instruments and include in the contract all costs of testing agencies and manufacturer's representatives for the above

1.18 DEMONSTRATION

- .1 Demonstrate to and instruct the Departmental Representative on the Operating and Maintenance procedures for all systems using the assistance of specialist sub-trades and manufacturer's representatives for instruction and include all costs. Systems to be demonstrated shall include but not be limited to: the video surveillance system; access control system; public address system and all other subsystems and interfaces.
- .2 Arrange an acceptable time with the Departmental Representative's and submit a program of instruction and demonstration for the Departmental Representative's approval. Assume that the Departmental Representative's are not familiar with any of the special equipment and/or systems installed.

1.19 TRAINING

- .1 Provide complete system training manuals. Two types of training manuals are required:
 - .1 Operators Training / Operations Manual
 - .2 Administrators Training / Administration Manual
- .2 Training manuals shall be provided to the Departmental Representative for review no less than two weeks prior to the start of applicable training sessions
- .3 Training sessions to include the use of electronic & printed copies of the presentation as provided to all trainees.
- .4 Training shall be provided for all the following functions. These should be considered minimum requirements
 - .1 Training shall include instruction and demonstration on the creation and modification of all user definable elements, screens, templates, schedules, tables etc. The level and depth of training shall ensure the Departmental Representative

- is completely self supporting on the system operation, modification and maintenance.
- .2 Instruction/demonstration shall include system backup, historical record archiving/retrieval for all systems and sub systems.
 - .3 Operation of System - Training will be provided directly to control operators. The training is to cover all aspects of routine operations and non-routine functions. Particular emphasis is to be placed on problem resolution and recovery. Contractor is to allow for minimum 2 training sessions of 2 hours duration each. Each training session may include up to 4 trainees. Training may need to be provided at times coordinated with employee's shifts. Training for each operator will be provided twice, once prior to cut over of any devices to the new system and again when the system is complete and prior to substantial performance. The training sessions outlined above are to be 2 sessions prior to completion of the system.
 - .4 System Administration - All functions covered in above item Operation of System and also training on modifications to the system parameters. Addition / deletion or changes to the programming, administration of passwords, etc. Contractor is to allow for 2 training days of 2 hours duration for each.
 - .5 System Maintenance - All items covered in above sections Operation of System and System Administration Training on all aspects of repair and maintenance of the systems, including but not limited to the following:
 - .1 Addition, deletion, and modification of system input and output points;
 - .2 Addition, deletion, and modification of doors;
 - .3 Allow for minimum 2 sessions of 2 hours for each. The first session to be completed prior to installation on site and the second session at Substantial Performance.
 - .5 Submit to the Departmental Representative, at the time of Substantial Performance inspection, a complete list of systems stating for each system:
 - .1 Date instructions were given to PFC staff;
 - .2 Duration of instruction;
 - .3 Name of persons instructed;
 - .4 Other parties present (Manufacturer's Representative, Departmental Representative, etc.);
 - .5 Signature of PFC staff stating that they properly understood the system installation, operation, and maintenance requirements and identifying any systems or equipment which were not demonstrated to their satisfaction and which must be re-demonstrated;

1.20

CLEANING AND REPAIR

- .1 At the conclusion of the job and before the Work will be accepted by the Departmental Representative, all equipment shall be clean and free of dust, plaster, paint, and other foreign materials.
- .2 Repair, at no cost to the contract, any equipment or structures damaged by the execution of the Work to its original condition.
- .3 Replace, at no cost to the contract, any equipment or structures irreparably damaged by the execution of the Work.

- .4 Openings and cut-outs shall not be burned into panels. Oversized openings shall not be patched up with loose plates or oversized washers. Oversized openings shall be considered damage to the equipment and the equipment shall be replaced.

1.21 WARRANTY

- .1 One (1) year period for parts, equipment repair and labor warranty commencing day after Substantial Completion.
- .2 Provide additional warranty where the equipment manufacturer exceeds 1 year term.
- .3 Use of installed equipment during the construction period, when permitted by the Owner &/or the Departmental Representative, shall not shorten or alter the Warranty.

1.22 PROJECT DOCUMENTATION

- .1 Shop Drawings
 - .1 Refer to Division 01.
 - .2 Notwithstanding the above, submit electronic copies of all shop drawings and diagrams to the Departmental Representative sufficiently in advance of requirements to allow time for review and comment.
 - .3 Shop drawings shall be neatly drafted and shall be complete and detailed and shall be provided as stipulated elsewhere in these Specifications.
 - .4 All shop drawings shall use metric dimensions. Scaled drawings shall use metric scale.
 - .5 Shop drawings shall bear specific names for each and every unit assembly defined thereon, the name of the project where installation is to take place, the name of the manufacturer, and the date of the drawing including notation of latest revision, if any.
 - .6 Except as may be necessary to indicate operation of systems to show field interconnections, detailed wiring diagrams of component assemblies need not be included with initial shop drawings unless requested by the Departmental Representative. However, such wiring diagrams shall be submitted to the Departmental Representative prior to installation commencing and shall be updated for inclusion in the Maintenance Manual as required by these Specifications.
 - .7 Detailed wiring and termination drawings shall be provided for all systems installed as part of this contract. The drawings and field labelling shall be consistent and will allow a repair person to easily identify all wiring. Excel spreadsheets or other databases shall not be a substitute for detailed wiring drawings.
 - .8 Submit shop drawings and product literature of items and system components as called for below but not limited to:
 - .1 Public Address System (FUTURE).
 - .2 Video Surveillance System.
 - .3 Access Control System.
 - .4 Device and equipment installation details.
 - .5 Panel fabrication details.
 - .6 Commissioning & testing plan.

- .9 Shop drawings prepared by the Contractor, or manufacturer's drawings will be accepted. All drawings required for one and the same system shall be submitted as a complete package. Incomplete system packages will not be reviewed and will be returned unmarked.
- .10 Shop drawings shall be reviewed by the Contractor prior to submission to the Departmental Representative. Shop drawings not bearing Contractor's review stamp, review date, signature, and project name will be returned without comment.
- .11 Manufacturers' brochures (product data) submitted as shop drawings shall clearly indicate type (i.e., GT card reader, etc.) and all features as specified as part of the unit(s).
- .12 Central system equipment shall have specially prepared shop drawings.
- .13 Catalogue literature may be submitted only for standard component items.
- .14 Indicate details of construction, dimensions, capacities, weights and performance characteristics of equipment or material.
- .15 Include wiring, single line and schematic diagrams.
- .16 Facsimile shop drawings will not be accepted.
- .17 Review of shop drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design intent. The review shall not mean approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades.
- .18 Ensure that copies of all shop drawings are available at the job site.
- .2 Operations and Maintenance Manuals
 - .1 Refer to Division 01.
 - .2 Furnish to the Departmental Representative three (3) complete bound sets of typewritten instructions for operating and maintaining all systems and equipment included in this Division.
 - .3 Submit all instructions first in draft for approval prior to final issue.
 - .4 Manufacturers' advertising literature or catalogues will not be accepted for operating and maintenance instructions.
 - .5 Manufacturers' parts list shall be included in each Maintenance Manual.
 - .6 Each set shall consist of ceralux bound and a Bristol flyleaf with the name of the Contractor, Subcontractor(s), and major equipment suppliers, or their local representatives if they are not local manufacturers, together with addresses and telephone numbers of all parties.
 - .7 Each system or piece of equipment shall have its own section separated from the next by a labelled Bristol divider. Shop drawings shall be included in the appropriate section. They shall be fastened into the book by means of a tab which will allow the drawings to be unfolded without being removed from the book.
 - .8 Include, in the final section of the Maintenance Manual, the maintenance schedule for each piece of equipment and all auxiliary systems furnished under

this contract and requiring regular maintenance and listed in the maintenance schedule, keeping in mind that the Departmental Representative's operating personnel are subject to change and may be people who do not necessarily understand the equipment and its function.

- .9 Include copies of all applicable guarantees, warranties, inspection approval certificates, and test certificates.
 - .10 The Operations and Maintenance manual are required to also be submitted in electronic format (PDF) in addition to printed copy requirements stated above.
- .3 Record Drawings
- .1 Refer to Division 1 General Requirements
 - .2 Notwithstanding the above, maintain in the job site office in up-to-date condition, one (1) complete set of whiteprints of each of the Contract Drawings and one (1) set of Specifications, including Revision Drawings, marked clearly and indelibly in red, indicating "As-Built" conditions, where such conditions deviate from the original directions of the Contract Documents, and indicating final installation of wiring/conduit routing and devices
 - .3 "As-Built" drawing markings shall include but shall not be limited to the following:
 - .1 All changes in circuiting and device labelling
 - .2 Size and routing of all conduits. Accurately record on "As-Built" drawings the size and routing of all installed raceways and cables
 - .3 Location of all junction and pull boxes
 - .4 Location of all access panels
 - .5 Location of all conduit or duct stubs, installed equipment, devices, and fixtures
 - .6 All changes to electrical/system installation resulting from Addenda, Change Orders, and Field Instructions
 - .7 Exact location of all services left for future work
 - .8 Location by accurate horizontal and vertical dimensions of the routes and terminations of all raceways and cables installed underground beyond the building
 - .4 At completion of construction, employ a competent computer drawing service to transfer all of the above to the original AutoCAD format drawing files of the Contract Drawings. AutoCAD electronic files of Contract Drawings will be provided by the Departmental Representative. Contractor to produce AutoCAD As-built drawing files with all the above information incorporated. All AutoCAD files shall be in accordance to the PWGSC Pacific Region CADD Guidelines in Appendices.
 - .5 Where extensive changes have been made to an area to the point where it is not practical to update the original proposal drawing, the area in question shall be enclosed with a heavy dotted line and reference made to the applicable Change Order, Site Instruction, and/or associated Revision Drawing
 - .6 For each and every "As-Built" drawing, reference shall be neatly drawn inside the framed space above the title block, listing all Contemplated Change Orders, Site Instructions, and Revision Drawing Numbers applicable to the particular "As-Built" drawing in question

- .7 Each "As-Built" drawing as defined above shall bear the Contractor's identification and signature, the date of record, and the notation: "We hereby certify that these Drawings represent the building As Built"
- .8 All Addenda and Revision Drawings not having their details transferred onto the submitted "as-built" drawings shall be included in the submission using the same drawing format as previously described
Deliver "As-Built" AutoCAD disks, one (1) set of reproducible full scale vellums, and updated Specification Schedules to the Departmental Representative at Substantial Performance of the contract for review and comment and, if necessary, revision, before ultimate transmittal to the Departmental Representative. A holdback will be effected by the Departmental Representative until "As-Built" drawings and AutoCAD electronic files are delivered in good order, as required herein. Refer also to General Conditions

1.23 LOOSE EQUIPMENT

- .1 All loose and portable components and equipment that are to be provided under Division 27/28 shall be handed over to the Departmental Representative at Substantial Performance of the contract and receipts obtained. Copies of such receipts shall be given to the Departmental Representative.

