
PWGSC ONTARIO	SPECIFICATION	SECTION 00 00 00
REGION PROJECT	TITLE SHEET	PAGE 1
NUMBER R.084085.001		2016-09-16

Project Title LONDON, ONTARIO
451 TALBOT STREET

Elevator Upgrade Project

Project Number R.084085.001

Project Date 2016-12-01

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Title and description of Work.
- .2 Contract Method.
- .3 Work by others.
- .4 Work sequence.
- .5 Contractor use of premises.
- .6 Owner occupancy.
- .7 Alterations to existing building.

1.2 PRECEDENCE

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

1.3 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises Elevator Upgrade at Government of Canada Building, located at 451 Talbot Street, London, Ontario; and further identified as PWGSC Project Number R.084085.001.
 - .1 Work shall be phased to provide minimum three elevators in service for public and building occupant use during the construction period.
 - .2 Upgrade equipment and finishes to all existing elevators.
 - .1 Existing mirrors to be removed, stored and reinstalled.

1.5 CONTRACT METHOD

- .1 Construct work under lump sum contract.
- .2 Relations and responsibilities between Contractor and subcontractors, suppliers and subcontractors assigned by Owner are as defined in Conditions of Contract.

1.6 COST BREAKDOWN

- .1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract amount.
- .2 Show separately cost of equipment purchased exempt from Ontario Retail Sales Tax, if applicable, under your Ontario Sales Tax license number.
- .3 Within 48 hours of acceptance of bid submit a list of subcontractors.

1.7 WORK SEQUENCE

- .1 Construct Work in phases to accommodate Owner's continued use of premises during construction.
 - .1 Phase 1: two passenger elevators within one shaft
 - .2 Phase 2: two passenger elevators within one shaft
 - .3 Phase 3: freight elevator
 - .4 Each phase must be complete, and upgraded elevators operational and licensed by authorities having jurisdiction prior to a subsequent phase beginning.
 - .5 During the construction period, minimum three elevators must be in service for public and building occupant use at all times.
- .2 Coordinate Progress Schedule.
- .3 Construct Work to provide for continuous public usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.
- .4 Maintain fire access/control.

1.8 CONTRACTOR USE OF PREMISES

- .1 Contractor shall limit use of premises for Work, for storage, and for access, to allow;
 - .1 Owner occupancy.
 - .2 Public usage.
- .3 Coordinate use of premises under direction of Departmental Representative.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.9 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.
- .3 Schedule and substantially perform each phase of Work of Owner's use prior to Certificate of Substantial Performance of entire Work.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used

PART 1 - GENERAL

1.1 ACCESS AND EGRESS

- .1 Maintain "access to" and "egress from" work areas, including stairs, runways, ramps or ladders, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.
- .2 Provide hoarding or construction partition to separate construction area from portion of the building accessible by public or building occupants.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Use only elevators or shafts within the area under alteration or repair for moving workers and material.
 - .1 Accept liability for damage, safety of equipment and overloading of existing equipment.
- .6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS AND REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
 - .1 Phase alterations and repairs to existing elevators so that minimum three elevators are operational at any time during construction.
 - .2 Each phase must be complete, and upgraded elevators operational and licensed by authorities having jurisdiction prior to a subsequent phase beginning.

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.

- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for personnel traffic.
- .4 Construct barriers in accordance with Section 01 56 00.

1.5 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 16.
- .2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .3 Keep within limits of work and avenues of ingress and egress.
- .4 Ingress and egress of Contractor vehicles at site is limited to Loading Dock area before 07:00 and after 17:00 Monday through Friday and all day on weekends and Statutory holidays.
- .5 Deliver materials between the hours of 17:00 to 07:00, unless otherwise approved by Departmental Representative.
- .6 Project will be constructed in phases as follows:
 - .1 Phase 1: 2 Passenger Elevators within one shaft
 - .2 Phase 2: 2 Passenger Elevators within one shaft
 - .3 Phase 3: Freight Elevator
 - .4 Elevators which are not under construction shall be available for public and building occupant use. Maintain minimum three elevators in service for public and building occupant use at all times.

1.6 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security clearances:
 - .1 Personnel employed on this project will be subject to security check.
 - .2 Obtain requisite clearance, as instructed, for each individual required to enter premises.
 - .3 Personnel will be checked daily at the start of each work shift and provided with pass which must be worn at all times. Pass must be returned at the end of each work shift and personnel checked out.

1.7 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.
- .4 Preside at meetings.
- .5 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .6 Reproduce and distribute copies of minutes within three days after meetings and transmit to Departmental Representative, meeting participants and affected parties not in attendance.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.
 - .3 Schedule of submission of shop drawings, samples. Submit submittals in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
 - .5 Site security in accordance with Section 01 56 00.
 - .6 Health and safety in accordance with Section 01 35 29.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Record drawings and specifications in accordance with Section 01 33 00.

- .9 Maintenance manuals in accordance with Section 01 78 00.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work, schedule progress meetings twice monthly.
- .2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.
- .3 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately [10] working days, to

allow for progress reporting.

- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit to Departmental Representative within Fifteen (15) working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within [5] working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Elevator Upgrades - by Phases
 - .6 Testing and Commissioning.
 - .7 Substantial Performance
 - .8 Final Certificate.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario of Canada.

- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 5 working days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, 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.
- .8 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.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit one transparency on plastic film three hard copies and one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

- .11 Submit three hard copies and 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.
- .12 Submit three hard copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit three hard copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit three hard copies and one electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit three hard copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 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 requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

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

1.6 FEES, PERMITS AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required.
- .3 Furnish certificates and permits.
- .4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1.7 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule twice monthly reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings specified in Section 01 31 19, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA): Canada
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code 2010 (NBC):
 - .1 NBC 2010, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .3 National Fire Code 2010 (NFC):
 - .1 NFC 2010, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- .4 Province of Ontario:
 - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
 - .2 O. Reg. 490/09, Designated Substances.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal statutes and authorities.
- .5 Treasury Board of Canada Secretariat (TBS):
 - .1 Treasury Board, Fire Protection Standard April 1, 2010
www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316§ion=text.
- .6 Fire Commissioner of Canada (FCC):
 - .1 FC-301 Standard for Construction Operations, latest edition.
 - .2 FC-302 Standard for Welding and Cutting, latest edition.
Human Resources and Social Development Canada
Labour Program
Fire Protection Engineering Services
4900 Yonge Street 8th Floor
North York, Ontario M2N 6A8

and copies may be obtained from:

Human Resources and Social Development Canada
Labour Program
Fire Protection Engineering Services
Ottawa, Ontario K1A 0J2

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.

- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operations found in work plan.
 - .3 Measures and controls to be implemented to address identified safety hazards and risks.
 - .4 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Building, Facility, Tenant's Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Building, Facility, Tenant's Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.
 - .5 Contractor's and Sub-contractors' Safety Communication Plan.
 - .6 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Building, Facility, Tenant's Emergency Response requirements and procedures provided by Departmental Representative.
- .3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within fifteen days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within seven days after receipt of comments from Departmental Representative.
- .4 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .5 Submit names of personnel and alternates responsible for site safety and health.
- .6 Submit records of Contractor's Health and Safety meetings when requested.
- .7 Submit three copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, daily weekly.
- .8 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .9 Submit copies of incident and accident reports.
- .10 Submit Material Safety Data Sheets (MSDS).
- .11 Submit Workplace Safety and Insurance Board (WSIB) - Experience Rating Report.

1.3 FILING OF NOTICE

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

1.4 WORK PERMIT

- .1 Obtain building permits related to project prior to commencement of Work.
- .2 Obtain 'Permit to Work Form' from Brookfield Global Integrated Solutions offices on site.
- .3 Obtain Hot Work Permit from Brookfield Global Integrated Solutions offices on site.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

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

1.7 REGULATORY REQUIREMENTS

- .1 Comply with the Acts and regulations of the Province of Ontario.
- .2 Comply with specified standards and regulations to ensure safe operations at site.

1.9 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.
- .3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.11 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 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.
- .3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act for the Province of Ontario.

1.12 UNFORSEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.
- .2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.13 HEALTH AND SAFETY CO-ORDINATOR

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

1.14 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.
 - .1 Contractor's Safety Policy.
 - .2 Constructor's Name.
 - .3 Notice of Project.
 - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
 - .5 Ministry of Labour Orders and reports.
 - .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
 - .7 Address and phone number of nearest Ministry of Labour office.
 - .8 Material Safety Data Sheets.

- .9 Written Emergency Response Plan.
- .10 Site Specific Safety Plan.
- .11 Valid certificate of first aider on duty.
- .12 WSIB "In Case of Injury At Work" poster.
- .13 Location of toilet and cleanup facilities.

1.15 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.17 POWDER ACTUATED DEVICES

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

1.18 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.
- .2 Assign responsibility and obligation to Health and Safety Coordinator to stop or start Work when, at Health and Safety Coordinator's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2010, National Fire Code of Canada (NFC) 2010 and Ontario Building Code (OBC) 2012, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's, other than those identified in Section 01 35 29 are discovered in course of work.

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.

1.5 IAQ - INDOOR AIR QUALITY

- .1 Comply with CSA-Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651-12.

1.6 ACCESSIBLE DESIGN

- .1 Comply with CSA B651-12, Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

1.7 TAXES

- .1 Pay applicable Federal, Provincial and Municipal taxes.

1.8 EXAMINATION

- .1 Examine existing conditions and determine conditions affecting work.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Mill tests.
- .5 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

- .1 Section 14 21 23 - Traction Elevators

1.3 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work, above and beyond those required of the Contractor. Cost of such services will be borne by Departmental Representative.

- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.8 REPORTS

- .1 Submit 4 copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.

1.12 EQUIPMENT AND SYSTEMS

- .1 Submit Commissioning Documentation in accordance with Section 14 21 23.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.

1.2 INSTALLATION AND REMOVAL

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

1.3 WATER SUPPLY

- .1 Departmental Representative will provide continuous supply of potable water for construction use.
- .2 Departmental Representative will pay for utility charges at prevailing rates.

1.4 TEMPORARY VENTILATION

- .1 Provide temporary ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Provide adequate ventilation to meet health regulations for safe working environment.
 - .2 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
 - .3 Pay costs for maintaining temporary ventilation of work areas.
-

- .4 Maintain strict supervision of operation of temporary ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.

1.8 TEMPORARY POWER AND LIGHT

- .1 Departmental Representative will pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.9 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, fax and data hook up, lines and equipment necessary for own use and use of Departmental Representative.

1.10 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

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TEMPORARY UTILITIES

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PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office and sheds.
- .3 Parking.
- .4 Project identification.
- .5 Construction Elevator

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA 0121-08, Douglas Fir Plywood.
 - .3 CSA Z797-09, Code of practice for Access Scaffold.
 - .4 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.

1.4 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
 - .2 Indicate use of supplemental or other staging area.
 - .4 Provide construction facilities in order to execute work expeditiously.
 - .5 Remove from site all such work after use.
-

1.5 SCAFFOLDING

- .1 Scaffolding in accordance with CSA Z797-09 R2014).
- .2 Provide and maintain scaffolding, ramps, ladders, platforms and temporary stairs.

1.6 HOISTING

- .1 Provide, operate and maintain hoists/cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists/cranes shall be operated by qualified operator.

1.7 ELEVATORS

- .1 Existing freight and passenger elevators may not be used by construction personnel and transporting of materials.

1.8 SITE STORAGE/LOADING

- .1 Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.9 CONSTRUCTION PARKING

- .1 Parking will not be permitted on site.
- .2 Provide and maintain adequate access to project site.

1.10 SECURITY

- .1 Pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.11 OFFICES

- .1 Provide office within work area of each phase of the project, heated to 22°C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
 - .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
-

- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.12 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.
- .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.13 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.14 CONSTRUCTION SIGNAGE

- .1 Provide and erect, within three weeks of signing Contract, a project sign in a location designated by Departmental Representative.
 - .2 Indicate on sign, name of Owner, Consultant and Contractor, of a design style established by Departmental Representative.
 - .3 No other signs or advertisements, other than warning signs, are permitted on site.
 - .4 Provide project identification site sign comprising framing, and one 1200 x 2400 mm signboard as detailed and as described below.
 - .2 Framework and battens: SPF, pressure treated minimum 89 x 89 mm.
 - .3 Signboard: 19 mm Medium Density Overlaid Douglas Fir Plywood to CSA O121.
 - .4 Paint: alkyd enamel to CAN/CGSB-1.59 over exterior alkyd primer to CGSB 1-GP-189.
 - .5 Fasteners: hot-dip galvanized steel nails and carriage bolts.
 - .6 Vinyl sign face: printed project identification, self adhesive, vinyl film overlay, supplied by Departmental Representative.
 - .5 Locate project identification sign as directed by Departmental Representative and construct as follows:
 - .1 erect framework, and attach signboard to framing.
 - .2 Paint all surfaces of signboard and framing with one coat primer and two coats enamel. Colour white on signboard face, black on other surfaces.
 - .3 Apply vinyl sign face overlay to painted signboard face in accordance with installation instruction supplied.
-

- .6 Direct requests for approval to erect a Consultant/Contractor signboard to Departmental Representative. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording shall be in both official languages.
- .7 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321-96 (R2006).
- .8 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.15 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Store materials resulting from demolition activities that are salvageable.
- .3 Stack stored new or salvaged material.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.*1 SECTION INCLUDES

- .1 Barriers.
- .2 Environmental Controls.
- .3 Traffic Controls.
- .4 Fire Routes.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA):
 - .1 CSA-O121-08, 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.

1.6 PROTECTION FOR PUBLIC PROPERTY

- .1 Protect surrounding public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.7 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.
-

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Manufacturer's instructions.
- .3 Quality of Work, coordination and fastenings.
- .4 Existing facilities.

1.2 REFERENCES

- .1 Within text of specifications, reference may be made to reference standards.
- .2 Conform to these 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 The cost for such testing will be born 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 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.

1.4 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 Amount or Contract Time.

1.5 METRIC SIZED MATERIALS

- .1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.
- .2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.
- .3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.
- .4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.
- .5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

1.6 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 and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .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.

1.7 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.8 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 Amount or Contract Time.

1.9 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.

1.10 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.

1.11 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.

1.12 REMEDIAL WORK

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

1.13 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

1.14 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.

1.15 FASTENINGS - EQUIPMENT

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

1.16 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, and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .3 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 Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 MATERIALS

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

1.3 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 are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching 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 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .12 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00, full thickness of the construction element.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Final cleaning.

1.2 PROJECT CLEANLINESS

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

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .11 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .12 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .13 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Target for this project is 75% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Brick and portland cement concrete.
 - .2 Corrugated cardboard.
 - .3 Wood, not including painted or treated wood or laminated wood.
 - .4 Gypsum board, unpainted.
 - .5 Steel.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
 - .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested using Section 02 42 93, Deconstruction and Waste Products Workplan Summary.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING SITES

- .1 Province of: Ontario.
 - .1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
 - .2 Telephone: 800-565-4923 or 416-323-4321.
 - .3 Fax: 416-323-4682.
- .2 Recycling Council of Ontario: 215 Spadina Avenue, #225, Toronto, ON, M5T 2C7.
 - .1 Telephone: 416-657-2797
 - .2 Fax: 416-960-8053
 - .3 Email: rco@rco.on.ca.
 - .4 Internet: <http://www.rco.on.ca/>.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

Province	Address	General Inquiries	Fax
Ontario	Ministry of Environment And Energy 135 St Clair Avenue West Toronto, ON M4V 1P5	(416) 323-4341 (800) 565-4923	(416) 323-4682
	Environment Canada	(416) 734-4494	
	Toronto, ON		

END OF SECTION

PART 1 - GENERAL

1.1 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 to 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, adjusted and balanced and are fully operational.
 - .4 Certificates required by have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

- .1 In accordance with Section 01 74 11.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.

1.2 RELATED SECTIONS

- .1 Section 14 21 23 - Traction Elevators.

1.3 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 Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English.
- .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.

1.4 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on PWGSC encrypted USB drive.

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 addresses, and telephone numbers of Contractor with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to 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.

1.6 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Amendments and 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 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.
- .3 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .4 Keep record documents and samples available for inspection by Departmental Representative.
- .5 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.
- .6 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, 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 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .2 Field changes of dimension and detail.
 - .3 Changes made by change orders.
 - .4 Details not on original Contract Drawings.
 - .5 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 Amendments and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications and 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.
 - .1 Provide "Maintenance Control Program" for all modernized elevators in accordance with TSSA requirements and CSA B44-10; 8.6.1.2.1.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .11 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental

- agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
 - .4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue 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.

1.11 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 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.12 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 Certificate of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.

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CLOSEOUT SUBMITTALS

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of equipment and systems to Owner's O&M personnel.
- .2 O&M personnel includes property facility manager, building operators, maintenance staff, security staff and technical specialists, as applicable.

1.2 RELATED SECTIONS

- .1 Section 14 21 23 - Traction Elevators.

1.3 DESCRIPTION

- .1 Demonstrate operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of substantial performance.
- .2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.
- .2 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Report shall give time and date of each demonstration and training, with list of persons present.

1.5 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation.
- .2 Testing, adjusting, and balancing has been performed and systems are fully operational.

- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.
- .4 TSSA inspections have been passed and Operational Licenses have been received for modernized elevators.

1.6 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated O&M 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.

1.8 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 Section 14 21 23 Traction Elevators: 3 hours of instruction.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM):
 - .1 ASTM A269-10, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .2 ASTM A666-10, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .3 ASTM F593-02 (2008)e1, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data of each item specified in accordance with Sections 01 33 00 and 01 78 00.
 - .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Stainless steel sheet, strip, plate and flat bar: to ASTM A666, type 304, AISI No. 4 finish, 0.95 mm thick, minimum 75% recycled content.

2.2 FABRICATION

- .1 Fit joints in true planes and securely fasten.
- .2 Shop assemble work.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Supply other sections with templates, instructions and built-in items.
- .2 Install work straight, plumb and level to a tolerance of 1:600.
- .3 Provide required anchorage.

3.3 STEEL WALL PANELLING AND CEILINGS

- .1 Supply and install stainless steel panelling for walls in freight elevator and ceilings in freight elevator and passenger elevators.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International:
 - .1 ASTM E84-12, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .2 ASTM E136-11, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
- .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 19-GP-5M(1984), Sealing Compound, One Component, Acrylic Base, Solvent Curing (Incorporating Amendment No. 1).
- .6 Canadian Standards Association (CSA):
 - .1 CAN/CSA-O86-09 Consolidation, Engineering Design in Wood.
 - .2 CSA O112 Series M1977(R2006), CSA Standards for Wood Adhesives.
 - .3 CAN/CSA-Z809-08, Sustainable Forest Management.
- .7 Forestry Stewardship Council (FSC).
- .8 National Building Code of Canada, NBC 2010.
- .9 Sustainable Forestry Initiative (SFI).
- .10 South Coast Air Quality Management District (SCAQMD):
 - .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications, Amended January 7, 2005.
- .12 National Lumber Grades Authority Standard Grading Rules for Canadian Lumber, December 1, 2010:
 - .1 Special Product Standard SP-1-April 2011
 - .2 Special Product Standard SP-2-November 2010.

1.2 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Wood products: CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
 - .2 Panel products:
 - .1 Composite Wood, Agrifiber Products and Laminating Adhesives to be
-

free of added urea-formaldehyde resins.

- .2 Environmental Choice EcoLogo CCD-046: Adhesives.
- .3 CAN/CSA-Z809, SFI or Forest Stewardship Council (FSC) certified.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Wood: S-DRY, graded and stamped to National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber, December 1, 2010, S4S.
 - .1 Blocking, furring, strapping, nailers, bracing, bridging: spruce, pine or fir (SPF), 121c. and pine, 113d.

PART 3 - EXECUTION

3.3 INSTALLATION

- .1 Set items in place plumb, straight and level to a tolerance of 1:600 and rigidly secure in place.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Secure exterior work with galvanized or non-ferrous fasteners.
- .4 Install plywood backboards with countersunk screws.
- .5 Install gypsum sheathing in accordance with manufacturer's recommendations where shown. Edge joints parallel to and occurring over framing members. End joints staggered.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A208.1-[09], Particleboard.
 - .2 ANSI A208.2-[09], Medium Density Fibreboard (MDF) for Interior Applications.
 - .3 ANSI/HPVA HP-1-[2009], American National Standard for Hardwood and Decorative Plywood.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC), Architectural Woodwork Institute (AWI) and Woodwork Institute (WI).
 - .1 AWI/AWMAC/WI Architectural Woodwork Standards, Edition 1-2009.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-[M87], Hardboard.
- .4 CSA International
 - .1 CSA B111-[74(R2003)], Wire Nails, Spikes and Staples.
 - .2 CSA O121-[08], Douglas Fir Plywood.
 - .3 CSA O141-[05], Softwood Lumber.
 - .4 CSA O151-[09], Canadian Softwood Plywood.
 - .5 CSA O153-[M1980(R2008)], Poplar Plywood.
 - .6 CAN/CSA-Z809-08, Sustainable Forest Management.
- .6 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.
 - .2 FSC-STD-20-002-[2004], Structure and Content of Forest Stewardship Standards V2-1.
 - .3 FSC Accredited Certified Bodies.
- .7 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber December 2010.
- .8 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-[A2005], Adhesives and Sealants Applications.
- .9 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S104-[10], Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC-S105-[09], Standard Specification for Fire Door Frames.
- .10 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.

- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for plywood and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .3 Indicate materials, thicknesses, finishes and hardware.
- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
- .5 .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that construction wastes were recycled or salvaged.
- .2 Low-Emitting Materials:
 - .1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restrictions requirements.
 - .2 Submit listing of laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.3 QUALITY ASSURANCE

- .1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).
- .2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wood products from nicks, scratches, and blemishes].
 - .3 Replace defective or damaged materials with new.

- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 11 01.
- .5 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Softwood lumber: S4S, S-DRY graded and stamped in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWI/AWMAC/WI Architectural Woodwork Standards [custom] [premium] grade, moisture content as specified.
 - .4 Machine stress-rated lumber is acceptable.
 - .5 CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
- .2 Panel Material: Urea-formaldehyde free
 - .1 CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
 - .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .3 Poplar plywood (PP): to CSA O153, standard construction.
- .7 High pressure decorative laminate (HDPL): to AWI/AWMAC/WI AWS, Section 4, Grade Vertical, Type S standard, matt finish.
- .8 HDPL panel core: to AWI/AWMAC/WI AWS Section 4, 1.2.31 and 4.2c.
 - .1 Veneer core: CSP or PP.

2.2 ACCESSORIES

- .1 Nails and staples: to CSA B111; plain finish.
- .2 Wood screws: plain, type and size to suit application.
- .3 Splines: wood, plastic or metal.
- .4 Adhesive and Sealants: in accordance with Section 07 92 00.
 - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood products installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Do finish carpentry to AWI/AWMAC/WI Architectural Woodwork Standards.
- .2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .3 Form joints to conceal shrinkage.

3.3 CONSTRUCTION

- .1 Fastening:
 - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
 - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
 - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
 - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .4 HDPL Panelling:
 - .1 Secure panelling and perimeter trim using adhesive recommended for purpose by manufacturer.
 - .2 Secure panelling and perimeter trim using concealed fasteners.

3.6 INSTALLATION OF PANELLING

- .1 panel types:
 - .1 HDPL on plywood core.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by finish carpentry installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101-07, Standard Methods of for Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems.

1.2 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Continuity of Fire Separations: NBC 2010, Division B, Parts 3.1.8 and 3.1.9.1, 9.10.9):
 - .1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

- .3 Shop Drawings:
 - .1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00.
 - .1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
 - .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: person familiar with fire stopping installations.
 - .2 All fire stopping material shall be from one manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.
- .2 Storage and Protection:
 - .1 Store materials [indoors] [in dry location] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended.
 - .2 Fire stop system rating: F.
- .2 Service penetration assemblies: systems tested to CAN/ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 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.
- .10 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 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 without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .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 neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .4 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .5 Openings and sleeves installed for future use through fire separations.
 - .6 Around mechanical and electrical assemblies penetrating fire separations.

END OF SECTION

PART 1 - GENERAL

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C635/C635M - 13 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - .2 ASTM C636/C636M - 13 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S102-10, Standard Method for Test for Surface Burning Characteristics of Building Materials & Assemblies.