1.24 SUBSTANTIAL PERFORMANCE INSPECTION

- .1 Before the Departmental Representative is requested to make a Substantial Performance Inspection, submit written confirmation that:
 - .1 All wiring devices, cover plates, and other equipment are operational, plumb, clean, and correctly labelled
 - .2 All Test Reports have been submitted
 - .3 All systems have been tested as required and are in good and proper working order
 - .4 All certificates of final acceptance from the authorities having jurisdiction and the manufacturer have been received and submitted to the Departmental Representative
 - .5 Factory finished equipment has been cleaned, touched up, or refinished as necessary to present a new appearance.
 - .6 All sealing of conduits, cables, cable trays, wireways, etc. at all wall, ceiling, and floor penetrations have been completed
 - .7 All loose equipment, including spare parts and replacement parts, has been turned over to the Departmental Representative and receipts obtained for same
 - .8 The partial copy of the Maintenance Manual has been submitted
 - .9 All demonstrations and instructions to the Departmental Representative have been completed
 - .10 The "As-Built" Drawings and AutoCAD electronic files have been submitted to the Departmental Representative
- .2 Provision of the above shall not be construed as compliance with all administrative documentation required within the General Conditions.
- .3 Notwithstanding any other provisions of the contract, failure to complete all of the above shall give cause to deny the issuance of a Substantial Performance Certificate.

1.25 MEASUREMENT AND PAYMENT

- .1 Notwithstanding any other provisions of this contract, supply the following general information and any additional information as may be requested by the Departmental Representative, as part of each Monthly Progress Claim. Indicate the labour cost and the material cost separately for each Item of Work within Division 27 & 28.
- .2 Items of Work shall include but shall not necessarily be limited to the following:
 - .1 Public Address System (FUTURE)
 - .2 Access Control System
 - .3 Video Surveillance System
 - .4 Software
 - .5 Commissioning for all new systems.
 - .6 Testing and adjusting (final test reports).
 - .7 Operations & Maintenance Manuals
 - .8 Final Record Drawings ('As Built')
 - .9 Demonstrations
 - .10 Mobilization Costs (not to exceed 2% of the contract value)
- .3 The Departmental Representative reserves the right to make changes to the allocation of costs. In case of a dispute, the cost allocations shall be as directed by the Project Manager. All cost figures shall be adjusted on a percentage basis to correlate with the actual submission price.
- .4 For each monthly Progress Draw, change orders shall be listed separately.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 This section relates to all low tension systems and equipment.
- .2 Commission all new low tension systems and equipment; refer to the applicable sections for specific commissioning procedures and specific requirements by the Departmental Representative. Submit commissioning reports and test results to the Departmental Representative for review and approval prior to substantial completion.
- .3 Follow manufacturer recommendations, installation, and start-up procedures.
- .4 Record all test results, complete and store all commissioning reports; also include any quality control issues, code violations, material substitutions, poor workmanship, and apparent damage. Upon request by the Departmental Representative, submit commissioning reports and test results for review.

1.2 ELECTRONIC EQUIPMENT

- .1 Electronic components forming parts of computerized equipment and system controls are sensitive to transients in electrical power lines and to short duration power outages. Provide protection against disruption caused by these conditions.
- .2 Many electronic loads are nonlinear. AC to DC convertors (rectifiers) and switching mode power supplies are examples of loads in which the load current is not proportional to the instantaneous voltage, or is discontinuous. Such nonlinear loads create considerable harmonic distortion on the electrical system supplying the loads, even when the source voltage is a clean sine wave. The nonlinear loads will distort that voltage wave, making it non-sinusoidal. Prevent this effect.
- .3 Computerized equipment may generate spurious emissions in the form of conducted and radiated electrical/ electromagnetic interference. The operation of sensitive electronic equipment may be impeded by such omissions. Ensure that electromagnetic compatibility is complied with.
- .4 For each and every system specified in Section 27 05 00 to Section 28 23 00, provide single line riser diagram depicting room location of every device in the system and mount diagram in suitably sized glass frame mounted adjacent to respective main control cabinet.

1.3 TRANSIENT PROTECTION

- .1 The system shall be protected against transients in the power system and in the communication and signalling lines (i.e. spikes, glitches or surges).
- .2 The protection shall be for both common and differential modes.
- .3 The protection shall comply with the requirements of IEEE Standard 472 (ANSI/IEEE C37.90) titles "Guide For Surge Withstand Capability Tests".
- .4 The manufacturer shall install the devices within their equipment enclosure or case, and clearly label or otherwise identify the components used.

1.4 MEMORY PROTECTION

- .1 Provide protection against memory loss due to short duration power failures.

- .2 This protection shall take the form of an internal auxiliary power supply for microprocessor and memory components unless it is built from non-volatile components.
- .3 The equipment involved shall retain its status during interruptions lasting up to 20 seconds. It shall not be necessary to reload, reset or reprogram such equipment.
- .4 The equipment is not expected to continue functioning during the power outage. Indicating lights and other signals may cease momentarily. However, upon power restoration (either normal or emergency) shall regain its status and resume its operation with no ill effect due to the interruption.
- .5 The equipment shall indicate failure of the auxiliary power supply by pilot light, message or other acceptable means.

1.5 NON-LINEAR LOADS

- .1 Provide line filters to reduce the harmonic content of non-linear loads. Such filters shall be mounted inside the equipment enclosure (the enclosure shall be increased in size if necessary) and shall limit the total Distortion Factor (harmonic factor) to 3% as defined and measured in ANSI/IEEE Std 519 titled: "Guide for Harmonic Control and Reactive Compensation of Static Power Converters."

1.6 ELECTROMAGNETIC COMPATIBILITY

- .1 Emission Limits:
 - .1 Equipment emission of electromagnetic radiation shall be limited to Class-B of FCC RULES PART-15 subpart - J as tested in accordance with FCC measurements procedure MP-4 titled: "FCC measurement of Radio Noise Emission from Computing Devices".
 - .2 The Departmental Representative shall be notified where the above requirement cannot be met. The Departmental Representative may authorize class-A qualification or any other qualification of limited electromagnetic emission.
- .2 Susceptibility Limits:
 - .1 Equipment shall perform normally in presence of electromagnetic field of one V/m in accordance with ANSI/IEEE C63.12 titled: "Recommended Practice on Procedures for Control of System Electromagnetic Compatibility".
 - .2 The susceptibility to power conducted emission of electromagnetic radiation shall be one volt as defined and measured in the standard in 1.5.2.1.
 - .3 Equipment shall be capable of performing on supply systems containing notches without false triggering of circuits. This should be for notch depth of 0.7 of the rated maximum line voltage and width of 250 microseconds as stipulated in the standard in 1.4.1.
- .3 The Departmental Representative shall be notified where equipment does not meet the requirements in 1.6.2 so that corrective measures can be sought.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Section 26 05 28 - Grounding and Bonding.
- .2 Section 26 05 29 - Hangers and Supports for Electrical Systems.
- .3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 SCOPE OF WORK

- .1 Provide a complete communications raceway system for BSCS systems - Public Address, Access Control System and the Video Surveillance system). The communication raceway system shall include but not limited to:
 - .1 Outlet boxes.
 - .2 Pull boxes.
 - .3 Conduits.
 - .4 Sleeves and caps.
 - .5 Terminal cabinets.
 - .6 Pull wires.
 - .7 Distribution cabinets.
 - .8 Service fittings.
 - .9 Underground ducting.
 - .10 Cover plates.
 - .11 Plywood backboards.
- .2 Provide all other requirements for a complete raceway system, including pull boxes, pull wire labels, covers, mounting hardware and accessories; Include all rough-in requirements for all BSCS systems, coordinate requirements with BSCS contractor.

Part 2 Products

2.1 MATERIAL MISCELLANEOUS

- .1 Refer to appropriate section in Division 26.
- .2 Plywood backboards to be 20 mm, good one side, fire-rated, finished painted.
- .3 Provide polypropylene pull cord in all empty conduits to facilitate pulling wiring in future.
- .4 Provide labels on all pull strings indicating destination, system and usage.

2.2 CABLE TRAYS

- .1 Provide enclosed type cable tray where deemed necessary, c/w fastened covers throughout.
- .2 Cable tray and fittings: to EEMAC F5-1-1977.

- .3 Aluminum or steel trays, size as indicated. Load Class C.1 with minimum inside vertical dimension of 100 mm.
- .4 Horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required. Fittings to be manufactured accessories for the cable trough supplied. Radii on fittings: 300 mm minimum. 600 mm on trays used for main telephone trunk lines.
- .5 Provide full height barrier as indicated. Connect barrier sections together to form continuous barrier free from sharp edges and protrusions.
- .6 Hanger rods and supports shall be galvanized.
- .7 Provide supports and seismic slack cables as required.
- .8 Arrangement, where cable tray is connected to other wiring methods, shall prevent mechanical damage or abrasion to conductors. Effective ground continuity shall be maintained. Sharp cut edges require grommet protection.
- .9 Cable trays not permitted to be on the ground floor of inmate accessed buildings. All cables shall be in conduit.

2.3 WALL OUTLETS

- .1 Provide flush 100 x 100 mm deep boxes with plaster rings.

2.4 CONDUITS

- .1 Minimum size of telephone/data communication conduit per outlet unless otherwise indicated are 21mm, for 2 or 3 outlets use 25mm. Conduit shall be installed in accordance with relative Division 26 sections.
- .2 Refer to riser diagrams for conduit sizes, increase conduit size where required.

2.5 PULL BOXES

- .1 Where required or indicated, provide communication pull boxes complete with covers. Locate pull boxes such that cables can be installed without being pulled through more than two 90 degree bends, or their equivalent, ie: multiple bends totalling more than 180 degrees.

Part 3 Execution

3.1 INSTALLATION

- .1 Install empty raceway system, including a complete distribution system, pull wire, pull wire labels, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletrays, service poles, miscellaneous and positioning material to constitute complete system.
- .2 Conduit shall be fished, blocks cleared and outlet and pullboxes cleaned out at completion of installation. Conduit shall be left free of water or excess moisture. A nylon pull wire shall be installed continuously for outlet to outlet, through all conduit and shall be fastened at each box.
- .3 Conduit bends shall have a bending radius of not less than ten times conduit diameter.

3.2 CABLE TRAY

- .1 Install complete cable tray system where deemed necessary. Provide cable dropouts (waterfalls) for all wiring leaving tray and entering equipment cabinets. Coordinate with other services. Provide offsets as required:
- .2 Support cable tray both sides. Cable tray shall be supported on 1200mm centres and shall be adequately braced to withstand loads due to pulling in of cables.
- .3 Provide 6 mm nylon pull rope in telephone section.
- .4 Ensure that sharp burrs or projections are removed to prevent damage to cables or injury to personnel.
- .5 Install slack cables on both sides at 1200mm intervals (or to suit seismic consultant) for seismic restraint. Anchor to U/S of ceiling per seismic consultant's requirements.
- .6 Allow sufficient clearances around cable tray as required by code.
- .7 Provide grounding connections as per code.