1.3 CERTIFICATES

- .1 Submit certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Egg Crate Ceiling System (for Passenger Elevators 1 - 4): natural colour aluminium, eggcrate ceiling 12 x 12 x 19 mm thick, supported on baked enamel hung type ceiling frame.
 - .1 Ceiling height to match existing, minimum 2300 mm above finish floor.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install in accordance with ASTM C636/C636M except where specified otherwise.
- .2 Co-ordinate suspension system with related components.
- .3 Install eggcrate ceiling in accordance with manufacturer's instructions.
- .4 Cut eggcrate to fit adjacent work. Terminate edges with moulding.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International.
 - .1 ASTM D2047-04, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - .2 ASTM D3389-10, Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform, Double-Head Abrader).
 - .3 ASTM E492-09, Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
 - .4 ASTM E 648: Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - .5 ASTM E662-09, Test Method of Specific Optical Density of Smoke Generated by Solid Materials.
 - ASTM F 710: Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - .6 ASTM E989-06(2012: Standard Classification for Determination of Impact Insulation Class
 - .7 ASTM F925-02(2008), Standard Test Method for Resistance to Chemicals of Resilient Flooring.
 - .8 ASTM F970-07, Standard Test Method for Static Load Limit.
 - .9 ASTM F1066-04(2010)e1, Standard Specification for Vinyl Composition Floor Tile.
 - .10 ASTM F1344-12e1: Standard Specification for Rubber Floor Tile
 - .12 ASTM F1514-03(2008), Standard Test Method for Measuring Heat Stability of Resilient Flooring by Color Change.
 - .13 ASTM F1515-03(2008): Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change
 - .14 ASTM F1859-12: Standard Specification for Rubber Sheet Floor Covering Without Backing
 - .39 ASTM G21-09: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 Underwriter Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
 - .8 Scientific Certification Systems (SCS)
 - .1 SCS-EC10.2-2007, Indoor Air Quality Performance.

1.3 WHMIS

- .1 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health Canada for primer, cement and adhesive. Indicate VOC content.
- .2 Submit WHMIS MSDS in accordance with Sections 01 33 00 and 01 78 00.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for resilient flooring for incorporation into operation and maintenance manual specified in Section 01 78 00.

1.5 SUBMITALS

- .1 Submit a list of 6 projects (with contact people and phone numbers) completed within the previous 12 months which use the same systems specified here in accordance with Sections 01 33 00 and 01 78 00.
- .2 Submit copy of flooring manufacturer's installation procedures in accordance with Sections 01 33 00 and 01 78 00.
- .3 Submit copy of installer's certificate of competence granted by the linoleum manufacturer in accordance with Sections 01 33 00 and 01 78 00.
- .4 Submit letter stating that the moisture content of concrete slab and the pH of the surface is within manufacturer's written guidelines for proposed flooring system.
- .5 Do not proceed with flooring installation if the concrete slab moisture content is over 3.0 lbs/1000 S.F for vinyl or 3.5 lbs/1000 S.F. for linoleum. Contact the manufacturer's representative and inform the Departmental Representative immediately.
- .6 Submit a cut diagram indicating seam locations and roll direction in accordance with Sections 01 33 00 and 01 78 00. Use mitred transitions when changing directions in layout unless approved otherwise.

1.6 SAMPLES

- .1 Submit samples in accordance with Sections 01 33 00 and 01 78 00.
- .2 Submit duplicate 300 x 300 mm sample pieces of sheet material.

1.7 MAINTENANCE MATERIALS

- .1 Provide two square metres of sheet rubber flooring for maintenance purposes.
- .2 Deliver to job site in roll form, clearly marked with information on contents and include address and date of installation.
- .3 Unload and store within building where directed by Departmental Representative.

1.8 ENVIRONMENTAL CHOICE PROGRAM

- .1 Provide adhesive products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-44-92 for Adhesives.
- .2 Submit one copy of the licensing criteria statements and the verification of compliance with Sections 3(a) and 3(b) of the ECP to the Departmental

Representative.

1.9 AIR QUALITY

- .1 Select materials and off gas flooring products off site in accordance with CSA B651, including Annex A Environmental Considerations, A.5 Indoor Air Quality and FloorScore certified to SCS-EC10.2-2007.
- .2 No detectable odour after installation from flooring, adhesive or accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Sheet rubber flooring: conforming to ASTM F1344, Class I, A or B, overall thickness 3.0 mm, width 1.5 m, weldable seams and as follows:
 - .1 Static Generation of Friction: to ASTM D 2047
 - .2 Abrasion Resistance (H-18 500 g @ 1000 cycles) to ASTM D 3389: pass
 - .3 Impact Insulation Class (IIC) to ASTM E492/E989: 36 (3 mm)
 - .4 Critical Radiant Flux CRF (W/cm²) to ASTM E 648: >0.45
 - .5 Smoke Density to ASTM E 662: ≤ 450
 - .6 Impact Sound Insulation (AIIC) to ASTM E 2179: 8dB (3mm)
 - .7 Chemical Resistance to ASTM F925: meets requirements.
 - .8 Static Load (modified at 758 N/sq.cm.) to ASTM F 970: ≤0.13 mm
 - .9 Heat Stability to ASTM F1514: ΔE ≤ 8.0
 - .10 Light Stability to ASTM F1515: ΔE ≤ 8.0
 - .11 Rubber Sheet Floor to ASTM 1859: Type 1
 - .12 Antimicrobial/Antifungal Resistance Test to ASTM G21: Pass (28 days)
- .2 Sheet rubber flooring adhesive: solvent free, water based acrylic, Ecologo certified.
- .3 Primer, cement, and [seam] adhesive: type recommended by flooring manufacturer to suit substrate and installation, Ecologo certified.
- .4 Resin welding rod: type recommended by flooring manufacturer.
- .5 Sub-floor filler: premixed latex modified cement mixed with water to produce cementitious paste.

PART 3 - EXECUTION

3.1 SUB-FLOOR TREATMENT

- .1 Remove ridges and bumps.
- .2 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:500, allow to cure.
- .3 Remove dust, old adhesive, paint, dirt, wax, sealer and foreign matter from existing surfaces.

3.2 PREPARATION AND INSTALLATION

- .1 Maintain room and material temperature at approximately 20°C for 3 days before laying, and minimum 2 days after laying.
- .2 Prepare floor and install flooring in accordance with flooring manufacturer's instructions.
- .3 Adhere sheet rubber under the entire field of each sheet with adhesive and around the perimeter and underseams with cement. Force cement up into seam, remove excessive adhesive prior to setting.
- .4 Roll surface with 45 kg roller.

3.3 CLEANING AND WAXING

- .1 Clean to manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 01 00 10 - General Instructions.
- .2 Section 01 33 00 - Submittals
- .3 Section 05 50 00 – Metal Fabrication
- .4 Section 06 20 00 – Finish Carpentry
- .5 Section 09 50 00 – Resilient Tile Flooring Section
- .6 26 50 00 - Lighting for machine room

1.2 Reference Standards

- .1 Perform work to the following minimum standards:
 - .1 ASME A17.1-2013/CSA-B44-13 Safety Code for Elevators and Escalators
 - .2 CSA C22. No.77 Motors with Inherent Overheating Protection.
 - .3 CSA C22.2 No. 141 Unit Equipment for Emergency Lighting.
 - .4 Technical Standards and Safety Act 2000, Ontario Regulation 209/01 and Ontario Regulation 223/01.
 - .5 CSA C22.1, Canadian Electrical Code, Section 38.
 - .6 2010 National Building Code.
 - .7 CSA B651-04 (R2010) Accessible Design for the Built Environment
 - .8 Canada Labour Code, Part 2, Occupational Safety and Health Regulations including Section 13.13.
 - .9 Occupational Health and Safety Act including Section 109 of Ontario Regulation 213/91.
 - .10 CSA B44.2-10 Maintenance requirements and intervals for elevators, dumbwaiters, escalators and moving walks.
 - .11 TSSA Code Adoption Document 261-13r1, Latest Amendment
- .2 Finished elevator installations are to have appropriate guards and be Occupational Health-and-Safety-regulation compliant with respect to physical and electrical hazards to persons in the elevator machine spaces. Guarding to comply with the following:
 - .1 TSSA document: Elevator Machine Room Equipment Guarding - Best Practices.
 - .2 Sections 24, 25, 75 and 76 of Ontario Regulation 851 under the Occupational Health and Safety Act.
 - .3 CSA Z432-04 Safeguarding of Machinery.
- .3 In case of discrepancy, the above standards take precedence over details elsewhere in this specification.

1.3 Power Supply

- .1 Motor and controllers: 600 Volts nominal, 3 Phase, 3 Wire, 60Hz.
- .2 Lighting supply: 120 volts, 1 phase, 60Hz.

1.4 Permits and Inspections

- .1 Complete Design Submission and related research necessary for regulatory approval of Work.

- .2 Obtain and pay for all necessary Municipal or Provincial inspections and permits and make such tests as are called for by the regulations of such authorities. Make tests in the presence of the authorized representatives of authorities. Testing may be conducted during silent hours. Include for all costs.
- .3 Apply and pay for Code variances necessary for Municipal or Provincial inspections and make such tests as are called for by the regulations of such authorities.
- .4 The Owner shall pay the cost of the elevating device's operating licence.

1.5 Taxes

- .1 Pay all taxes levied by law including Federal, Provincial and Municipal. HST to be invoiced as an identified extra.

1.6 Measurements

- .1 Before the execution of the work, verify all dimensions with actual site conditions.

1.7 Quality of Work

- .1 Perform Work by licensed mechanics skilled in the installation of elevators and escalators. Provide qualified and experienced supervision in the field of elevator modernization and installation.
- .2 Comply with all applicable provisions of all federal, provincial and local labour laws.

1.8 Shop Drawings and Product Data

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Before beginning work, prepare all drawings necessary to show the general arrangement of the elevator equipment and other data which is called for and is to be submitted for review. Provide these drawings within two (2) weeks after notification of award of contract.
- .3 Drawing review is for the sole purpose of ascertaining conformance with the general design concept and does not constitute approval of the design details inherent in the shop drawings, responsibility for which shall remain with the Contractor. Review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents.
- .4 Indicate on shop drawings:
 - .1 Size and location of machine, controller and drive;
 - .2 Size and location of car, hoisting beam, deflector sheaves, guide rails, buffers and other components in hoistway;
 - .3 Rail bracket spacing and maximum loads on guide rails;
 - .4 Reactions at points of support;
 - .5 Weights of principal components;
 - .6 Top and bottom clearance and overtravel of cars;

- .7 Location of circuit breaker, switchboard panel or disconnect switch, light switch and feeder extension points in machine room;
- .8 Include on general arrangement drawings:
 - .1 Type, size, location of hoistway entrances showing details of fastening to hoistway structure.
 - .2 Plan and section view of hoistway and machine room.
 - .3 Detailed drawing showing all fixtures, position indicators, push buttons, car operating stations, corridor control panels, and any other special fixtures pertaining to the project.
 - .4 Location of monitoring system and diagnostic equipment.
- .9 Location and size of access doors;
- .10 Loads on hoisting beam;
- .11 Heat generation of equipment in machine room;
- .12 Working platforms and access ladders in passenger elevator pits.
- .5 Provide product data for:
 - .1 Signal and operating fixtures, operating panels and indicators;
 - .2 Cab design and components;
 - .3 Door details.
 - .4 List of products to be used for conservation of wood and metals for approval.
- .7 Provide detailed drawings indicating materials, size, connection joints, method of anchorage, supports, reinforcements,
- .8 Shop drawings shall bear the stamp of professional engineer licensed to practice in the province of Ontario.

1.9 Project Record Documents

- .1 Submit project record documents in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Record actual locations of equipment, names of equipment manufacturers and suppliers, concealed conduit and boxes, concealed devices and disconnects

1.10 Operation and Maintenance Data

- .1 Provide three (3) copies and one pdf version, in English, of the Operation and Maintenance manuals. Include a copy of the registered Design Submission, TSSA inspection and test reports, MVP and any obtained variances in the manual.
- .2 Bind data in vinyl hard cover 3 D ring type loose leaf binders for 212 x 275 mm size paper. Binders must not exceed 75 mm thick or be more than 2/3 full.
- .3 Enclose title sheet labelled "Operation Data and Maintenance Manual", project name, date and list of contents. Show project name on binder face and spine.

- .4 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .5 Include the following maintenance data for each elevator:
 - .1 Description of elevator system's method of operation and control including, but not restricted to, motor control system, emergency power operation, door operation, Firefighter's Emergency Operation (Including reset) and special or non-standard features provided;
 - .2 Replacement parts list.
 - .3 Provide two (2) copies of Maintenance Control Program for each car, which will be applied to the equipment installed. One copy shall be placed in the machine room and one copy in the maintenance manual.
- .6 Provide legible schematic wiring diagrams covering all electrical equipment as supplied and installed, including all changes made in final work, with all symbols listed corresponding to identity or markings on both machine room and hoistway apparatus. Cover one (1) copy in plastic or glass, frame and mount in machine room. Include lubrication chart.
- .7 Include all wiring diagrams for all equipment on controllers.
- .8 List information on each piece of equipment including:
 - .1 approval drawing number
 - .2 model, part and serial number
- .9 Detail the following maintenance information:
 - .1 lubrication products and schedules
 - .2 trouble shooting procedures
 - .3 adjustment techniques
 - .4 operational checks
 - .5 maintenance of special finishes
 - .6 planned maintenance tasks and their frequencies.
- .10 List recommended spare parts to be maintained on site to ensure optimum efficiency. List all special tools and appropriate unique applications. Detail manufacturer and supplier names and addresses.

1.11 Record Drawings and Data

1. Before final acceptance of each elevator, provide two (2) sets of reproducible marked up wiring diagrams, including all apparatus on controllers, covering any specific devices and two copies of final layout. Laminate drawings or enclose in plastic protectors. Provide one soft copy of the above information in pdf or AutoCAD 2011 format
- .2 Mark up changes or additions to original wiring diagrams in red colour.
- .3 Submit drawings and data in accordance with specification in General Requirements.

1.12 Maintenance Service

- .1 Provide complete interim maintenance of the elevators during the construction period until date of Final Certificate of Completion as part of this contract. Immediately following the issuance of the final acceptance, the terms and condition of the PWGSC's Long term Contract (attached as Appendix A) will be invoked. The cost for a Ten Year Elevator Maintenance Agreement shall be included in the tender.
- .2 All inspections, tasks and tests as described in CSA Standard B44.2-10 shall be adhered to as a minimum. Compliance with Elevating Devices Code Adoption Document - Amendment 261/13 and the attached PWGSC Long Term Vertical Transportation Contract is mandatory.
- .3 Systematically clean, lubricate and adjust all of the equipment as required.
- .4 Repair or replace electrical and mechanical parts of any equipment as required, whether due to defect or normal wear and tear.
- .5 Use only genuine standard parts of manufacturer of equipment.
- .6 Perform work by competent, licensed personnel under supervision and in direct employ of the manufacturer, or manufacturer's licensed agent.
- .7 Schedule work during regular Elevator Trade working hours with Departmental Representative.
- .8 Maintain locally an adequate stock of parts for replacement or emergency purposes and have qualified staff available to ensure fulfilment of parts requirements in a timely fashion.
- .9 Maintain a standard type locked metal cabinet in the machine room, stocked with a supply of parts known to require frequent replacement, manufacturer-recommended lubricants, cleaning supplies and schematic wiring diagrams.
- .10 Include 24 hour call-back service required by equipment stoppage or malfunction at all times at no additional cost.
- .11 Complete and maintain the PWGSC supplied log book, record all callbacks and repairs, as work is carried out. Provide an "acknowledgement of inspection" form at each inspection.
- .12 Remove garbage at each weekly examination.

1.13 Layout

- .1 Design equipment to suit space as shown on drawings distributed at the time of project tender, including hoistway cross-sections, overhead dimensions, pit depths, machine room dimensions and machine room location.
- .2 In the event that design changes are proposed by the Contractor with respect to any of the above-noted dimensions, required either for convenience or by physical necessity, notify Departmental Representative in writing without delay.

1.14 Guarantee

- .1 Guarantee that the materials and workmanship of the apparatus installed under these specifications are first-class in every respect and make good any defects, not due to improper use or care, which may develop within one (1) year from the date of acceptance.

- .2 Provide an extended warranty of an additional two (2) years for finished surfaces visible to elevator passengers. Warranty coverage to include imperfections that may develop on painted and architectural steel surfaces, as well as shifting, delamination, bending or other imperfections of joints, panels and skins. Warranty does not cover damage by mis-use.
- .3 Commence warranty on work at date of certification of Final Completion, as certified by the Departmental Representative.

1.15 Elevator Performance

- .1 With equipment adjusted to the required parameters, operate elevator with smooth acceleration and provide a comfortable and agreeable ride to the passengers.
- .2 Meet required parameters in conjunction with dependable, consistent elevator operation and without undue wear or excessive maintenance over the life of the elevator installation.
- .3 Provide a flight time not to exceed 8.2 seconds - passenger elevators.
- .4 Set the car and hoistway doors to safely close in 2.5 seconds and open in 2.0 seconds – passenger elevators.
- .5 Provide adjustable dwell times and independent dwell settings for car and hall calls.
 - .1 Set the dwell times to 2.5 seconds for car, and 3.5 seconds for hall initially.
- .6 Maintain floor levelling accuracy of 5 mm or better.
- .7 Set door detector interrupt and nudging time to 20 seconds.
- .8 Limit cab noise levels to 60 dB when moving and 68 dB during a door operation cycle, as measured by a sound meter located in the centre of the cab and set on the "A" scale with an "F" response.
- .9 Limit horizontal vibrations in both the post-to-post and front-to-back axis to 25 milli-g in the 2 - 10 hz range.
- .10 Limit vertical vibrations to 20 milli-g.
- .11 Adjust typical acceleration rate to between 1.0 m/s² and 1.1 m/s².
- .12 Limit jerk rate (change in rate of acceleration) to 2.5 m/s³.
- .13 Provide car speed to within 5% of contract speed in both directions.

1.16 Markings

- .1 Provide all identifications and instructions in English or with international symbols.
- .2 Provide new identification numbers at the recall level and in each elevator.

PART 2 - PRODUCTS

2.1 Description of Existing Elevators

Passenger Elevators

Type:	Four (4) gearless traction elevators with overhead machine
Class:	Passenger
Designation:	1 - 4
Installation Number:	29179, 29180, 29181, 29182
Capacity:	1814 kg (4000 lbs)
Speed:	2.5 m/s (500 fpm)
Landings:	Cars 1, 2, 3, 4: Floors 1 - 11 Front openings for all landings
Door Opening:	Centre Parting, 1220 mm x 2134 mm high
Machine:	Dover/ Bull, Gearless, Frame #GTM14C Model # D405 41.7HP @ 174rpm
Roping:	6 x 1/2", 2:1
Hall Entrance Finish:	Retain existing entrances.
Type of Control:	Provide microprocessor-based
Type of Operation:	Group Supervisory

Freight Elevator

Type:	One (1) geared traction elevator with overhead machine location.
Class:	Freight Elevator
Designation:	5
Installation Number:	29177
Capacity:	1814 kg (4000 lbs)
Speed:	1.25 m/s (250 fpm)
Landings:	Floors P2, P1, 1 - 11 Front openings for all landings
Door Opening:	Two Speed Side Opening, 1220 mm x 2134 mm high

Machine: Dover, Geared #1 - overhead
VV DC motor, 25 hp, 1150 rpm
240 V FR# SMB326
MG, AO Smith Bull, 25 hp, 575v,
15 kw 240v @ 1770 rpm

Roping: 5 x 5/8", 1:1

Type of Control: Provide microprocessor-based

Type of Operation: Simplex selective collective

Provide for All

Special Features: Independent service operation;
F.E.O. - Phase I and Phase II Operation;
Elevator 5 to be dedicated firefighter's elevator
Emergency power operation;
Remote Video Monitoring and control system.

Signals: LED Illuminated buttons and signals;
Car position indicators;
Hall position indicators;
Car direction indicators – Freight elevator
Card reader provisions in cab
New car operating panels;
Appendix "E", ASME17.1/CSA-B44-10 Safety Code for Elevators

2.2 Components

- .1 Use major elevator components from standard product line of one manufacturer, unless noted otherwise.
- .2 Major components means controllers, solid state drives, operation and control systems.
- .3 All materials and equipment furnished shall be new and be installed in a neat, accurate, workmanlike manner. Furnish to the Departmental Representative samples as directed. Delivered material shall be in accordance with the approved samples.
- .4 Provide only systems designed and field tested for the application, with adequate capacity to meet all performance criteria and to provide long term, reliable operation.

2.3 Electrical Wiring Conduit and Fittings

- .1 Furnish and install new insulated wiring to connect all parts of the equipment including all wiring in hoistway, machine room, car top and car enclosure.
- .2 Provide new wiring from machine room disconnects to new controllers.
- .3 Where electrical metallic tubing is used use fittings with set screws. Provide a separately identified grounding conductor inside the raceway.
- .4 Include at least 10% spare conductors of each wire size in each cable.

- .5 Include at least one coaxial cable and six (6) pair shielded wires for audio, video or other electronic equipment. Install this shielded wiring from machine room to the Security control console (C.A.C.F.).
- .6 Do not parallel conductors to increase current carrying capacity unless individually fused.
- .7 Do not use armoured flexible metal conduit as grounding conductor.
- .8 Provide additional disconnect switches and wiring as required by Codes and Regulations, to suit machine room layout.
- .9 Include wiring, conduit and connections to elevator devices remote from hoistway and between elevator machine rooms.
- .10 Connect all wiring as required to fire alarm signals as provided.
- .11 Limit use of flexible conduit on car top, in machine room or any exposed area, only to items that require movement or periodic adjustment.
- .12 Provide insulated wiring having a flame retarding and moisture resisting outer cover. Run in metal conduit, metallic tubing or wire ducts comply with Table 6 of CEC Part 1.
- .13 Use threaded rigid galvanized conduit, electrical metallic tubing or other galvanized steel raceway.
- .14 When installing conduit or trough through floor, extend at least 100 mm above the floor. Completely enclose all floor openings.
- .15 Do not run conduit or wiring along the pit floor. Install all conduit and wiring at a minimum of 300 mm above pit floor.
- .16 Existing conduit or trough may be retained provided condition of conduit is acceptable.
- .17 Provide new ETT type travelling cables.
- .18 A labelled communication system junction box shall be provided on the outside of the controller and the wires shall be identified for the communication system. Provide uninterrupted shielded wiring from communication system in car to junction box located at controller in machine room.

2.4 Existing Electrical Services

- .1 Design equipment to operate using the existing 3 phase power supply.
- .2 The voltage supply may fluctuate plus or minus 10%.
- .3 The Elevator Contractor shall be responsible to provide shielding, grounding or bonding required to accommodate the new elevator equipment and connect to the building's true earth ground.
- .4 Any modifications carried out to the existing electrical system relating to the elevator work shall be carried out by a licensed electrician and be inspected by the Electrical Safety Authority at the completion of the work. A copy of the inspection permit and report must be provided to the Departmental Representative.
- .5 Connect output signals from fire alarm system to the elevator controller to initiate automatic emergency recall operation, recall by machine room smoke sensor and alternate floor recall.

- .6 The Elevator Contractor will be responsible for coordination of the testing and verification of the elevator recall operation with the existing fire alarm contractor to ensure proper operation. Testing may occur after hours. Include for all costs.

2.5 Finish

- .1 Paint machinery equipment with oil resistant machinery enamel.
- .2 Free structural parts of rust.
- .3 Provide protective coverings for finished surfaces.
- .4 Do not use manufacturing techniques such as spot welding which may cause visual imperfections or visual distortion of exposed surfaces.
- .5 Paint all equipment in the hoistway including car top and underside, rails, fascias, counterweight and pit equipment at completion of project. Paint all machine room equipment.

2.6 Roller Guides

- .1 Equip car and counterweight with new roller guides, individually spring loaded, mounted on top and bottom of car and counterweight frames. Provide minimum diameter as follows:
 - .1 Elevators 1 – 4: 254 mm for cars, 150 mm for counterweights.
 - .2 Elevator 5: 150 mm for car, 75 mm for counterweight.
- .2 Provide each guide with durable, oil resistant and resilient tired ball bearing rollers to run on three finished rail surfaces.
- .3 Do not lubricate guide rails. Maintain each roller on its respective guide in uniform contact with rail surface at all times by means of substantial adjustable springs or by resilient mountings.
- .4 Provide guide operation, which is inaudible to passengers in car or outside hoistway with car operating at rated speed and car fan off.
- .5 Use roller tire material which will not develop flat spots after standing idle for 72 hours under average environmental conditions.

2.7 Compensation

- .1 Retain and refurbish all compensating equipment in the pit including compensation cables. Verify operation of switches.
- .2 Properly adjust the tension of all compensating cables. Properly protect and guide the cables into the sheave to prevent any cable or sheave damage.
- .3 Lubricate compensating sheave guide rail to allow free movement of sheave.
- .4 Paint upon completion.

2.8 Buffers and Pit Equipment

- .1 Retain and refurbish existing buffers and pit steel under car and counterweight.
- .2 Drain oil, thoroughly clean, refill with new oil, test all buffers in the presence of the Departmental Representative and provide written proof of this test. Insert copy in the maintenance manual.
- .3 Mount any conduit approximately 305 mm above pit floor. Suitably support this conduit.
- .4 Install new data plates on all buffers. All data shall be permanently inscribed.
- .5 Provide a new pit stop switch for each elevator.