3.3 FIRE BARRIERS

- .1 Arrange for opening in fire rated walls, and floors for width and depth of cable tray to run tray through, where applicable:
 - .1 Arrange and make good fire rating of floors or walls after cables have been installed.
 - .2 Where trays penetrate fire separations they shall have a solid section of at least 1 metre length and packed with approved fire retardant after cable has been installed.
 - .3 Fire stop material must be of the easily removable and renewable type to allow for future addition of cables.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Supply and install complete Category 6 structured cabling system, as indicated on the drawings and specified herein.
- .2 System shall be complete with all data/telephone telecommunication outlets, patch panels, equipment cabinets, cable management systems, punch-down blocks, wire and cable to form a complete system.
- .3 Entire system to certified to Category 6 standard. FT-6 jacketting where exposed in return air ceiling cavities and FT-4 jacketting when run in conduit.
- .4 Systems installer to provide and coordinate all labelling with Departmental Representative.

1.2 APPLICABLE STANDARDS

- .1 TIA/EIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
- .2 TIA/EIA-568-C.1 Commercial Building Telecommunications Cabling
- .3 TIA/EIA-568-C.2 Balance Twisted-Pair Telecommunications Cabling and Components Standard
- .4 TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard
- .5 TIA/EIA-569-C Commercial Building Standard for Telecommunications Pathways and Spaces
- .6 TIA/EIA-606-B Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- .7 TIA/EIA-607-B Commercial Building Grounding and Bonding Requirements for Telecommunications
- .8 EIA-310E Standard for Racks, panels and Associated Equipment
- .9 Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – Latest Edition at time of Tender

1.3 SHOP DRAWINGS

- .1 Shop drawings shall be submitted as outlined herein and contain all items within one complete submission.
- .2 Shop drawings which are submitted incomplete will be returned to Contractor without review.
- .3 Shop drawings to include a complete material list with manufacturer, style, model number and quantity. Wire and cable to be included in material list.
- .4 Shop drawings to include manufacturer's specification sheets with photographic depiction of all system components. Specification and descriptive data to include dimension, weight, appearance, connection provisions, materials, metal gauges and operating specification, characteristics, features and controls.
- .5 Shop drawings to include the following diagrams:

- .1 Front backboard punch down block elevations for each backboard. Elevations to indicate component layouts, cable routing and component functions.
- .2 System room plan drawings depicting backboards and cable routing.
- .3 Layout drawings for patch panels and jack fields.
- .4 Cable details, including type and electrical characteristics.
- .5 Complete engineering drawings of all custom made components indicating all materials, gauges, finishes and wiring diagrams.
- .6 Complete system block diagrams indicating all components, interconnection and cabling.
- .7 Complete detailed system circuit diagrams depicting how components are interconnected component functions, cable terminations, terminal identification and cable designation.
- .8 Complete system wire and cable designation schedule indicating origin, terminus, origin terminal identification, terminus terminal identification, cable function, cable type and cable designation, at each demarcation point.
- .9 Under no circumstances will wiring schematics or typical wiring details be considered as circuit diagrams.

1.4 APPROVALS

- .1 Submit in accordance with Section 26 05 00.

1.5 OPERATING MANUALS

- .1 Operating manuals shall be furnished as specified in Section 26 05 00. Operating instructions to consist of following:
 - .1 Individual factory issued manuals containing all technical information on each type of equipment installed. In event such manuals are not available from the factory, system installer to establish same and compile within the manual to satisfaction of the Departmental Representative.
 - .2 Each manual to contain a system parts list, a parts list for individual components, detailed schematics and recommended maintenance procedures. Advertising brochures or operational instructions shall not be considered as technical manuals.
 - .3 Engineering drawings depicting layout and interconnection of all system components and as-built conduit layout.
- .2 In addition to the above described manuals, system installer to include all shop and circuit drawings, wiring schedules and single line block drawings, all cable test results (hard and soft copies) in the manuals.

1.6 GENERAL REQUIREMENTS

- .1 System shall be complete with all necessary components to provide functions required whether or not each and every item is necessarily mentioned. All components to be production proven models. Custom designed units will only be considered for those items that are not currently available on commercial market. System to be supplied and installed by an established communications contracting firm that is approved by Departmental Representative.
- .2 Selection of system to be made on the basis of quality and suitability of equipment, service facilities, and past performance of contracting firm.

- .3 Before proceeding with installation, successful system installer to submit to Departmental Representative for approval a complete detailed proposal as outlined in Clause 1.3, Shop Drawings.
- .4 All conduit, pullboxes, junction boxes and terminal panels are to be installed to provide a complete conduit system for the Telephone and Data system.
- .5 All wiring for systems to be PVC insulated, unshielded, twisted pair. All wiring to be installed in conduit and tray system unless otherwise specified.
- .6 The system, when complete, must perform to complete satisfaction of Departmental Representative and must be free of all interference from cross-talk, hum, switch and relay noise, etc. All wiring in Communication Rooms to be terminated on punchdown blocks and to be neatly installed, laced and tagged.
- .7 Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project. Proof of certification must be provided prior to commencement of work.
- .8 The system shall be certified. The system shall be installed by a contractor designated and trained by the manufacturer of being capable to do so and shall provide written confirmation of this fact.

1.7 SYSTEM DESCRIPTION

- .1 The communication cabling data system consists of horizontal and Intra-building and Inter-building trunk cabling.
 - .1 **Horizontal (BSCS):** 4-pair Cat6 unshielded twisted pair (UTP) cables from termination hardware in Telecom Room to field devices as shown on drawings.
 - .1 All data horizontal cabling shall homerun from the field device back to the head-end area and terminate on rack mounted patch panels within telecom room.
 - .2 **Intra-building and Inter-building Trunk:**
 - .1 Outside plant rated OSP

1.8 WARRANTY/SERVICE

- .1 System installer to include with his base tender price a guarantee stating:
 - .1 Full parts and labour warranty on new system to be provided for twenty-five (25) years.
 - .2 Service to be provided on system within 24 hours of call origination during the warranty period.
 - .3 During warranty period system installer at his expense to repair and replace all such defective work and other work to new system damaged thereby which fails or becomes defective during term of warranty, provided that such failure is not caused by improper usage or physical damage.
 - .4 Warranty date to commence from date of Final Acceptance of this work.
 - .5 System shall be certified to meet and or exceed Category 6 standards of performance for the duration of the warranty as specified by the manufacturer.
 - .6 Contractor shall provide to the owner within two (2) weeks of Substantial Completion:

- .1 A letter of certification which includes verification of the performance of the installed system, identification of the installation by location and project number and a copy of the warranty.
- .2 A Warranty plaque with the name Correctional Services Canada clearly indicated.
- .3 Warranty Manual

1.9 TRAINING

- .1 System installer to conduct training program for designated maintenance and operating personnel. This program to include but not be limited to the following:
 - .1 Operation: designated personnel to be trained to accomplish and understand all aspects of system operation.
 - .2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.
 - .3 Training period schedule to be established by Departmental Representative. Training periods to take place after building completion and prior to system use.

Part 2 Products

2.1 CABLE

- .1 Horizontal Cabling for Telephone and Data
 - .1 All horizontal cable shall be 4-pair, 24AWG solid copper conductor, unshielded, twisted, 100 Ohm, Category 6 with riser rated sheath, CSA FT-6 compliant (refer to other sub-sections herein).
 - .2 Cable to be UL listed type NEC-CMR
 - .3 CCTV cabling to be GREEN in color.
 - .4 Data cabling to be BLUE in color.
- .2 Fiber Optic Cable Riser / Backbone:
 - .1 Fiber Optic Cable Riser / Backbone to be to as follows:
 - .1 Physical Descriptions:
 - .1 Type: multi-mode, 50/125 µm core/cladding diameter, 850/1300 nm, OM3 fiber optic cable.
 - .2 Indoor/outdoor rated, loose tube, gel-free with water-blocking capability OSP.
 - .2 Fire Rating: riser rated sheath, CSA FT-6 compliant (refer to other sub-sections herein).
 - .1 Strength Member: Aramid.
 - .2 Minimum Bend Radius:
 - .1 Installation: 30.5 cm.
 - .2 Long-term: 17.8 cm.

2.2 PATCH CABLES

- .1 UTP Type:

- .1 UTP patch cables shall match performance and specification of installed horizontal UTP cable's transmission and electrical performance specifications.
 - .2 Patch cables shall be pre-manufactured c/w RJ-45 jacks and boot covers on each end. Patch cables colour to match the system horizontal cabling.
 - .3 Patch cables shall be stranded conductors wired for straight through configuration (non cross-over).
 - .4 CCTV system patch cables to be GREEN in colour.
- .2 Optical Fiber Type:
- .1 Transmission Properties: match installed cable's transmission and electrical specifications in the building.
 - .2 Configuration:
 - .1 Dual fiber, single jacket, with breakout assemblies separate LC connectors each end.
 - .3 Fiber optic terminal connectors to the approval of the manufacturer's instructions.

2.3 TELECOMMUNICATIONS OUTLET ASSEMBLIES

- .1 Communications Outlet - Boxes:
- .1 Two gang (100mm square) recessed deep box and single gang wallboard adapter ring.
 - .2 25mm EMT conduit with pull string, stubbed from box to cable tray as part of communications conduit system, grommetted or bushed cable exit(s).
 - .3 Use existing conduits where meets current code conduit fills and to the approval of the owner representative.
- .2 Communications Outlet - Faceplates:
- .1 Minimum four (4) ports capable of accepting RJ-45 modular jack snap-in or slide-in inserts. Number of ports shall accommodate all horizontal cables provided at the telecommunications outlet. Where mounted in surface raceway provide compatible adapter plate.
 - .2 Mounts to standard single gang, electrical box, or adapter ring opening.
 - .3 Unused ports shall be provided with blank inserts.
 - .4 Where mounted in surface raceway provide compatible adapter plate.
- .3 Communications Outlet - Jacks:
- .1 Modular snap-in RJ-45 connector, 8P/8W, non-keyed, IDC punch down termination wired using T568A configuration.
 - .2 CCTV outlets to be GREEN in color.
 - .3 Data outlets to be WHITE in color.