2.9 Hoisting Ropes and Governor Ropes

- .1 Provide hoist ropes with fibre core from same factory production run and governor rope, in accordance with good practice. Provide rope tags.
- .2 Provide springs on one end of hoist ropes.
- .3 Use approved type wedge clamp type sockets.
- .4 Secure the returned end of the wire ropes with two retaining clips. Set first clip approximately 50 mm (2") above top of wedge clamp, and second clip 100 mm (4") above first clip. Tape end of the wire rope. Provide anti-rotation devices on all rope fastenings.
- .5 Ensure that the wedge clamps are arranged in the hitch plate to minimize pull off when either the car or counterweight are at the top of the hoistway.
- .6 Provide new automatic hoist rope oilers.

2.10 Counterweight

- .1 Retain existing counterweight. Thoroughly clean off and examine counterweight sheave.
- .2 Provide steel retaining arrangement to prevent counterweight from leaving guide rails in the event roller guide assemblies leave their attachments. Retaining arrangement to be fastened to counterweight frame independent of primary guiding means.
- .3 Weigh the car, frame and accessories, rebalance counterweight, Rebalance counterweight to ensure counterweight is equal to complete elevator cab plus between 40% to 42.5% of the contract load. Record the car weight in the log book.
- .4 Statically balance the counterweight so that, at the centre of the hoistway, the counterweight hangs in the centre of the rails with top roller guides removed.
- .5 Provide maximum runby sign on pit wall in the vicinity of counterweight. Stencil to be used to provide a legible sign.

2.11 Safeties and Governor

- .1 Provide new governors complete with switches and idler sheaves.

- .2 Retain and refurbish existing safeties.
- .3 Lubricate all pivot points on safeties under car.
- .4 Test under car safeties at governor tripping speed at completion of project and display a certificate of test in machine room. Provide a copy in the maintenance manual.

2.12 Gearless Traction Machine – Elevators 1 - 4

- .1 Retain and refurbish existing gearless machines.
- .2 Check brushes in rotating electrical equipment for freeness and tension. Replace those brushes having 40% or less of their original length remaining.
- .3 Thoroughly blow out and examine existing machine. Re-varnish armature and field coils if there are signs of cracked insulation or indications of insulation breakdown.
- .4 Turn and undercut the commutators.
- .5 Thoroughly dismantle the existing brake. Replace the brake cores, brake coils and brake shoes. Rebush the brake bearing points. Provide new brake pins with grease fittings.
- .6 After brake spring has been adjusted for correct tension drill the brake spring nuts and rod and insert a cotter pin to minimize the possibility of future incorrect brake adjustment.
- .7 Replace all machine bearings.
- .8 Check rotating electrical equipment connections. Torque to recommend setting for type of connection means.
- .9 Provide a brake setting data plate to code requirements.
- .10 All hoist ropes must sit evenly in drive sheave. If new ropes do not sit evenly in grooves regroove or replace drive sheave.
- .11 Provide guards around cable holes on machine room floor.
- .12 Provide all new seals on machines to eliminate all leaks.
- .13 Obtain a letter from a certified and licenced company experienced in the repair and rewinding of elevator electric equipment stating that the motor has been checked and is equivalent to new condition.
- .14 Provide engineered approved component guarding on all hazardous points on all hoist machines and ancillary equipment in compliance with OHSA requirements.

2.13 Geared Machine – Elevator 5

- .1 Provide single-worm type, geared traction machine with all units mounted on a steel or cast iron bed plate. Provide all necessary machine beams, bearing/mounting plates and tie-down supports.

- .2 If geared machine must be dismantled to be conveyed to the machine room all moveable components must be dowelled before machine is dismantled. Ensure that the motor, brake and worm shaft are all aligned as part of the re-assembly. Use of a dial gauge is mandatory.
- .3 Provide single worm geared traction machine with motor, brake, gearing, and driving sheave mounted on or integral with cast iron or steel bedplate.
- .4 Use steel worm, integral with worm shaft with ball or roller bearing thrust unit to withstand worm thrust in both directions.
- .5 Design to permit removal of thrust unit without dismantling machine.
- .6 Hob gear from bronze rim and shrink fit or press and bolt to gear spider with fitted body bolts.
- .7 Include means for lubrication and provide oil tight inspection ports for worm gear face, gear contact and gear mounting bolts.
- .8 Design brake to be spring applied electromagnetically released and quietly operated by direct current. Clean and lubricate all brake pins.
- .9 Press and key brake drum securely onto worm shaft.
- .10 Provide a driving sheave with a pitch diameter no less than 40 times the diameter of hoist ropes.
- .11 Press and key sheave shaft into worm gear and traction sheave centre or fit integral traction sheave and worm gear centre to bearings on sheave shaft.
- .12 Provide gearing which operates without appreciable noise and which cause no noticeable vibration in car.
- .13 Prevent lateral displacement of machine.
- .14 Reduce all cable holes to a minimum. Provide guards around cable holes.
- .15 After brake spring has been adjusted for correct tension drill the brake spring nuts and rod and insert a cotter pin to minimize the possibility of future incorrect brake adjustment.
- .16 Provide a brake setting data plate to code requirements.
- .17 Provide new resilient pads to effectively isolate machine from machine beams or flooring. Use bridge bearing neoprene pads to manufacturer's recommendations for this duty. Do not use built-up pads.
- .18 Provide machine guarding as an integral part of the assembly and designed and installed by the equipment manufacturer in compliance with OHS requirements.

2.14 Hoist Motor – Elevator 5

- .1 Provide new high efficiency, low slip AC motor designed for elevator service and recommended by manufacturer of motor drive as follows:
- .2 Conform to NEMA Standards.
- .3 Impregnate windings with insulation and bake to prevent absorption of moisture and oil.

- .4 Provide not less than one megohm insulation resistance between motor windings and motor frame.
- .5 Do not use motor bearings as thrust for worm shaft.
- .6 Totally enclose in a non-ventilated cast-iron shell.
- .7 Provide a rotor of die cast aluminum.
- .8 Provide Class B insulation rated for 50 degree Celsius temperature rise, or better.
- .9 Include manually reset integral overheating protection to CSA C22.2 No. 77 of motors subjected to elevator service.

2.15 Ascending Car Overspeed and Unintended Car Movement Protection

- .1 Equip all elevators with a safety device to provide UP direction car overspeed protection and with protection against unintended movement outside of door zone.
- .2 Locate device in the elevator machine room or secondary level. Provide all hardware required to fasten safety device to machine room floor or machine bed plate including raising of machine bedplate if required. Use a fastenings and support design approved by a Professional Engineer authorized to practice in the Province of Ontario.
- .3 Use a device adjusted only to act on lift ropes. Double action brake is not an acceptable alternative.
- .4 Design safety device to be capable of setting repeatedly without damaging itself of the elevator machine or ropes.
- .5 Arrange device to be reset from a single button so-indicated in the controller.
- .6 Do not use devices which employ cylinders pressurized with air or other gasses to apply to ropes.

2.16 Sheaves and Supporting Beams

- .1 Thoroughly clean off and examine all existing sheaves and supporting beams.
- .2 Replace bearings in sheaves. Lubricate all bearings.
- .3 Provide any deflector sheaves and bearings and any beams necessary to obtain the proper lead of the ropes to car and counterweight.
- .4 Provide sheaves of cast iron, accurately machined and grooved for the diameter of ropes used and supported by steel beams or channels.
- .5 Provide all sheaves sufficiently larger than that required by Code, in pitch diameter and thickness, to permit at least one re-grooving of sheave.

2.17 Drive Control System – Elevators 1 - 4

- .1 Provide fully regenerative solid state motor drive to include the following:
 - .1 Convert 3 phase, 60 Hz AC to variable DC voltage for motor operation.

- .2 Use automatic closed loop control system.
- .3 Provide instant and noiseless response according to power required.
- .4 Include regenerative braking of motor during deceleration by feeding power generated by motor, back to AC power lines.
- .5 Conform to ASME17.1/CSA-B44 Safety Code for Elevators.
- .6 Design circuitry with redundant systems to fail safe.
- .7 Filter power supply to give essentially ripple free current.
- .8 Modify frequencies emanating from rectifier drive which are objectionable to personnel or interact with various parts of building.
- .9 Design solid state devices to handle 200% current to 30 s and 300% for 10 s.
- .10 Eliminate surges on the AC line which might cause blowing of the DC line fuses or which might cause trouble in other equipment connected to AC line. Filter DC if necessary.
- .11 Include disconnecting pole in DC motor armature circuit to prevent blowing fuses on loss of power while elevator is in any state of operation including regeneration.
- .12 Design tac motor to suit control system.
- .13 Automatically re-start equipment which has stopped due to AC power failure.
- .14 Withstand damage to system and avoid malfunction due to any variation of power supply.
- .15 Cause no adverse effects on power supply, or other equipment connected to power supply, under operating conditions.
- .16 Provide electronic feed back circuits to limit the current through the motor and solid state power devices.
- .17 Include a means for dissipating the heat generated by the solid state power devices.
- .18 Include a means to shut down the unit in the event overheating occurs.
- .19 Include governor switch set to trip at no more than 90% of governor tripping speed; activated by overspeed in both directions.
- .20 The elevator equipment shall not produce voltage distortion or notches in excess of the limits suggested in IEEE 519. Manufacturer to also limit EMI through the use of shielding, efficient power conductor run and filters.

2.18 VVVF Motor Drive – Elevator 5

- .1 Provide Variable Voltage Variable Frequency AC flux vector, fully regenerative, drive system. Design equipment to operate unaffected under minor levels of voltage fluctuations and harmonics generated from within and outside the building.
- .2 Make drive system capable of producing full torque at zero speed and shall utilize a shaft mounted position transducer to accurately monitor the rotating frequency.

- .3 Take power for system from proposed building 3 phase power supply.
- .4 Change AC voltage to DC, and a power transistor inverter circuit will change the DC voltage to AC to power the elevator motor.
- .5 Control motor speed and torque by varying the frequency and amplitude of AC voltage.
- .6 Eliminate surges on the AC line which might cause blowing of the DC line fuses or which might cause trouble in other equipment connected to AC line. Filter DC if necessary.
- .7 Modify frequencies emanating from rectifier drive which are objectionable to personnel or which interact with any building equipment.
- .8 Produce no voltage distortion or notches in excess of the limits suggested in IEEE 519. Limit EMI through the use of shielding, efficient power conductor run and filters. Electrical measurements to be taken at the elevator machine room mainline disconnect switches
- .9 Provide stepless acceleration and deceleration and smooth operation at all speeds.
- .10 Include regenerative braking of motor during deceleration by feeding power generated by motor, back to ac power lines. Failure of the drive's system to remove regenerated power shall cause the drive's output to be removed from the hoist motor.
- .11 Provide closed loop tachometer feedback control. Continuously monitor the elevator speed signal from the velocity transducer and compare it with the intended signal to verify proper and safe operation of the elevator and to correct the actual elevator speed to match the intended speed.
- .12 Automatically re-start equipment which has stopped due to ac power failure.
- .13 Limit Voltage Total Harmonic Distortion to 2%, and limit any individual harmonics to 0.5%.
- .14 Limit Current Total Harmonic Distortion to 5%, and limit any individual harmonics to 3%.

2.19 Machine Room Noise Level

- .1 Design and install the equipment so that the increase in noise level in the machine room with the elevator running, as measured by a sound meter located in the centre of the machine room does not exceed 30 dB.
- .2 Measure this noise level using a sound level meter on the "A" scale with a "S" response.

2.20 Controller and Cabinet

- .1 Remove and dispose of existing controller cabinets. Provide new enclosed sheet metal cabinets with adequate ventilation and hinged doors, designed for floor mounting. Provide new non-proprietary, solid-state controller equipped with microprocessor controls and self-diagnostic features. Provide design specific to elevator drive applications. Versions of all control equipment shall include:
 - .1 All required diagnostic are "on board".
 - .2 All programming and diagrams required for long-term maintenance are provided with the controller.

- .3 The controller will not shut down or alter its functionality in any way after a pre-determined increment of time or use.
- .4 Any elevator contractor shall be allowed to purchase parts, supplies, diagrams, support or training directly from the factory at the same cost level as the original installer. A published price list shall be supplied with the controller.
- .5 Parts including circuit boards shall be available for direct purchase from the factory in numbers and not on an one-for-one exchange only basis.
- .2 Enclose the controller in enamelled, ventilated, sheet steel cabinet, with swing-type doors at front.
- .3 Provide relays and contactors particularly designed for elevator duty.
- .4 Provide a suitable communication system junction box on the outside of the controller and identify it accordingly. Provide a separate identified box for the fire alarm connection and emergency power signal.
- .5 Cord all field wiring and insulate from metal contact.
- .6 Permanently identify all switches and relays.
- .7 Provide protection against reverse and open phasing of main feeders.
- .8 Include properly sized primary and secondary fuses for each transformer used in the controller.
- .9 Mount all controller components, including resistors, inside the cabinets. Do not mount components on controller doors or removable panels.
- .10 Govern motion of cars by means analysing real position of car in hoistway. Position device shall be positively connected to the car by mechanical or electrical means. Travelling to a terminal landing for recycling is not acceptable. Stepper relays are not acceptable.
- .11 Do not employ components or controller logic which will disable or otherwise alter the operation of the elevator after a pre-determined number of starts, door cycles, etc.
- .12 Use microprocessors for all logic related functions such as dispatcher, car controller and motion control. Provide crystal regulated frequencies. Provide a dispatching program in ROM, with at least 40% spare capacity. Power each processor from a separate power supply. Isolate the inputs and outputs by optical devices or relays.
- .13 Use easily removable printed circuit boards for all solid state devices other than high power SCR's and rectifiers. Use gold plated edge connectors. Protect circuits from oxidation. Make all wiring connections through properly dimensioned pads.
- .14 Design solid state circuits to operate in the anticipated environment. Provide means to restart the elevator system efficiently in the event of power interruption. Incorporate noise suppression devices in power supplies, inputs and outputs.
- .15 To facilitate testing and troubleshooting, arrange control circuits to ground one side of the control power supply used for external circuits. (External circuits are those outside of microprocessors or solid state devices, such as relays, lights, limits, locks and buttons.) Arrange the design so that safety circuits are not compromised by accidental grounding of control circuits.

- .16 Install wiring runs neatly. Terminate wiring at studs or terminal strips, using connections that assure substantial electrical and mechanical integrity. Identify all major components exactly as they are indicated on schematic and wiring diagrams. Use engraved lamicaid or metal tag mounted immediately adjacent to the component.
- .17 Provide battery back-up for all circuits containing volatile memory to retain all information for at least 48 hours without regular power.
- .18 Provide insulated wiring having a flame retarding and moisture resisting outer cover. Run wiring in metal conduit or tubing or wire ducts.
- .19 When using conduits or troughs through floor, extend conduit or trough at least 100 mm (4") above floor.
- .20 Do not run conduit or wiring along the pit floor. Install all conduit and wiring a minimum of 300 mm (12") above pit floor.
- .21 Use type ETT travelling cables. Suitably suspend the travelling cables to relieve strain in the individual conductors.
- .22 Include at least eight (8) spare twisted pairs of shielded wires and one coaxial cable for audio, video or other electronic equipment, such as a card reader system - minimum 20 gauge and RG6/U respectively.
- .23 Include at least 10% spare conductors in each cable. Tape and legibly identify all spare wires at the controller.
- .24 Provide hand held diagnostic tools used to make any and all adjustments to the elevator controller and all other devices. This tool shall be the property of the Departmental Representative and remain on-site at all times. Locate one in each machine room.

2.21 Terminal Stopping Devices

- .1 Provide an automatic stopping device, arranged to bring car to a stop at the terminal landings independent of the regular operating device in the car.
- .2 Existing limit switches can be retained and refurbished. Limit switches to be operated by the car and arranged to stop the car and prevent normal operation, should it travel beyond the zone of the normal stopping device.
- .3 Provide new interconnecting wiring to limit switches. Dowel final limits to main rails.

2.22 Car Frame

- .1 Retain existing car frame. Thoroughly examine frame for any cracks, bends or broken welds. Ensure finish is smooth and good to receive finish.
- .2 Provide reinforcement where required to relieve car enclosure of undue stress.

2.23 Car Platform

- .1 Retain the existing platform.

- .2 Retain existing car sills.
- .3 Ensure clearance between the car and all hall sills is within code requirements. Make all necessary adjustments.
- .4 Replace all isolation rubber pads between car frame and platform

2.24 Car Enclosure

- .1 Prior to the start and at the completion of the alteration, weight each car and counterweight separately in accordance with Clause 3.4 of the specifications
- .2 Retain and refurbish car cab enclosures as indicated on drawings. Refurbishment of car cabs shall also include but not be limited to the following:
 - .1 Secure all new wall finishes with hidden fastenings. Design for removal of finishes from inside car.
 - .2 Use bolts fitted with washers and lockwashers and fabric separators, if necessary, to assemble and guarantee entire structure to operate entirely free from squeaks and metallic sounds.

Elevators 1 - 4

- .1 Retain and refurbish passenger car cab enclosure as follows:
 - .1 Retain existing mirrors on all walls. Remove all existing decorative cab enclosure wall finishes from below the handrails. Install new fire rated laminate below the handrails as determined by Architect on all non-accessible sides of car cab. Surface mount laminate.
 - .2 Finish cab ceiling with two coats of enamel with final coat brought to semi-gloss finish to match existing. Emergency exit to be of same finish.
 - .3 Re-skin headers and return panel in stainless steel. Polish stainless steel door posts.
 - .4 Use bolts fitted with washers and lockwashers and fabric separators, if necessary, to assemble and guarantee entire structure to operate entirely free from squeaks and metallic sounds.
 - .5 Provide pad hooks in each car and a complete set of protective pads. Coordinate location of pad hooks with Engineer.
 - .6 Provide a stainless steel licence frame and cover in the machine room.
 - .7 Supply and install new ceramic/porcelain tile. Colour and pattern to be chosen by Departmental Representative. Adjust car sill height to accommodate the new flooring material.
 - .8 Provide a six fixture down light ceiling system. Provide MR16 fixtures with LED lamps (5W/60 deg/warm white) c/w satin aluminum trim ring and directional gimbal. Finish the suspended ceiling panels in #4 stainless steel. Design for light intensity measured at car sill of 100 Lx minimum. Totally enclose and conceal all wiring from view within the car and finish ceiling cavity white. Refer to Architectural Drawings.

- .9 Noise level developed with the elevator running from one extreme of the hoistway to the other with the fan off shall not exceed 50 dBA .
- .10 Provide new car doors, Stainless Steel #4 Brush finish to match existing.
- .11 Install new 250 mm #4 Brush Finish handrails on all non-accessible sides. Set at maximum height of 918 mm above floor with 38 mm clearance between wall and handrail.
- .12 Ventilate by a new exhaust air handling unit through roof. Mount new air handling unit on top of car and effectively sound isolate system from car to prevent transmission of vibration to car structure. Include two speed operation.

Elevator 5

- .1 Retain and refurbish freight car cab enclosure as follows:
 - .1 Finishes to Architects Design Drawings. Flame spread ratings shall meet Code requirements for a dedicated firefighter's elevator.
 - .2 Secure all new wall finishes with hidden fastenings. Design for removal of finishes from inside car.
 - .3 Ventilate by a new exhaust air handling unit through roof. Mount new air handling unit on top of car and effectively sound isolate system from car to prevent transmission of vibration to car structure. Include two speed operation of ventilation system.
 - .4 Provide two new two lamp fluorescent light fixture with substantial lamp guard flush with under side of top. Include high efficiency fluorescent light fixtures using electronic ballasts and T8 lamps. Design for light intensity measured at the sill level of 100 Lx. Totally enclose and conceal wiring and ballasts from view within the car.
 - .5 Use bolts fitted with washers and lockwashers and fabric separators, if necessary, to assemble and guarantee entire structure to operate entirely free from squeaks and metallic sounds.
 - .6 Provide pad hooks and a complete set of protective pads.
 - .7 Provide a stainless steel licence frame and cover in the machine room.
 - .8 Provide new aluminum checkerplate flooring.
 - .9 Cover headers and return panels with rigidized stainless steel. Provide a new stainless steel base.
 - .10 Noise level developed with the elevator running from one extreme of the hoistway to the other with the fan off shall not exceed 50 dBA.
 - .11 Provide new car doors finished in rigidized stainless steel. Wrap stainless steel around the door. Do not use binder angles.
 - .12 Finish cab ceiling with two coats of white enamel with final coat brought to semi-gloss finish. Emergency exit to be of same finish.

- .13 Provide new 6mm x 250 mm stainless steel handrails/bumper rails on all sides arranged to relieve walls from impact forces. Rigidly support bumper rails and mount one set at 304 mm from cab floor and the second set at approximately 920 mm to centre of rail.
- .14 Provide a type-of-freight loading sign, indicating Class of loading.
- .15 Engrave on car station "Elevator Licence Located In Machine room"

2.25 Two-Way Communication

- .1 In addition to the auto-dialler unit supplied in each cab, provide the following Firefighters Communication System for all elevators:
 - .1 Provide two-way communication for firefighters between each elevator and the security Centre (central alarm and control facility). Ensure that cross-talk and interference are minimized. If machine room inspection operation is provided, provide two-way communication between machine rooms and the interior of each car.
 - .2 The master station in each machine room shall be restricted to the elevators within its own group and to the main console at the Central Alarm and Control Facility.
 - .3 Supply and install all necessary conduit and shielded wiring between each car, hoistway and security centre to provide a complete and operational intercommunication system.

2.26 Car Doors

- .1 Provide new car doors on Elevators 1 - 4.
 - .1 Provide two (2) new lower guides on each car door panel.
 - .2 Provide new car door hangers, track, rollers and upthrust eccentrics. Provide all new air cords and steel hanger rollers with nylon inserts.
 - .3 Adjust car doors for smooth and quiet operation.
- .2 Provide new car doors on Elevator 5.
 - .1 Provide two (2) new lower guides on each car door panel.
 - .2 Provide new car door hangers, track, rollers and upthrust eccentrics. Provide all new air cords and steel hanger rollers with nylon inserts.
 - .3 Adjust car doors for smooth and quiet operation.

2.27 Independent Service

- .1 Include independent service by means of key-operated switch in car service panel to allow removal of a car from automatic service and to operate independently in response to car calls only and as follows:
 - .1 Render the hall lanterns inoperative.

- .2 Cause the car to park with the doors open. Arrange the controls so that the car responds to any car calls registered if a button is held until the doors are closed and the interlocks made-up.
- .3 Cause the doors to reopen if the button is released at any time up to the point at which the elevator starts to move. Render inoperative the normal door protective devices.
- .4 Cancel all registered car calls when the direction reverses or a car arrives.

2.28 Access to Pit, Hoistway and Top of Car Inspection

- .1 Provide lunar key access to each hall door.
- .2 At the top landing, provide keyed-access to car top.
- .3 Provide between car crosshead and hoistway door, a single operating fixture containing the following: an emergency stop switch, continuous pressure buttons for operating the car and a switch for making the buttons on top of the car operable. Operation from top of the car shall be obtained by simultaneous, continuous pressure of the appropriate direction button and a safety operating button after these buttons have been made effective.
- .4 Operation from top of the car shall not be possible unless all electric door contacts are closed.
- .5 Means shall also be provided so that when the car is to be operated from the top of the car, automatic levelling, power door operation and the normal operating devices car and landing are made ineffective.
- .6 Arrange circuits to prevent car moving away, when on top of car operation, by any other means.
- .7 The speed of the elevator shall be not more than .76 m/s and not less than 0.25 m/s while on top of car inspection operation.

2.29 Car Top Work Area

- .1 Provide a 110 volt duplex (GFI) receptacle on top of car.
- .2 Provide two (2) protected light fixtures on car top. One light to be a moveable unit to be used as a hand-held light. Guard both with metal cages.
- .3 Provide an outline of the top of car refuge area.

2.30 Emergency Lighting

- .1 Provide a new emergency lighting system in each car as follows:
 - .1 Use dry cell type battery operated emergency lighting equipment, to CSA C22.2 No. 141, to provide general illumination in car and 10 Lx minimum illumination at operating panels measured at any point 1225 mm and 890 mm above the car floor and approximately 300 mm in front of a car operating panel for 4 hour minimum.
 - .2 Include in the car operating station a key switch for convenient manual operation and testing of each unit from within car. The key switch used must be spring return type.
 - .3 Arrange battery unit as a source of power for alarm bell during power failure.

- .4 Emergency light unit is to be an integral part of each car station.

2.31 Car and Hoistway Door Operator

- .1 Provide a heavy-duty, high-speed door operator to open and close the car and hoistway doors quietly and smoothly. Provide solid-state feedback for closed loop control.
- .2 Operate the car door and hoistway doors simultaneously.
- .3 Provide electrical cushioning at each end of travel.
- .4 Provide a new gate switch operated by a roller attached to each door panel (two per door on center parting doors).

2.32 Car Door Protective Devices

- .1 Provide a three-dimensional solid state, electronically operated door reversal device on the leading edge of the car door panel. Fully enclose in an insulated chassis. Arrange the device to:
 - .1 Provide silent, long-term reliable operation.
 - .2 Include no moving parts;
 - .3 Have all components installed behind the door jamb, so as to provide a clear opening and present a clean architectural appearance.
 - .4 Provide a means of disconnecting the 3D operation without accessing the top of the car.
- .2 Design the device to provide a zone of detection a minimum of 75 mm in advance of the leading edge of each car door and arrange the operation as follows:
 - .1 Trigger the protection system when any object is located in the entrance and cause the door to reopen without engaging the object;
 - .2 Permit the protection system to be active over the full travel of the doors.