2.4 TERMINATION HARDWARE – COMMUNICATION ROOMS

- .1 LAN Cabinet:
- .1 Cabinet shall be used to house telecom room and patch panels used for UTP horizontal and fiber data cable termination hardware.
 - .2 Cabinet requirements:

- .1 Wall mounted, pivoting enclosed cabinets c/w 16-gauge steel, solid, black side panels.
 - .2 Welded steel construction Black powder coated
 - .3 Designed for industry standard (EIA-310-D)
 - .4 Accepts EIA standard 483 mm (19”) wide panels, minimum useable depth of 900mm deep, height of cabinet to accommodate 100% of expansion of patch panels and network switches, min. of 198mm.
 - .5 Standard adjustable 10-32 threaded rack rails marked with rack space increments both front and rear of cabinet, with provision to attach grounding.
 - .6 Vented lockable front door and rear door access (both locks keyed alike)
 - .7 Rack Top black powder coated with provisions for four 101.6mm (4”) fans.
 - .8 Vertical Cable Management
 - .9 Horizontal Cable management – provide between patch panels and network switches, hinged front cover with vertical access to patch panels above and below.
 - .10 Removable side panels.
 - .11 Three (3) Power Distribution Unit’s - rear mounted at bottom of cabinet, each with six (6) AC receptacles, 6 foot shielded cord, on/off switch with reset breaker and surge protected.
 - .12 Six (6) rack shelves minimum 150mm deep for equipment.
 - .13 All duplex receptacles suppling the rack equipment shall be on UPS dedicated power.
- .2 Patch Panels:
- .1 UTP Patch Panels
 - .1 Patch Panels configuration shall be 24 modular ports. Each port cable of accepting individual Cat6 RJ45 modular jack inserts same type(s) as corresponding telecommunication outlets. Refer to telecommunication outlet jacks.
 - .2 Rear-mount Cable Support Bracket(s): minimum 1 per 32 incoming cables.
 - .3 2 RU in height, standard 483mm (19”) width and EIA mounting hole spacing
 - .2 Fiber Patch Panels
 - .1 Backbone Patch panels to be installed in cabinet and in multiples of 24 ports for multi-mode cable and multiples of 12 ports for single mode cable,
 - .2 Patch panels to utilize modular cassette type fiber housing with LC connectors
 - .3 Fiber optic terminal connector type to the approval of the NRC IT forces, confirm with the Departmental Representative prior to installation.
 - .4 Storage tray and cable management for excess fiber cable and jumper loops.
 - .5 Removable front and rear covers.

- .3 Provide sufficient patch panels for all cables including copper and fiber plus 25% spare.

2.5 NETWORK HARDWARE

- .1 Provide and install an Ethernet network routing switch, switch to match existing switches throughout the building where possible, alternate is acceptable to the owners representative only.
 - .1 Provide 1 network switches within the new head end cabinet.
 - .2 Site specific equipment
 - .1 Layer 2/3 capable. PoE, Confirm manufacturer w/ NRC IT forces, prior to ordering.
 - .2 Allow for CISCO 3750-X series.

Part 3 Execution

3.1 INSTALLATION

- .1 Cable Installation:
 - .1 Install data cable and telephone cable in conduit and cable trays, wireways and surface raceways indicated on drawings.
- .2 Wireways and Surface Raceways:
 - .1 Install cable management raceway on both sides of racks and on backboard in telecom room.
- .3 Boxes and Fittings:
 - .1 Ensure in advance that outlet box/data outlet installation methods yield vertically-mounted data outlets.
- .4 Cabinets, Enclosures, Racks, Backboards:
 - .1 Install at locations and heights indicated on drawings.
 - .2 Use green insulated 6 AWG ground conductors for grounding racks. Use grounding bushing, solderless lug, clamp, or cup washer and screw.
 - .3 Protect ground conductors from mechanical injury.
 - .4 Install ground conductors such that neither ground conductors not data cables interfere with one another in regards to future servicing of patch panel rear connections.
 - .5 Anchor or stabilize cabinet.
- .5 Wire and Cable:
 - .1 Swab raceway system before installing wiring.
 - .2 Do not exceed manufacturer's maximum pulling force specifications.
 - .3 Maintain not less than minimum bending radius for fiber and copper conductors.
 - .4 Install cable along or at right angles to building lines unless impractical to do so. Verify specific cases of deviation in advance with Departmental Representative.
 - .5 Maintain industry accepted clearances and separation distances for installed cables from electrical equipment, electrical lines, electrical lighting and other EMI - or discharge-generating equipment.

- .6 Ensure that cable is not flattened, squeezed, or crimped at any point along entire run. No splices or intermediate terminations in cable runs.
 - .7 Install cables in raceway in communications room and fan individual cables to applicable patch panels in neat, logical fashion.
 - .8 Tie wrap cables neatly into logical bundles. No nylon tie straps acceptable use only Velcro style tie wraps.
 - .9 Minimum 1m of slack cable per run within LAN cabinet in the telecom room.
- .6 Connectors:
- .1 Use tooling specific to connector types in use.
 - .2 Use connectors suitable for nature of conductor in cable, e.g. stranded vs. solid copper.
 - .3 Ensure that connectors' strain relief provisions are used. Strip jackets only amount required.
 - .4 Maintain pair twists within 13 mm of termination.
- .7 Patch Panels:
- .1 Mount patch panels in orderly fashion. Submit rack layouts for approval prior to installation.
 - .2 Ground as required by system.
 - .3 Attach horizontal wiring in an ordered fashion following grid numbering of outlets, alpha character first, e.g. a-1, a-2, etc.
 - .4 Attach horizontal wiring in order of grid number of outlets.
 - .5 Mount panels to racks with as many screws as there are mounting holes or slots in panels.
 - .6 Provide and install necessary strain reliefs and cable support brackets, plus trays for fiber cable loop behind panel and install cables utilizing such devices.
- .8 Cabling System Labelling
- .1 The Contractor shall adhere to NRC IT standard for labeling and identification. Where no standard is available, the Contractor shall follow TIA/EIA-606-A administration and labeling standard to develop and submit for approval a labelling scheme for the cable installation. At a minimum, the labelling system shall clearly identify all components of the system: racks, cables, panels, and outlets. The labelling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labelled to identify the location within the cabling system infrastructure. All labelling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labelling scheme.
 - .2 All label printing will be machine printed, bold face laser quality printed, generated using indelible ink ribbons or cartridges. Labels shall have black lettering on white background. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's labels provided with the outlet assembly.

3.2 TESTING

- .1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to the Departmental Representative. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.
- .2 UTP Copper and Fiber Testing
 - .1 Acceptable Test Instruments:
 - .1 Copper: Fluke DSP-4000
Microtest Omni scanner
 - .2 Fiber: OTDR and Power Source / Attenuation Meter
 - .2 Copper Media:
 - .1 Category 6 UTP:
 - .1 UTP cables not meeting TIA 568-C.2 requirements for 4-pair category 6 cabling shall be repair and retested at no additional cost to the contract.
 - .2 Tests at highest contemplated frequency:
 - .1 Wire Map / Continuity
 - .2 Run Length
 - .3 DC Loop Resistance
 - .4 Insertion Loss / Return Loss
 - .5 Attenuation to cross-talk ratio (ACR)
 - .6 Delay Skew
 - .7 Propagation Delay
 - .8 Near-end crosstalk (NEXT) - for each pair
 - .9 Equal level far-end cross-talk (ELFEXT)
 - .10 Power Sum NEXT (PSNEXT)
 - .11 Power Sum ELFEXT (PSELFEXT)
 - .12 Power Sum ACR (PSACR)
- .3 Test system components in presence of the Departmental Representative's to ensure correct operation of system. On completion of tests, submit to the Departmental Representative a certificate listing components tested.
- .4 Except where otherwise specified, arrange and pay for testing & adjusting of the system.
- .5 No marginal or conditional passes shall be accepted.
- .6 If test results do not conform to applicable requirements, repair, replace, adjust, or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.
- .7 Log and tabulate test results on appropriate test report forms and as specified.
- .8 Submit forms to the Departmental Representative prior to use.
- .9 Submit copy of completed test report forms to the Departmental Representative immediately after tests are performed for review.
- .10 Insert a hardcopy (and softcopy on CD) of completed test report forms in each copy of the Operating and Maintenance manuals.

3.3 REPORT

- .1 Record results in tabular form.
- .2 Segregate horizontal runs, inter-room runs, and risers by category or run and by type of cable.
- .3 Present horizontals - results in ascending order.
- .4 Report Submission:
 - .1 Submit three (3) reports printed on 215 mm by 280 mm white paper.
 - .2 Submit two (2) reports prepared in electronic form on CD-R's housed in jewel cases using Microsoft Excel. Include in the electronic O&M manual.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts, including:
 - .1 Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets
 - .2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings
 - .3 Section 27 01 00 – General Requirements

1.2 REFERENCE DOCUMENTS & STANDARDS

- .1 Common Work Results
 - .1 Refer to section 26 05 00 Common Work
 - .2 Refer to section 27 05 00 Communication Services
- .2 Quality Requirements
 - .1 UL 294 Access Control System Units
 - .2 UL 1076-Proprietary Burglar Alarm Units and Systems
 - .3 FCC Parts 15 and 68, and the equivalent Industry Canada regulations
 - .4 Canadian Electrical Code
 - .5 RS-170A, NTSC
 - .6 MS ODBC Interface Standard
 - .7 ISO SCS for C++and C+

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Sustainable Requirements
 - .1 Materials and products in accordance with Division 01 Sustainable Requirements: Construction.
 - .2 Do verification requirements in accordance with Division 01 Sustainable Requirements: Contractor's Verification.
- .2 Waste Management and Disposal
 - .1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
 - .2 Avoid using landfill waste disposal when recycling facilities are available.
 - .3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 SHOP DRAWINGS

- .1 Provide complete shop drawings which include the following:
 - .1 Include a complete Access Control system (ACS) one-line, block diagram.

- .2 Include a statement of the system sequence of operation.
- .3 Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type and jacket fire rating, conductor routings, quantities, and connection details at device.
- .2 Product Data: Provide complete product data that includes the following:
 - .1 Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the ACS.
 - .2 A system description including analysis and calculations used in sizing equipment required by the ACS. The following information shall be supplied as a minimum:
 - .1 Server(s) processor(s), disk space and memory size
 - .2 Description of site equipment and its configuration
 - .3 Backup/archive system size and configuration
 - .4 System expansion capability and method of implementation
 - .5 System power requirements
 - .6 Equipment environmental requirements (heat load parameters)
 - .7 Operating system and application software version

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 26 05 00.
- .2 Submit shop drawings in accordance with Section 26 05 00.

1.6 WARRANTY

- .1 System warranty to cover one-year parts and labor from date of system acceptance. Manufacturers' extended warranties on equipment shall apply if longer than one year.
- .2 Contractor to submit a table listing all equipment types, model numbers, manufacturer, and length of warranty.
- .3 System supplier to include a written guarantee that service will be provided on the system within 24 hours of call origination during the warranty period.
- .4 During the warranty period the system installer, at own expense, will repair and replace all such defective work, and other work to the new system, which fails or becomes defective during the term of warranty, provided that such failure is not caused by improper usage or physical damage resulting from actions of the end user.

1.7 PRODUCT APPROVAL

- .1 Requests for alternate equipment approvals to be submitted to the Engineer/Consultant
- .2 Alternate products must meet or exceed the performance requirements of specifications. Alternate products which are approved on the merits of manufacturer's documentation, yet prove nonetheless to be insufficient to meet the performance requirements of the specification, will be removed and replaced with suitable equipment at the Contractor's expense.