2.33 Entrances

- .1 Retain, clean and refurbish existing metal entrances including but not limited to; doors, frames, sill, jamb and controls,
- .2 Adjust all hoistway doors for smooth and quiet operation and to fully clear the elevator entrance when fully opened.
- .3 Provide new stainless steel on mat black jamb plates on hoistway door frames in accordance with barrier-free requirements.
- .4 Replace all worn astragals.

2.34 Struts

- .1 Thoroughly examine all headers and strut angles in hoistway for proper fastening to building structure.
- .2 Securely fasten any loose headers or struts.

2.35 Hoistway Door Hangers, Tracks and Closing Devices

- .1 Retain and refurbish the existing hangars and tracks.
- .2 Replace the existing electric interlocks and pick-up roller assemblies for each hoistway door. Provide all new wiring including a separate green ground wire from door locks back to the controller.
- .3 Dowel all hoistway door pick-up roller assemblies after final adjustments have been made.
- .4 Replace all door rollers as follows:
 - .1 Use ball or roller bearings sealed to retain grease lubrication and wipers to maintain rollers and track in clean condition.
 - .2 Provide hanger rollers of steel with resilient inserts, no less than 82 mm in diameter. Provide sealed, self-lubricating ball bearings.
 - .3 Provide new upthrust eccentrics.
- .5 Provide new sill mounted spring type closing devices or heavy duty spirators (one per door panel)
- .6 Remove and dispose of all redundant hoistway door relating cables, spirators and/or other closing devices.

2.36 Identification

- .1 Provide 100 mm (4") numerals corresponding to floor level on hoistway side to fascia plates and locate numerals as required by Code. Use a stencil.
- .2 Provide all engraving on faceplates as required.
- .3 Provide six (6) keys of each type used with key rings and engraved gravoply discs, identifying use of key.

2.37 Hall Lanterns – Elevators 1 - 4

- .1 Retain and refurbish existing hall lanterns at each floor. Illuminate lantern suitably to indicate direction of car travel to waiting passengers.
- .2 Remove existing light bulbs from all hall lanterns and replace with a suitable LED retrofit package. LED's to be rated for 100,000 hours illumination
- .3 Remove existing gongs from lanterns and replace with adjustable electronic chimes. Signal volume to be adjustable between 60 and 90 dBA.
- .4 When car has reached pre-determined distance from floor, and is going to stop at that floor, illuminate corresponding lantern and sound gong in advance of stop. Maintain lantern illumination until car has left the landing.
- .5 Sound gong or chime with the illumination of lanterns, one gong for up and two for down. Time gong so as to be heard by passengers waiting in the hall.

2.38 Car Riding Lanterns – Elevator 5

- .1 Provide a new car-riding lanterns in each door post. Illuminate lantern suitably to indicate direction of car travel to waiting passengers.
- .2 Provide illuminated fixture not less than 70 mm in the smaller dimension.
- .3 Sound gong or chime with the illumination of lanterns, one gong for up and two for down. Time gong so as to be heard by passengers waiting in the hall.

2.39 Hall Button Fixtures

- .1 Provide two (2) risers of LED illuminated push buttons for gearless passenger elevators and one riser for Elevator 5. LED's to be rated for 100,000 hours illumination.
- .2 Provide #4 Stainless Steel faceplate designed to match existing profile for Elevators 1 – 4. Provide stainless steel brushed finish for Elevator 5.
- .3 Install in existing locations extended to barrier free height.
- .4 Provide flush mounted illuminated type push button. Illuminate buttons when pressed to indicate a call has been registered and retain illumination until the call has been answered.
- .5 Provide at main recall station, "Communication Failure Device" with visual/ audible warning and reset switch.
- .5 Provide at recall level, for each group, a flush-mounted station containing a recall switch with pilot light. Provide three (3) position switch; RESET -OFF - ON at the recall level of each group.
- .6 Provide a two position, key operated hall station at the ground floor of Elevator 5 to provide restricted access to this elevator. Include a keyed reset switch.
- .7 Provide at recall level near elevator hoistway a box conspicuously located and identified containing the emergency recall service keys.

2.40 Position Indicators and Voice Annunciation

- .1 Provide new car position indicators in each car and at the main floor for elevators 1 - 4. Provide new LED illumination. LED's to be rated for 100,000 hours illumination.
- .2 Elevator 5 - Provide a new LED type illuminated digital hall position indicator and a digital car position indicator in car operating station. LED's to be rated for 100,000 hours illumination.
- .3 Provide segmented indicator format for all numerals and characters with a height of 50.
- .4 A range indications to illuminate sequentially and to transfer illumination instantaneously between floor levels.
- .5 Provide bi-lingual voice annunciation indication of each floor, when served and of car direction. Provide volume control adjustable from behind car station. Provide high-power speakers, minimum of two (2) per car so no distortion is readily noticeable to passengers. Provide sample of annunciations, to be in English and French languages (English first), with shop drawings.

2.41 Car Operating Station

- .1 Provide two (2) operating stations in each of Elevators 1 - 4 and one (1) car operating station in Elevator 5. Provide #4 stainless steel faceplate design for passenger elevators and freight elevator. No manufacturer's logos permitted. Car station profile for Elevators 1 – 4 to match existing.
- .2 Provide one (1) service cabinet per car located in the main station. In cabinet provide key-operated switches for lighting, emergency light test, fan, independent service and out of service. Provide one spare key switch. Provide a 110 volt, 15 amp duplex receptacle. Provide a lockable flush-mounted door.
- .3 Engrave all wording required on car station - do not use surface mounted plates. Engrave all characters in cover 0.30 mm deep and filled with enamel.
- .4 Use LED-illuminated brass/bronze floor buttons, one for each floor served for the passenger elevators and LED illuminate stainless steel buttons for the freight elevator. Provide flush mounted tactile identification at side of each button. Include momentary audible signal to indicate call has been registered.
- .5 Provide a key operated stop switch, an alarm button, door open and close buttons.
- .6 Provide a separate lockable "Firefighter's Operation" cabinet located at the top of the car operating panel (no higher than 1800 mm from finished cab floor) housing the Fire Operation key switch, Call Cancel button, STOP switch, DOOR OPEN and DOOR CLOSE buttons, additional indicator light and operating instructions.
- .7 Engrave identification in upper or lower case, Helvetica medium, at least 9 mm, filled with red or black enamel, as required.
- .8 Engrave the car number, government installation number and maximum capacity in kilograms and lbs. and number of persons on each car station. Also engrave "Licence Located In Machine Room"
- .9 Use international symbols wherever possible. All engraving to be bilingual, English followed by French. Submit engraving for approval.
- .10 Provide a speaker and grille with assistance button identified on the car operating panel. Include autodialler and all wiring required to be connected to the Owner's telephone line. Install a metal guard behind the speaker to eliminate interference from car operating panel controls.
 - .1 Provide an international telephone symbol to identify the assistance button with engraved bilingual signage "HELP".
 - .2 Provide two LED visual indicators on the car operating faceplate. One RED to flash as the auto-dialler dials and one GREEN to illuminate when the call has been connected. Engrave beside the RED signal "Call in Progress" and beside the GREEN "Alarm Received". Locate button 1220 mm from finished cab floor.
 - .3 The hands free emergency communications device shall contain an internal speaker and microphone to enable two-way communication with elevator passengers.

- .4 The device shall be activated by pressing the assistance button located on the car operating station faceplate and shall automatically dial a telephone number of the Owner's choice.
- .5 The device shall contain a ring sensor which shall allow the initiation of a call to the elevator.
- .6 Emergency in-car communication system shall have the capability of receiving calls from the CACF and having the in-car telephone forwarded as required.
- .7 Provide a desk mounted, master station at the security control desk.
- .11 Include uninterrupted telephone wiring within elevator hoistway, from car cab to a box located on the outside of controller.

2.42 Terminal Stopping Devices

- .1 Provide an automatic stopping device, arranged to bring cars to a stop at the terminal landings independent of the regular operating device in the car.
- .2 Final limit switches to be provided in the hoistway, operated by the car and arranged to stop the cars and prevent normal operation, should it travel beyond the zone of the normal stopping device.
- .3 Dowel final limits to main rails.

2.43 Barrier-Free Design

- .1 Meet all requirements of Appendix "E" of the ASME A17.1-2013/CSA-B44-13 Safety Code for Elevators and Escalators.

2.44 Signal Illumination

- .1 Illuminate signal fixtures with intensity which produces distinct and well defined indications.

2.45 Fixture Fastening

- .1 Fasten all fixture faceplates, including car-operating station, with tamper-proof screws unless noted otherwise.

2.46 Emergency Power Operation

- .1 The emergency power system shall be arranged by the Departmental Representative so that:
 - .1 The emergency power source is capable of providing sufficient power to run two elevators simultaneously at contract speed and capacity (Car 5 and one of cars 1 – 4).
 - .2 The emergency power will be provided on the same lines and the same disconnect as the normal power.
 - .3 Two pairs of signal wires will be run to the elevator controller.

- .4 One pair of wires will be shorted together giving a closed circuit to indicate that the elevator will be supplied by normal power.
 - .5 The same pair of signal wires will give an open circuit to indicate that the elevator will be supplied by emergency power.
 - .6 The second pair will provide an advanced warning signal that is closed for normal power and opens 20 seconds prior to transfer from emergency to normal power or from normal power to emergency power during an emergency power test.
- .2 Arrange elevator circuits, wiring and controls so that:
- .1 A signal light marked "ELEVATOR EMERGENCY POWER" is illuminated in the main lobby station of each group.
 - .2 The car shall remain operational on emergency power.
 - .3 Elevator control equipment and motor drive are not damaged on transfer to and from emergency power.
- .3 Provide a new #4 Stainless Steel panel, mounted in the existing location, housing one selector switch as follows:
- 1. One five (5) position selector switch marked; AUTO - 1, 2, 3, 4
 - 2. Elevator 5 and 1 shall remain operational.

2.47 Security System Provisions

- .1 Provide a security system interface to provide restrictive operation to the car calls of the elevator with a proximity card reader system. Security system will be supplied and installed by others. In general, security programming to be used on all elevators to restrict car calls after hours.
- .2 Provide as a minimum the following for each car:
 - .1 Six (6) pairs of twisted-shielded cables, #18 AWG.
 - .2 Two (2) RG6 Coax, aluminum wrapped (100% coverage) braided with tinted copper (60% coverage).
 - .3 One (1) 3 pr #18 AWG overall shield (reader cable)
- .3 Terminate cables in machine room within a junction box or terminal strip mounted on the exterior of each controller, clearly designating these cables as for security system use. Secure other end of cables behind each car operating station.
- .4 Extend each call button from the elevator controller of each elevator to a demarcation point/terminal strip inside the junction box
- .5 The junction box for each car shall be a minimum size of 300 mm x 300 mm and will be a termination point for security cabling leading from the cab. Where multiple elevators exist, the termination/demarcation point can be combined in a single box of larger size.
- .6 Provide a minimum 100 mm high x 140 mm wide cut on each car operating panel (one reader per car). Provide a 40 mm deep space behind cut-out and provide translucent, Lexan cover, flush mounted in cut-out opening.

- .7 Isolate all car and hall call circuits to prevent electrical feedback through any inter-connections with proximity card reader controls.
- .8 Run wiring between the elevator machine room and car operating panel without splices, breaks, or joint connections.
- .9 Include for coordinating the installation of the proximity card reader devices as well as coordinating the interfacing and connection requirements to ensure a workable security system.
- .10 Provide ability to restrict calls to specific floors.
- .11 Provide security override for Emergency Service operation.
- .12 Provide keyed manual over-ride of security system, in case of system malfunction. Locate key switches as indicated at time of shop drawing review.
- .13 Provide space and allowances in the rear of the car cab (near or at the ceiling level) acceptable for a camera to be installed. Cameras shall be located opposite the entrance at ceiling height in the centre of the back cab wall. Provision can also be made for mounting a corner camera in the corner that provides the closest distance to the door that is opposite the entrance. Note that for an Elevator Cab with two doors, two camera locations will be required to gain a shot of each door opening.