1.8 OPERATING & MAINTENANCE DATA

- .1 In accordance with 26 05 00.
- .2 The Contractor shall return the following documentation to the Owner and Consultant:
 - .1 Electrical inspection permit and report.

1.9 SYSTEM REQUIREMENTS

- .1 System to control access of specified door(s) based on programmed time schedules, through use of personnel credential cards or fobs, or operator action and provide hard copy of events.
- .2 Hardware and software (if necessary) shall be provided to facilitate these functions:
 - .1 To secure door(s).
 - .2 To monitor door status.
 - .3 To release door(s) under fire conditions.
 - .4 To release door(s) when valid credential is presented to card reader.
 - .5 To place door(s) in a secure or unsecured mode automatically by software time schedule.
 - .6 To place door(s) in a secure or unsecured mode via workstation control.
 - .7 To manually release door(s) for exiting.
 - .8 To verify valid credentials, unlock doors, display entry on display monitor(s) and provide hard copy of event.
 - .9 To monitor input points connected to the building fire alarm system
 - .10 To prioritize alarm conditions.
 - .11 To graphically display alarm points, door status and monitor points accurately.
 - .12 To graphically allow the operator to manipulate input and output points via a mouse from both a text screen and a separate graphics display screen.

1.10 GENERAL REQUIREMENTS

- .1 Systems shall be complete with all necessary components to provide functions required whether or not each and every item is mentioned specifically in this specification.
- .2 All components to be production proven models. Custom designed units will only be considered for those items that are not currently commercially available.
- .3 In all cases the security installation shall be designed and undertaken with Facility users' safety and security in mind.
- .4 Selection of system shall be made on the basis of quality and suitability of equipment, the service facilities available, and the experience, capabilities, and past performance of the Contracting firm.
- .5 Before proceeding with installation, successful system installer to submit shop drawings per 26 05 00.
- .6 Division 26 shall be responsible for supply and installation of all conduit, wire, device boxes and terminal panels where required.

- .7 All wiring for systems to be PVC insulated, shielded, twisted pair, multi conductor etc, as called for by this specification or as required per manufacturer's instructions. System wiring to be terminated by Security Contractor. All wiring for systems to be plenum rated where required. It is the responsibility of the Contractor to determine what cable jacket fire rating must be used to satisfy local governing Authority requirements.
- .8 All security systems (Access Control, CCTV) shall be connected to dedicated power circuits.
- .9 Individual monitoring points shall be configurable to cause intelligent field controllers to enable secure or non-secure mode. All points can be grouped, thus allowing control on an "if / then" basis whereby one event can trigger another. Each input and output point can be controlled in this way on a system-wide basis.
- .10 System shall continuously scan all monitoring devices for change of state. All devices are to be continuously supervised for tamper and trouble conditions on a 24/7 basis. System shall have door position status on all doors monitored.
- .11 Coordinate software programming requirements, time schedules, ID's, operators and display defaults with End User prior to initial system programming.
- .12 Software application program to lock and unlock specified door(s) via timed software schedules, valid ID cards, authorized operator manual requests, exit pushbuttons, security sensor bars, or key switches and provide monitored status of each specified door.
- .13 The system shall be supported by sufficient back up battery supply to operate all devices simultaneously until power circuits are re-energized.
- .14 The Contractor must ensure that the system is configured and equipped to reliably operate 24/7.

1.11

PERFORMANCE CRITERIA

- .1 The Pacific Forestry Centre is expanding its existing access control system through the addition of controls on existing doors in the manner indicated on drawings and in the door schedule.
- .2 Several doors will be equipped with delayed egress crash bars.
- .3 Several doors will require the addition of long range readers (effective to approximately 6 feet / 1.9 metres).
- .4 A card access disabling feature is required for all exterior doors to deny access to the building when this feature is enabled.
- .5 The disabling feature will be activated by a hardwired mushroom button at the Command Centre. Mushroom buttons must require a key to reset. A second button intended for the disabling function will also be required at an alternate location, to be determined in consultation with the Owner.
- .6 The access control system will integrate with the video surveillance system such that, at minimum, when an alarm is initiated at an access controlled door, all local CCTV cameras associated with the door will be displayed on the access control workstation(s).
- .7 The access control system will integrate with the existing Intrusion system. While there is no expansion of the Intrusion system in the scope of this project, the Contractor will

connect and integrate doors into the Intrusion system such that no alarm will be announced when an authorized user enters using valid credentials.

- .8 All access control panels and field controllers will be installed in secured communications rooms.
- .9 All access panels will be provided with 2-hour continuous battery backup operation.
- .10 The access control system will supply power to each door via controller outputs provided expressly for that purpose, or by the use of a separate power supply equipped with individually fused, battery backed circuits for each door. Each individual power supply will serve no more than 8 doors total.

Part 2 Products

2.1 ACCESS CONTROL

- .1 The Pacific Forestry Centre's existing access control system (ACS) uses Kantech KT-300 controllers. Kantech or approved alternates will be used to the satisfaction of the Departmental Representative. New field panels can be acceptable as an alternative to re-using existing panels.
- .2 If the access control system provided is not identical to the Authority's existing system, then it will fully integrate with the existing system and utilize that system's database of users, groups, and schedules. Integration must be such that any change to one system will affect and cause the same change on the other system, with no additional input or action.
- .3 The Contractor will equip the access control system with a new Server, the manufacturer's recommended OS, and the latest version of the ACS platform software and any required licenses, including that necessary for video system integration.
- .4 The system will grant or restrict access to employees via a programmable classification system down to the field panel level, and operate over a standard TCP/IP Ethernet network.
- .5 An Access Control Workstation is to be furnished as a new Windows PC physically located as determined by PFC.
- .6 Provide all necessary hardware and software to allow the following general access control functions:
 - .1 To electronically secure door(s) in a fail secure configuration (or as required by code).
 - .2 To monitor door position status.
 - .3 To release door(s) when valid ID card is presented to card reader.
 - .4 To shunt monitoring upon Request-To-Exit device activation
 - .5 To release door(s) under fire conditions.
 - .6 To place door(s) in a secure or unsecured mode automatically from software time schedule.
 - .7 To place door(s) in a secure or unsecured mode manually via access control workstation command.

- .8 To manually release door(s) for exiting via field devices (i.e. Push button, intercom).
 - .9 To graphically display ALL field alarm points, door status and monitor points accurately on a custom Graphical User Interface of the building floor plan.
 - .10 To graphically allow the operator to manipulate input and output points via a mouse from both a text screen and a graphics screen.
 - .11 To allow expandability for physical and IT identity management
 - .12 To permit full functional control from an on-site workstation.
- .7 The access control system will be configured to indicate alarms and the position status of doors by graphic display, and to provide an interface for central locking/unlocking of doors as needed.
- .8 The Access Control system shall support an integrated IP Digital Video Management System (DVMS) recording solution that provides the following features and capabilities:
- .1 Seamless integration with the ACS
 - .2 Standalone operation without connection to the ACS
 - .3 Video events shall be linked to ACS events in the ACS database.
 - .4 Any alarm / event in the ACS shall have the ability to be associated with a digital video clip in real time. The DVMS shall support user defined pre and post event video playback.
 - .5 An unlimited number of access control hardware / video device links shall be configurable.
 - .6 Each alarm / event condition shall have the ability to mark the start of a video event or the end of a video event in real time.
 - .7 The system shall require user authentication from specific individuals or groups granted the ability to view live or recorded video or make modifications to the system.

2.2 ACCESS CONTROL / VIDEO CLIENT WORKSTATION

- .1 Client Workstations
 - .1 There will be two workstations, one in the ground floor Command Centre, and one in the second floor Security Centre.
 - .2 The Access Control Client Workstation(s) shall be 100% Windows/Intel Standard compatible, with the minimum requirements of a business class computer.
 - .3 Each Workstation will come complete, with keyboard and mouse, and with the latest OS version compatible with the access and video software installed.
 - .4 Each Workstation shall come with two (2) 24" commercial grade LED monitors; c/w articulating VESA mounts suitable for desk or wall mounting.

2.3 ACCESS CONTROL SERVER

- .1 ACS Server
 - .1 The Access Control Server shall be 100% Windows/Intel Standard compatible, with the minimum requirements of a business class computer.
 - .2 The server will come complete, with keyboard and mouse, a 19" LED pull-out shelf monitor, with the latest manufacturer-recommended Server OS version, and with the most recent version of access control and video integration software installed. The access control software version will be one that is capable of later integration into a multi-site, Enterprise access control system.
 - .3 The server will come with sufficient storage to retain Pacific Forestry Centre event data for a minimum of one year.
 - .4 Provide a minimum of three Workstation licenses.

2.4 INTELLIGENT SYSTEM CONTROLLER

- .1 The Intelligent System Controller (ISC) shall link the access control software to all "down-stream" field hardware components (RIMs, ICMs and IOMs). The ISC shall provide full distributed processing of access control / Alarm Monitoring rules and operations. A fully loaded and configured ISC shall respond in less than one-half (0.5) second to grant or deny access to cardholder.
- .2 The ISC shall continue to function normally (stand-alone) in the event that it loses communication with the ACS software. While in this off-line state, the ISC shall make access granted/denied decisions and maintain a log of the events that have occurred. Events shall be stored in local memory, and then uploaded automatically to the ACS database after communication has been restored.
- .3 In addition, the ISC shall incorporate the following features at minimum:
 - .1 UL 294, ULC, and CE Certified
 - .2 Support for Host Communications Speed of 115,200 bps
 - .3 Support for Direct Connect, Remote-Dial Up, or Local Area Network (LAN) Connection
 - .4 Support for Dual Path Host Communications - Secondary Path shall be either Direct Connect, Local Area Network (LAN) Connection, or Remote Dial-Up Connection.
 - .5 Support for up to 8 MB of On-Board Memory
 - .6 Flash Memory for real time program updates and overall host communications
 - .7 Initial base memory download between ISC with standard memory from the ACS shall require no more than ten (10) seconds
 - .8 Support of multiple card technologies
 - .9 Supervised Communications between ISC and ACS Software
 - .10 AES 128 bit Symmetrical Block Encryption conforming to the FIPS-197 standard between ISC and ACS Software communications driver.
 - .11 Support of up to eight card formats and facility codes

- .12 RS-485 Full Duplex, UL 1076 Grade AA communication channel to the ACS head-end
- .13 Integration to other manufacturer's card readers
- .14 Uninterruptible Power Supply (UPS) with 20 minute battery backup
- .15 32-bit Microprocessor
- .16 Biometric Interface Support
- .17 An ISC downstream serial port shall multi-drop 16 access control field hardware devices using an RS-485 UL 1076 Grade A communication format allowing a distance of 4,000 feet using Belden 9842 cable or equivalent
- .18 12 VAC or 12 VDC input power
- .19 Issue Code Support for both Magnetic and Wiegand Card Formats
- .20 Individual Shunt Times (ADA Requirement)
- .21 Up to Nine Digit PIN Codes
- .22 Downstream serial RS-232 device support
- .23 Status LEDs for normal component and communication status
- .24 Support for RS-485 over Category grade cable.

2.5 INPUT CONTROL MODULE (ICM)

- .1 The Input Control Module shall provide 16 UL 1076 Grade B, A or AA alarm input zones and monitor / report line fault conditions, alarm conditions, power faults and tampers. Status LEDs shall provide information about the sixteen alarm zone inputs, cabinet tamper, and power fault.
- .2 In addition, the ICM shall incorporate the following features:
 - .1 UL 294, ULC, and CE Certified
 - .2 Alarm contact status scanning at up to 180 times per second for each zone
 - .3 Filtered data for noise rejection to prevent false alarms
 - .4 Up to 16 Grade B, A, or AA Supervised Inputs in any Combination
 - .5 12 or 24 VDC Input Power
 - .6 2 Form C 5A, 30 VDC Contacts for load switching
 - .7 2 dedicated inputs for tamper and power status

2.6 OUTPUT CONTROL MODULE (OCM)

- .1 The Output Control Modules shall provide 16 Form-C 5A 30 VDC relay contacts for load switching. The relays shall be configurable for fail-safe or fail-secure operation. Each relay shall support "On" "Off" and "Pulse"
- .2 12 or 24 VDC input power
- .3 Two dedicated digital inputs for tamper and power failure status
- .4 RS-485 communications, multi-dropped (2-wire or 4-wire RS-485)
- .5 Up to 16 OCMs per Intelligent System Controller
- .6 Onboard termination jumpers

- .7 DIP switch selectable addressing
- .8 Status LEDs for communication to the host, heartbeat and relay status

2.7 PROXIMITY CARD READER

- .1 Reader is to utilize proximity technology; no physical contact during a card swipe will be permitted.
- .2 Long read range (up to 6 feet / 1.9 metres).
- .3 Mounted on mullions or single-gang electrical boxes.
- .4 LED for visual feedback, Piezo for audio feedback
- .5 Compatible with all Wiegand access control systems.
- .6 Industry standard Wiegand (26 to 56 bit) output.
- .7 Operating temperature from -30C to 65C.
- .8 Where existing wall boxes cannot be re-used, all card readers will be provided with sealed single gang boxes for wall mounting.
- .9 Standard of Acceptance: HID MaxiProx.

2.8 PROXIMITY CREDENTIAL

- .1 Existing cards must be compatible with the new readers, and achieve read range of 6 feet / 1.9 metres.
- .2 High security technology using mutual authentication between card and reader, encrypted data transfer, and diversified keys for read/write capabilities.
- .3 Provide 250 new credentials.
- .4 Standard of Acceptance: HID ProxPass tags

2.9 DELAYED EGRESS HARDWARE

- .1 For Delayed Egress (DE), pre-packaged assemblies will be used which include at minimum: Electrified door locking device, local door controller with auxiliary input/output for integration with other systems, audible alarm with light indicator, re-set key station at each door, panic push bar with built in switch, and all other necessary components for a complete operational system.
- .2 Standard of Acceptance: Stanley DE systems; Securitron DE systems; Von Duprin DE systems.

Part 3 Execution

3.1 INSTALLATION

- .1 Where existing wiring is compatible and meets applicable standards and codes, this wiring may be re-used. Where existing wiring is re-used, the installing Contractor must be willing to include such wiring's integrity during the one-year warranty period. Any system problems during the warranty period related to wiring that has been re-used will

be the responsibility of the Contractor to mitigate, with adherence to the wiring requirements of this specification.

- .2 All new wiring and cable installed and connected to any piece of equipment which forms part of the security system is to be electrically supervised, and shall indicate a fault or tampering (open, ground) and provide a unique display of circuit trouble in the system on the display screen.
- .3 Conduit must be used for security cabling throughout.
- .4 All security control panels shall be located in secure, accessible location(s) within the protected space (i.e. – panels and equipment shall not be mounted in electrical or data rooms which are not within the protected space).
- .5 All cable and equipment supplied, and all installation methods used, shall be as specified by the equipment manufacturer.
- .6 No splices shall be permitted in the wiring except where a connection is made to a device. Where existing cabling is found to be in violation of this requirement, it may not be re-used and must instead be replaced.
- .7 All cables shall be permanently identified and listed on as-built drawings as follows:
 - .1 Cable number
 - .2 Source
 - .3 Destination
- .8 Electrical panel circuit number shall be clearly identified on all system panels.

3.2 LABELING

- .1 All equipment units (field panels, access control units, etc.) to have lamacoid description label. Description to be in code as directed by the Contractor.
- .2 All wire and cable to be labeled with suitable identification code affixed to cable jacket near terminations. Label to be permanently affixed, vinyl, plastic or similar material.

3.3 TESTS AND ADJUSTMENTS

- .1 Upon completion of system installation, tests to be conducted by the system installer to determine system conformity to the requirements of the specification. Tests to be conducted in presence of the Consultant and/or his representative who may suspend or discontinue tests at any time performance is considered unsatisfactory. Resumption of testing to cover the previously untested elements and any completed elements at the discretion of the consultant.

3.4 TESTING PROCEDURES:

- .1 A door or point has to pass all the tests listed below in order for it to be marked as verified. All time periods used during testing are test periods whose duration are set to approximately 5 minutes.
 - .1 Operation Typical Door
 - .1 Present valid card and lock releases for the time period (default 5 seconds).

- .2 Door relocks after door has been opened.
- .3 Door held open is annunciated at security room workstation after time period (default 15 seconds).
- .4 Request to exit releases lock immediately and shunts door open alarm.
- .5 Door unlocks when released from the security command centre.
- .2 Typical "check list" shown below is for reference purposes.
 - .1 Security control panel location and mounting height is as per Drawings and Specifications.
 - .2 Sufficient working space is left in front of the security control panel to perform maintenance.
 - .3 Readers or other access devices are located where they are accessible.
 - .4 Security sensors are located, aimed and directed to insure best operational efficiencies.
 - .5 An adequate number of security detection devices have been installed to achieve security of premises (ie. on double doors a door switch for each door is required).
 - .6 Emergency power backup of Security System is in place and functioning.
 - .7 Security System has been tested and verification of the test success has been made available.
 - .8 Interfacing between the Access Control System and the following systems has been completed:
 - .1 Security System
 - .2 Video Surveillance System
 - .9 Each security panel is tagged and identified.
 - .10 Individual conductors are tagged and identified and terminals and terminal strips are tagged and identified.
 - .11 Raceways, junction boxes and termination cabinets are identified with color-coded bands or other approved means.
 - .12 Equipment is CSA / ULC approved.

3.5 TRAINING

- .1 System installer to conduct training program for designated maintenance and operating personnel. This program to include but not be limited to the following:
 - .1 Operation: designated personnel to be trained to understand and undertake all aspects of system operation.
 - .2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.
 - .3 Training sessions to be delivered after building completion and prior to system use.
 - .4 Total training time required is 16 hours (which would include access control, CCTV, intrusion, etc.).

- .5 PFC/ Departmental Representative shall provide the Contractor with a training attendance sign-off sheet. This sheet shall identify the site, time and date as well as a listing of all personnel in attendance.

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts, including:
 - .1 Section 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets
 - .2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings
 - .3 Section 27 01 00 – General Requirements

1.2 REFERENCES

- .1 Refer to section 26 05 00 Common Work Results.
- .2 Refer to section 27 05 00 Common Work Results for Communications.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Sustainable Requirements
 - .1 Materials and products in accordance with Division 01.
 - .2 Do verification requirements in accordance with Division 01.
- .2 Waste Management and Disposal
 - .1 Separate and recycle waste materials in accordance with Division 01.
 - .2 Avoid using landfill waste disposal when recycling facilities are available.

1.4 SHOP DRAWINGS

- .1 Shop drawings to be submitted as outlined herein and contain all items within one complete submission. Refer to Section 26 05 00 for submission details and the following:
- .2 Shop drawings are to be submitted as outlined herein and contain all items within one complete submission.
- .3 Shop drawings to include a complete material list with manufacturer, style, model number and quantity. Cable type and size to be included in material list.
- .4 The term “shop drawings” means drawings, diagrams, illustrations, schedules, performance charts, operating specifications, characteristics, features and controls, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.
- .5 Shop drawings shall 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 the Contractor shall indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed and shall also indicate cross references to design drawings and specifications.

- .6 The required number of copies of product data sheets or brochures shall be submitted for requirements requested in specification sections and as the Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.
- .7 No material or equipment to be delivered to the jobsite prior to final approval of shop drawings unless otherwise specified and documented in writing by the Consultant.
- .8 Shop drawings to be submitted complete with all necessary drawings, interconnection diagrams and details with an index in appropriate binder or folder. Diagrams and detail drawings to be of professional quality drafting.

1.5 SUBMITTALS

- .1 Submit product data in accordance with Section 26 05 00.
- .2 Submit shop drawings in accordance with Section 26 05 00.

1.6 WARRANTY

- .1 System warranty to cover one year parts and labor from date of system acceptance. Manufacturers' extended warranties on equipment shall apply if longer than one year.
- .2 Contractor to submit a table listing all equipment types, model numbers, manufacturer, and length of warranty.
- .3 System supplier to include a written guarantee that service will be provided on the system within 24 hours of call origination during the warranty period.
- .4 During the warranty period the system installer, at own expense, will repair and replace all such defective work, and other work to the new system, which fails or becomes defective during the term of warranty, provided that such failure is not caused by improper usage or physical damage resulting from actions of the end user.

1.7 PRODUCT APPROVAL

- .1 Requests for alternate equipment approvals to be submitted to the Engineer/Consultant
- .2 Alternate products must meet or exceed the performance requirements of specifications. Alternate products which are approved on the merits of manufacturer's documentation, yet prove nonetheless to be insufficient to meet the performance requirements of the specification, will be removed and replaced with suitable equipment at the Contractor's expense.

1.8 OPERATING AND MAINTENANCE DATA

- .1 In accordance with 26 05 00.
- .2 The Contractor shall return the following documentation to the Owner and Consultant:
 - .1 Electrical inspection permit and report

Part 2 Products and System Requirements

2.1 GENERAL REQUIREMENTS

- .1 A new IP CCTV system is to be installed on site, replacing the existing analogue camera system.
- .2 The existing CCTV system is to be removed and disposed of according to other divisions of this specification. Camera's to be turned over to PFC.
- .3 Provide all necessary equipment and infrastructure required to support the new CCTV system.
- .4 Provide and install the supporting infrastructure including power, wiring (CAT6), and equipment necessary to meet the requirements of these new cameras and their recording system for their intended use.
- .5 Provide CCTV cameras in the interior and exterior of the facility as indicated on the drawings.
- .6 The cameras will be connected to a new NVR in the equipment room head end.
- .7 The system must be able to record clear images of individuals, sufficient to allow distinction of gender, ethnicity and age category. The system will provide recorded images of sufficient detail and quality to be used as court evidence in Canada.
- .8 The Contractor must ensure that the system is configured and equipped to reliably operate 24/7.

2.2 DIGITAL VIDEO MANAGEMENT SYSTEM (DVMS)

- .1 The DVMS will offer a complete video surveillance solution that will be scalable (in an open architecture) from one to at least 64 cameras that can be added on a unit-by-unit basis.
- .2 The DVMS shall be based on a true open architecture that shall allow for use of non-proprietary PC storage hardware; that shall not limit the storage capacity; and that shall allow for incremental upgrades of recording capacity while data storage and redundancy (RAID) of the existing archive is maintained.
- .3 The DVMS shall include applications and features which support the following requirements:
 - .1 System Server (PC Based) – for recording audio/video
 - .2 Virtual Matrix
 - .3 PTZ camera control
 - .4 Event Triggered Monitoring
 - .5 Auto alarm video call-up
 - .6 Audio Recording
 - .7 Seamless playback and switching between recorded and live video without interruption
 - .8 Synchronized simultaneous playback of multiple audio/video recordings
 - .9 Still image capture from video feed

- .10 Simultaneous view of multiple video sources
- .11 Touch Screen Control
- .12 Video recording triggers (Minimum)
 - .1 Capture on motion
 - .2 Capture on Alarm
- .4 All video streams supplied from IP cameras shall be digitally encoded in MPEG-4, MJPEG, H.264, compression formats and recorded simultaneously in real time.
- .5 The DVMS System shall interface with IP cameras and analog-to-digital video encoders, hereafter referred to as digital video servers (DVS). The VMS shall support IP cameras and DVMS devices from various manufacturers.
- .6 The DVMS shall require no proprietary recording hardware for video or audio recording and monitoring.
- .7 The DVMS shall be able to use multiple control keyboards to view and operate the entire set of cameras throughout the system, including cameras of various manufacturer brands, and provide cross-brand PTZ functionality (ie. a Pelco keyboard can control a Panasonic dome, or vice-versa).
- .8 The DVMS shall allow users to activate all live viewing controls using a standard PC keyboard and mouse. All standard camera switching and automation functions of a CCTV keyboard shall be available using a PC keyboard and mouse.
- .9 Data Retention and Storage requirements:
 - .1 Storage of audio/video shall be on storage system disks directly attached to the server, or on Network Attached Servers (NAS) on a LAN or WAN.
 - .2 Recording - Storage capability for recording and archiving video for at least 30 days on the cameras provided, at 30 IPS based on 50% motion activation over a 24 hour period.
 - .3 Fail Safe Backup – Storage server data to be maintained until minimum data retention time is met. Hard drive redundancy using RAID 5 configuration and multiple servers shall be used.
 - .4 In the event of a HDD failure, the event should be annunciated immediately by monitoring via the access control system, so the drive can be replaced as soon as possible and the archive preserved.
- .10 Video export format must comply with video format standards acceptable in court of law (usually AVI). The DVMS shall be able to export recorded content to removable media in the legally acceptable video format. Drives for exporting to DVD +R/-R, CD R/RW, and USB flash drive storage shall be provided.
- .11 The DVMS shall have the ability to quickly playback a video sequence to a monitor upon activation of an alarm or event. The length of the playback sequence shall be configurable, and may include pre and post video.
- .12 Standard of Acceptance: Most recent releases of Genetec Omnicast, Milestone XProtect, American Dynamics Victor.

2.3 FIXED CAMERA CHARACTERISTICS

- .1 IP based with Ethernet Network Interface
- .2 Progressive Scan CMOS or CCD imager
- .3 Colour camera with mechanical cut filter and auto switching to B/W for low light
- .4 Supports multi-stream MJPEG / MPEG4 / H.264
- .5 Resolution and frame rate: Both 1.3MP and 3MP cameras will be used (please see drawings and camera schedule for specifics and locations). The cameras will produce color images at a minimum 1.3 MP (1280x1024 pixel) MJPEG at 30fps in full HD (except where specified otherwise) for the 1.3 megapixel versions. The 3 megapixel cameras will produce color images at a minimum 3 MP (2048 X 1536 pixel) MJPEG at 30fps in full HD (except where specified otherwise).
- .6 Minimum scene illumination 0.1 lux B/W and 0.3 lux Colour, each at 30fps (full frame rate).
- .7 Auxiliary inputs: Selectable line / mic level audio input, and line level output; minimum one alarm input and one relay output.
- .8 Capable of 12VDC, 24VDC and PoE power operation. All cameras shall be Power Over Ethernet (PoE) capable.
- .9 Camera shall be available with a varifocal 3-8mm auto-iris lens featuring remote focus / back focus capability. Varifocal range requirements may vary within this specification according to requirements at specific locations. Contractor to ensure that lens provided is capable of achieving the field of view angle desired by the Owner.
- .10 The camera module shall meet or exceed the following design and performance specifications:
 - .1 During installation and the imager module design shall allow adjustment of the camera on three axes (pan, tilt, rotation) to permit maximum flexibility during scene adjustment.
 - .2 The imager module shall be easy to service, featuring a quick connect/disconnect design.
 - .3 The camera module may be removed to permit unobstructed access to the inside of the enclosure during installation.
 - .4 Outdoor camera(s) shall offer protection against the elements and include thermostatically controlled heaters that allow operation in extreme temperatures. The manufacturer suggested operating temperature range shall be -40° to 50° Celsius (-40° to 122°F).
 - .5 All video Ethernet cable connections shall be made using crimped or pre-manufactured connectors only.
 - .6 Each camera shall be equipped with an auto iris lens selected to provide the best combination of wide viewing angle and large image size at designated locations and as indicated on the drawings.
 - .7 Cameras shall feature at minimum back light compensation (BLC), and where stipulated shall offer sufficient wide dynamic range (WDR) to deal with difficult light conditions.

- .11 Standard of Acceptance: Axis, Panasonic, Samsung, Bosch.

2.4 CAMERA DOME ENCLOSURES

- .1 The dome enclosure shall meet or exceed the following design and performance Specifications:
- .1 Include a polycarbonate high security lens bubble that has high optical clarity and nominal distortion at all camera angles. The bubble shall be impact resistant, capable of withstanding repeated multiple blunt impact forces of up to 100 foot-pounds.
 - .2 The enclosure will be NEMA 4 / IP 66 rated
 - .3 Outdoor operation cameras shall be service rated down to -40C by use of heater.
 - .4 Mounts to a standard 4S or double-gang electrical box using an adapter plate (provided); or to the switch plate or lighting hole pattern that is standard on most double-gang mud rings.
 - .5 Enclosures shall accept a connection to 20mm NPT threaded conduit from the side, or to a 20mm conduit adapter from the rear of the enclosure.
 - .6 The enclosures, when installed, shall leave no exposed wiring.

2.5 PTZ CAMERA WITH DOME ENCLOSURE

- .1 PTZ cameras shall be day/night and include a minimum 1.3 MP colour CCD or CMOS sensor with a minimum 20X optical zoom lens.
- .2 All pan/tilts shall be IP based and will provide 360 degree pan movement at variable speeds between 0.5 - 250°/second, with the range graduated in a minimum of 64 incremental steps. Pan/tilt units shall be corrosion resistant and in all cases constructed of materials suited for the intended environment and operation. Pan/tilt units shall be programmable with a minimum of 32 pre-set positions and zoom settings.
- .3 Unit shall be capable of auto-pattern operation by recorded tour, or by timed sequential movement between presets.
- .4 All CCTV cameras to be PoE and 24 VAC power operation. Where power supplies are used, each PS output shall supply only one camera, and shall be individually fused.
- .5 The automatic iris lens shall be suitable for use in areas where there are varying light conditions. The camera shall also feature BLC for surveillance under backlit conditions, and/or WDR where uneven lighting is more severe.
- .6 The enclosure shall be NEMA 4 and IP66 rated. Dome housing shall be outdoor environmentally sealed and shall include a factory installed heater and blower as required to maintain fog free operation. The manufacturer shall offer pendant mounts, pole mounts and corner mounts which can replace or be adapted to standard wall mount arms. The housing shall be heavy duty and vandal resistant.
- .7 The camera shall provide built-in power line surge and lightning protection.
- .8 Standard of Acceptance: Pelco Spectra, Axis PTZ, Panasonic PTZ.

2.6 CAMERA MOUNTING HARDWARE

- .1 Appropriate camera mounting hardware (pole/pipe, pendant, wall, ceiling, pedestal mount etc.) will be provided to suit each camera and the conditions of its location.
- .2 Dome cameras mounted on the side of the building, if they cannot be ceiling mounted under an appropriate overhang or soffit, will be provided complete with a pendant mount so that the dome is oriented downward under the mount, and is thereby less susceptible to accumulations of dirt and rain.

2.7 LOW VOLTAGE CAMERA POWER SUPPLY

- .1 Where camera or accessory power requirements cannot be supported by PoE, use a listed, approved power supply that meets manufacturer recommended specifications.
- .2 Power supply cabling will be of a gauge sufficient to account for voltage drop, with a jacket suited to installation conditions and environment.
- .3 Power supply cabinet to be complete with key locking device and keys, fast acting 24V miniature fuses for each camera, terminal strip with labels, 120VAC/24VAC transformer(s), LED light to signal the power supply is on and functioning correctly. Power supply to be rated for 125% capacity at full load with all devices operating.
- .4 Separate plug-in power supplies for each camera will not be permitted.
- .5 Install camera power supplies in the nearest acceptable electrical room to the device.
- .6 Standard of Acceptance: Altronix, Pelco, LifeSafety.

2.8 CONNECTORS

- .1 Ethernet connectors to be crimp type installed with proper installation tool.
- .2 Spade lugs to be crimp-type on all solid or stranded conductors where power or control cables are connected under terminal screws. Spade lugs to be sized for gauge of wire and terminal lugs being used.

2.9 CABLE

- .1 Power cable to be minimum 18 gauge 2 conductor cable. Contractor to calculate and select cable gauge with respect to distance, current load, and calculated voltage drop.
- .2 Video data cable to be minimum Category 6 or higher, or as otherwise indicated in this specification. Cable colour shall be BRIGHT GREEN.
- .3 Optical fibre cable to be used to connect equipment in the two communication rooms, and otherwise only where copper cable cannot be used due to distance limitation between camera and switch. Fibre optic cable shall be BRIGHT GREEN.

2.10 NETWORK SWITCH

- .1 Network switches are to be provided to support the CCTV network, and shall provide Power over Ethernet (PoE) and Gigabit uplinks.
- .2 Switches shall be rack mountable, and selected with features that meet the requirements of the camera and VMS manufacturers.

- .3 Switch RJ-45 ports will be 10/100/1000 and include 1000BASE-FX SFP modules.
- .4 Switches shall not be provided and installed prior to determining with the Owner what brands are acceptable to their IT standards. Network switches provided will then be from one of these manufacturers.

2.11 PATCH PANELS

- .1 Fibre
 - .1 Fibre patch panels will be 24-port or 48-port configuration supporting both single mode/multi-mode connectivity and c/w fibre storage tray, lockable front cover, port labels and identification.
 - .2 Fibre modular cassette and Connectors type: LC.
 - .3 Patch panels shall be rack mountable.
 - .4 Standard of Acceptance: AMP, Panduit, Corning, or Approved Alternate.
- .2 UTP
 - .1 Patch panels shall be CAT6 RJ45 modular ports, 24-port or 48-port configuration c/w 2RU horizontal cable management below each panel. .
 - .2 Patch panels shall be rack mounted.
 - .3 Standard of Acceptance: AMP, Panduit, Approved Alternate.

2.12 EQUIPMENT CABINET (STANDALONE)

- .1 Provide and install a four-post, lockable cabinet for new security equipment.
- .2 Meets EIA standard for cabinets per EIA-310E, standard 19 inch / 483mm width.
- .3 Minimum useable depth of 24"; minimum useable height of 78" / 1980mm.
- .4 Top mounted fan kit c/w four (4) 4.5" fans and one fan controller.
- .5 Cabinet door will be metal perforated, front locking type.
- .6 Cable management: Horizontal cable chase management system.
- .7 Standard of Acceptance: Middle Atlantic BGR-SA or equal equivalent.
- .8 Power Distribution (power bars):
 - .1 Provide two (2) 48" vertical 20A / 120 VAC power bar c/w surge suppression and power on indicator LED.
 - .2 Minimum 14 outlets (7 duplex) receptacles – CSA 5-20R.
 - .3 10 foot / 3050mm cord and CSA L5-20P twist-lock plug.
 - .4 All equipment shall be fed from the existing rack mounted UPS.
- .9 Cabinet equipment to include a pullout tray 17" LCD display with keyboard and mouse, and KVM to switch between the CCTV and access control servers for programming and maintenance.

2.13 WORKSTATION EQUIPMENT

- .1 Workstation equipment including LCD monitors shall be supplied by the Contractor (the Video Workstation is also the Access Control Workstation. Please see appropriate section in 2813000 Access Control).
- .2 Contractor will provide two (2) complete workstations (c/w OS, keyboard and mouse) equipped according to manufacturers' specifications for use with both the access control and video systems. One workstation will be installed in the ground floor Command Centre; the other will be installed in the second floor Security Office. Both workstations will be connected to the security systems network.
- .3 Each workstation will be provided with two 24" LED displays. In addition, two 42" LED displays will be provided with the Command Centre combination access control / CCTV workstation (see Access Control section for Workstation details).
- .4 Provide articulating VESA wall mount brackets for the 42" monitors, and also for the Command Centre workstation's 24" monitors if desk space is not sufficient to accommodate these displays.

2.14 KEYBOARD CONTROLLER

- .1 The keyboard controller shall provide control of the virtual matrix switcher through password-protected controls and shall consist of a control keypad, select buttons for camera and monitor, lens and iris control buttons, and a joystick for pan/tilt/zoom control.
- .2 The keyboard controller shall meet or exceed the following design and performance specifications:
 - .1 The keyboard controller shall provide the main user interface to the matrix system and have control of all system functions, including auxiliary relays, receivers, camera/monitor switching, multiplexed view functions, and macro programming.
 - .2 The keyboard controller shall permit the creation and initiation of PTZ patterns, zones, zone labels, and presets.
 - .3 The keyboard controller shall provide a variable speed, vector-solving joystick for pan/tilt/zoom control. The joystick shall have a reliability rating of 1.5 million cycles. The controller also shall have self-centering software, which automatically compensates for any minor irregularities in the joystick when the keyboard is powered up. All additional control functions shall be positioned next to the joystick for one-handed operation.
- .3 Standard of Acceptance: Pelco KBD300A.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Co-ordinate phasing of work with other trades.
- .2 CCTV system UTP cabling shall be installed according to applicable network infrastructure standards.

- .3 All CCTV system equipment shall be located in secured communication rooms.
- .4 All cable and equipment supplied, and all installation methods used, shall be as specified by the equipment manufacturer.
- .5 Conduit must be used for security cabling throughout.
- .6 All wiring shall be concealed unless otherwise authorized by the Contractor.
- .7 All cables shall be permanently identified with label at both termination ends and listed on as-built drawings as follows:
 - .1 Cable number
 - .2 Source
 - .3 Destination
- .8 Electrical panel circuit number shall be clearly identified on all system panels.
- .9 Dress cables neatly into equipment rack
- .10 All work shall be installed in a neat and workmanlike manner. The contractor is responsible for cleanup and disposal of all garbage and debris caused as a result of their work. (Please refer to Section 1.3 'Waste Management and Disposal')
- .11 Confirm all camera mounting locations with Consultant or supervising Contractor. Provide mounting detail and hardware at each location with shop drawings.
- .12 All cable to be pulled in one continuous run. No splices will be allowed.
- .13 Provide any required additional backing or structural support required for camera mounting.

3.2 LABELLING

- .1 Refer to Section 281300 Access Control for Labelling requirements.

3.3 TESTS AND ADJUSTMENTS

- .1 Upon completion of system, installation tests to be conducted by the system installer to determine system conformity to the requirements of this specification. Security Contractor to prepare test forms. Tests to be conducted in the presence of the Consultant and/or his representative who may suspend or discontinue tests of any time performance is considered unsatisfactory. Resumption of testing to cover the previously untested elements and any completed elements at the discretion of the Consultant.
- .2 All equipment or wiring provided by the system installer which tests prove to be defective or operating improperly to be corrected or replaced promptly at no additional cost to the Contractor.
- .3 Test system for proper operation and programming.
- .4 Test all equipment as directed by Consultant and systems manufacturer, as for example:
 - .1 Test cameras for field of view, focus, auto iris function, lens clarity, proper resolution, pan-tilt-zoom, presets, and alarm recording.
 - .2 Test monitors for proper resolution, colour reproduction, stability, good signal termination, etc.

- .3 Test network video recorder and alarm management system software for proper operation, call to presets, recording and playback of events including pre-and post-alarm, etc.
- .4 Test system for keyboard control, networked access by remote workstation, mobile apps, browser interface etc.

3.4 DOCUMENTATION

- .1 The contractor shall return the following documentation to the Owner and Consultant:
 - .1 As-built drawings showing location and models of all devices, controls, power supplies and switches, workstations etc. Electrical panel circuit breaker shall be clearly identified and noted on both the panel cover and as-built drawings.
 - .2 All installation manuals for equipment provided in the system.
 - .3 A drawing of the network topography of the video system.
 - .4 Device verification sign-off sheets.
 - .5 Manufacturer's cut sheets for all devices.
 - .6 Electrical inspection permit and report.
 - .7 Training session attendance sheet.

3.5 TRAINING

- .1 Refer to Section 281300 Access Control for Training requirements.

END OF SECTION

PROJECT NO. R.076291.001
NRCAN – SECURITY SYSTEM UPGRADES
PACIFIC FORESTRY CENTRE
VICTORIA, B.C.

APPENDIX A

Page 1 of 2

Appendix A
Certificate of Exemption Contractor



CERTIFICATE OF EXEMPTION CONTRACTOR

under the Provincial Sales Tax Act

Responsibilities for Sellers and Eligible Contractors:

Sellers - this certificate allows you to collect the information and declaration required under the Provincial Sales Tax Act (the Act) in order to provide a PST exemption to your customer.

If you do not receive a completed and signed certificate or the required information and declaration before the sale, you must charge and collect PST. Failure to do so may result in an assessment, penalty and interest.

Eligible Contractors - you are responsible for ensuring that you meet all the requirements for the exemption under the Act. If you complete the certificate but you do not qualify for the exemption, you are responsible for paying the PST.

General Instructions:

- Refer to Page 2 for detailed instructions.

Freedom of Information and Protection of Privacy Act (FOIPPA)

The personal information on this form is collected for the purpose of administering the Provincial Sales Tax Act under the authority of both this Act and section 26 of the FOIPPA. Questions about the collection or use of this information can be directed to the Manager, Program Services, PO Box 9442 Stn Prov Govt, Victoria, BC V8W 9V4. (Telephone: toll-free at 1 877 388-4440)

PART A - CERTIFICATION OF ELIGIBLE PERSON (see Page 2)

NAME OF CORPORATION, ASSOCIATION, PARTNERS, INDIAN BAND OR INDIVIDUAL: Public Works Gov. Canada; MAILING ADDRESS (including postal code): 219 - 800 Burrard Street Vancouver, B.C. V6Z 0B9

I certify that I have entered into a contract with the eligible contractor named below for the supply and installation of affixed machinery or improvements to real property and if I were to purchase the tangible personal property identified below I would be exempt from PST because (check (✓) one and complete the appropriate section):

- 1. I am eligible for the Production Machinery and Equipment (PM&E) exemption under the Act.
2. I am a status Indian or authorized representative of an Indian band and the items being purchased would be exempt from PST under section 87 of the Indian Act (Canada). If you are representing an Indian band, attach written authorization from an official of the band that you are authorized to act on behalf of the Indian band.

Form fields for Indian and Indian Bands (BAND NAME, STATUS CARD NUMBER) and Indian Bands Only (NAME OF REPRESENTATIVE)

- 3. I am a qualifying aquaculturist under the Act. (AQUACULTURE LICENCE NUMBER)
4. I am a qualifying farmer under the Act. (PROPERTY TAX FOLIO NUMBER / ADDRESS OF FARM)
5. I am eligible for a PST exemption under the Consular Tax Exemption Regulation. (DIPLOMATIC / CONSULAR IDENTITY CARD NUMBER, EXPIRY DATE)

I certify that the Government of Canada has entered into a contract with the eligible contractor named below for the supply and installation of affixed machinery or improvements to real property.

- 6. I am an authorized representative of the Government of Canada. (PST NUMBER: PST-1000-5001)

By signing this form, I certify that the above information is correct.

Signature block for Patrick Truong, dated 2015/12/15

PART B - CERTIFICATION OF ELIGIBLE CONTRACTOR (see Page 2)

FULL LEGAL NAME; MAILING ADDRESS (including postal code)

Description of all items of tangible personal property (goods) being purchased (if you require more space, attach an additional document):

I certify that the tangible personal property (TPP) identified above is being acquired to fulfill a contract for the supply and installation of affixed machinery or improvements to real property that meets the requirements of (check (✓) one):

- 7. Customer is the eligible person identified in Part A: the contract is with the eligible person identified in Part A, or
8. Customer pays the PST: you have a written agreement with your customer that they will pay PST on the TPP described above and the agreement sets out the purchase price of the TPP. You must be registered for PST before supplying this TPP to your customer. You may only use this certificate in advance of receiving your PST number

By signing this form, I certify to the best of my knowledge that the above information and any attached information is correct. I acknowledge that if I make a false statement to avoid paying tax, the Provincial Sales Tax Act charges a fine of up to \$10,000 and/or imprisonment up to two years, in addition to a penalty of 25% of the tax due and an assessment for the tax that should have been paid.

Signature block for the contractor, dated 2015/12/15