2.48 FEO - Phase I Emergency Recall Operation

- .1 Provide emergency recall service which will be initiated automatically and manually by the recall switch. When recall has been initiated:
 - .1 The elevator controlled by the recall switch and on automatic operation, including independent service operation, shall return directly to the recall level where the doors shall open and remain open. The elevator shall not respond to the landing or car call buttons. Travelling to a terminal landing first and then reversing to travel to the recall level is not acceptable.
 - .2 The elevator that is stopped with the doors closed, or is travelling towards the recall level, shall proceed non-stop to the recall level.
 - .3 The elevator travelling away from the recall level shall reverse at or before the next available landing without opening its doors.
 - .4 A car stopped at a landing shall have its emergency stop switch rendered inoperative as soon as the doors are closed and the car starts to move. A moving car shall have its emergency stop switch rendered inoperative.
 - .5 All call registered lights and directional lanterns shall be extinguished and remain inoperative. Position indicators, in the car and at the recall level, should remain in service.
 - .6 The car shall be provided with a visual and audible signal system which shall be activated to alert passengers that the car is on the emergency recall operation and at least the visual signal shall remain operative until the car reaches the recall level.

- .7 An elevator stopped at a floor other than the recall level with doors open shall close its doors and proceed non-stop to the recall level.
- .8 Door re-opening devices that may be affected by smoke or hot gases shall be rendered inoperative.
- .9 If the elevator is on inspection operation, a signal shall warn the inspector to return the car to the recall level. The elevator shall remain under the control of the inspector.
- .10 The recall operation shall be terminated when both switches at the main control panel and lobby panel are in the "RESET" or "OFF" position, as is appropriate.
- .11 Include alternate floor recall operation and recall operation by machine room smoke sensor.
- .12 Provide a duplicate recall switch at the CACF room.

2.49 FEO - Phase II Emergency In-Car Operation

- .1 Provide in-car emergency service for the elevator initiated by a key switch located in the car station. The switch shall be marked "OFF - HOLD - ON" and the key shall be removable in the OFF and HOLD positions. The switch shall become effective in initiating in-car emergency operation when in the "ON" position, provided the emergency recall operation is in effect and the car has returned to the recall level. During emergency in-car operation, the elevator shall operate as follows:
 - .1 The elevator shall be operable only by a person in the elevator.
 - .2 The elevator shall not respond to elevator landing calls.
 - .3 The opening of power-operated doors shall be controlled only by continuous pressure on the "DOOR OPEN" button. If the "DOOR OPEN" button is released during the "OPEN" motion, the door shall reclose immediately. When doors are fully open, they shall remain open until closed as in point 5.
 - .4 Door re-opening devices for power-operated doors shall be rendered inoperative.
 - .5 The doors shall be closed and the car started by registering a car call and constant pressure on the "DOOR CLOSE" button or on any car call button until the doors are fully closed.
 - .6 Momentary operation of the in-car emergency service switch to the "HOLD" position shall cancel registered car calls.
 - .7 When the car is at a landing and the key switch in the car is turned to the "HOLD" position, the doors shall remain open and car calls cannot be registered.
 - .8 When the car is at a landing and the key switch in the car is turned to the "OFF" position, the car shall automatically return to the recall level as on emergency recall operation regardless of the position of the emergency recall switch.
 - .9 The elevator shall be returned from In-car operation only when the car is at the recall level and the in-car switch is in the "OFF" position.

2.50 Load Weighing

- .1 Provide load weighing with means to measure the load in the car within 5% of the elevator capacity. Device to monitor deflection of spring at rope hitch
- .2 Design device to provide a signal to the controller for:
 - .1 Preventing a loaded car from answering registered hall calls.
 - .2 Designating hall calls to the most available car and controlling traffic analytically.
 - .3 Dispatching a parked car from the main floor as soon as the car has been loaded to a pre-set setting.
- .3 Adjust the load weighing device to ensure that it will operate over the required range of settings.
- .4 Verify that the load weighing device has a long term stability such that the settings do not require re-adjustment more frequently than every two years.
- .5 Use load weighing to pre-torque elevator and prevent movement in reverse direction when leaving a floor.
- .6 Provide an Anti-Nuisance operation which will cancel car- registered calls when the number of calls is not reasonably proportional to the cab load

2.51 Monitoring and Diagnostic System

- .1 Equip elevator control systems with system for monitoring, diagnostics and control.
- .2 Provide connections and modem for remote dial-up LCD visual display of interactive elevator functions.
- .3 Equip controllers with necessary interface software logic program to monitor elevator functions and record events to storage.
- .4 Provide two (2) working computers, loaded with licensed software, with the following capabilities. Locate one in the Central Security Control Centre and locate one in the main elevator machine room.
 - .1 Real-time display screens.
 - .2 Online Help to provide a complete content-sensitive help program shall be provided to give the users hints and explanations of the current task.
 - .3 Summary to give a brief description of the system, including the job number, job name, number of cars, number of landings, number of openings per landing for each car, car labels, and landing labels.
 - .4 Individual Flags - This screen shall display a list of the selected car's internally generated computer flags for diagnostics.

- .5 Graphic Hoistway Display - The Central Monitoring System shall display the elevator system hoistway. That is, users shall be able to view a graphical representation of the elevator hoistway. Including : Simulated Hoistway and Car Configuration
 - Individual Elevator Position
 - Individual Elevator Car Calls
 - Individual Elevator Direction
 - Individual Elevator Door Position
 - Individual Elevator Status of Operation (Recall., Emer. service etc.)
 - Individual Elevator Communication Status
 - Registered Up and Down Hall Calls
 - Controller Real-Time Clock Date and Time
- .6 Emergency Notification - in case of unit shutdown, the system shall have the ability to page designated personnel to notify them of an emergency event.
- .7 Reporting ability including malfunction events, Average Wait Time for elevators and total availability time for all units.
- .8 The system shall provide a multiple level of password protection for the usage of the system.
- .9 Store fault codes or malfunction logs for a minimum of 180 days.
- .5 Monitor system parameters including calls per floor, calls per elevator, average waiting time and % calls answered in 30, 60, 90 and 120 seconds. Allow for graphical analysis of any parameter for any chosen time interval from the previous 180 day period.
- .6 Provide minimum system characteristics for all computers:
 - .1 Core i5 Processor at 3.0 GHz;
 - .2 432 mm colour monitor; provide flat-screen, low profile monitor with LCD.
 - .3 52X CD-ROM and 6X writeable CD;
 - .4 Windows XP Pro with Service Pack 2 system or Windows 7;
 - .5 1 GB SDRAM;
 - .6 500 GB Hard Drive.
 - .7 SVGA Card
 - .8 2 x USB laser jet printers with cable (compatible with Microsoft Windows XP Pro, Service Pack 2 or Windows 7)
- .7 Supply and run all necessary interconnecting wiring between elevator machine rooms and from each hoistway to the Security Centre. Tape and legibly identify all wires and terminal boxes.

2.52 Simplex Control – Elevator 5

- .1 Provide operating devices in the car containing flush mounted LED- illuminated push buttons to correspond with landings served, keyed switch for car light, alarm button and keyed emergency stop switch.
- .2 Mount illuminated type push buttons at each terminal landing and "UP" and "DOWN" buttons with bronze faceplates at the intermediate landings.

- .3 Start car upon momentary pressure of one or more car or landing buttons, other than those for landing at which car is standing, and cause car to stop at first landing for which car or landing button is pressed, corresponding to direction in which car is travelling.
- .4 Stop car at landings for which calls are registered and make these stops in order in which landings are reached, irrespective of sequence in which buttons are pressed, provided button for given landing is pressed sufficiently in advance of arrival of car at that landing to permit stop to be made.
- .5 If no car buttons are pressed and car starts up in response to several down calls, proceed first to highest down call and reverse to collect other down calls. Collect up calls similarly when car starts down in response to such calls.
- .6 If car stops for landing call and car button is pressed within predetermined interval after stop for landing corresponding to direction car was travelling, proceed in same direction regardless of other landing calls registered.
- .7 If down landing buttons are pressed while car is travelling up, do not stop car at these landings but allow calls to remain registered.
- .8 After highest car and landing calls have been answered reverse car automatically and respond to down car and landing calls.
- .9 When travelling down, do not permit car to respond to up landing calls, but allow these calls to remain registered to be answered on next up trip.
- .10 At each stop in response to either car or corridor call, hold car at landing for adjustable time interval to permit transfer of passengers. Cancel interval upon registration of car call or pressure on door close button.
- .11 When lifting rated load, do not permit car speed to vary from rated speed by more than 10%.
- .12 Include a feature to hold the car for an adjustable interval of twenty (20) seconds maximum at landings at which stops are made to enable passengers to enter or leave car. Cancel interval upon registration of car call or pressure on door close button.
- .13 Permit car call to be registered to establish direction of travel when car has answered farthest call, even if other landing calls are registered.

2.53 Group Supervisory Control – Gearless Passenger Elevators

- .1 Provide microprocessor based group automatic operation to fully integrate and coordinate the movement of the elevators.
- .2 Provide dispatching programs in read-only-memory, with a minimum of 40% spare capacity.
- .3 Arrange dispatching software to be capable of assigning hall calls based on a composite of weighted criteria. Include sufficient parameters for assigning cars to answer hall calls, as to produce average and maximum call registration times as herein specified. Include as assignment criteria:
 - .1 Time to landing: Calculate total time for each elevator, summing all trip phenomena (current car calls, assigned hall calls, etc.) to be encountered in reaching the particular destination landing. Include times for accelerations, running, slowdown and levelling, door operating times, door open dwell times and anticipated passenger transfer times.

- .2 Re-assignment: Evaluate the suitability of each car of a group, at least five times per second. Continue the sequence of re-evaluations until the last possible moment, in keeping with requirements for advanced and chime signals.
- .4 Provide keyboard means to revise the logic programming in the machine room, with a minimum of down time.
- .5 Use a solid state system clock to define peak intervals, with time displays in the machine room and with:
 - .1 Means to reset the clock manually.
 - .2 Accuracy to within five seconds per month.
 - .3 Battery back-up for at least 24 hour duration.
 - .4 Means to override dispatch programs related to clock time.
- .6 Initiate UP-peak operation when an adjustable number of consecutive cars depart from the ground floor, each loaded over 60% of rated capacity, while clock validation is in effect. Terminate the UP-peak operation when peak demand ceases for an adjustable time span.
- .7 Initiate DOWN-peak operation when two consecutive cars of group arrive at the ground floor, each loaded above 55% of rated capacity, while clock validation is in effect. Terminate the DOWN-peak operation when peak demand ceases for an adjustable time span.
- .8 During clock UP-PEAK operation, bring an adjustable number of cars to the ground floor, and/or cause unloaded cars to travel express directly to the ground floor, when the number of elevators there is insufficient. Provide keyboard means in the machine room to revise the number of cars to be at, or sent to, the ground floor.
- .9 In the event of failure of the automatic dispatch system, provide alternate dispatching means to ensure service to all landings and for both travel directions.
- .10 TRAFFIC BALANCE
 - .1 Arrange the control system to integrate the movement of cars so that between the hours of 7:00 to 17:00 on a normal working day:
 - .1 55% of the hall calls are answered within 20 seconds.
 - .2 80% of the hall calls are answered within 30 seconds.
 - .3 90% of the hall calls are answered within 50 seconds.
 - .4 99% of the hall calls are answered within 90 seconds
 - .5 100% of the hall calls are answered within 180 seconds.

2.54 Machine Guarding

- .1 Provide Machine Guarding in accordance with OSHA, O. Reg 851, section 24 & 25 and TSSA document: Elevator Machine Room Equipment Guarding - Best Practices TSSA.

PART 3 - EXECUTION

3.1 Removal of Redundant Equipment

- .1 Remove and dispose of all redundant elevator equipment including electrical controllers, generators, governors and machines.
- .2 Remove all redundant wiring in elevator hoistway and machine room completely back to its source.
- .3 Provide Departmental Representative with option for keeping and storing any equipment deemed of heritage value.
- .4 Remove existing metal screen at existing ledges (platforms) each side of hoistway and at every floor. Refer also to architectural plans for location.

3.2 Car Balancing

- .1 Before final adjusting commences, statically balance the car so that, at the centre of the hoistway, the car hangs in the centre of the rails with the top roller guides removed.
- .2 Carry out this test with the car doors closed and an empty car.
- .3 Balanced car using iron or steel weights mounted in a steel frame under the car.

3.3 Inspection

- .1 Periodically during construction of hoistway and machine room structure, verify that hoistway, pit and machine room are proceeding correctly for equipment installation.
- .2 Verify shaft and openings are of correct size and within tolerances.
- .3 Confirm electrical power is available and of correct characteristics.
- .4 Report defects in writing to Departmental Representative.

3.4 Weighing of Car and Counterweight

- .1 Cab interior upgrade shall be carried out comply with TSSA CAD 261/13 Rev1.
- .2 Prior to the start and at the completion of the alteration, weight each car and counterweight separately. Record both weights .
- .3 Provide Engineer with a digital photo of the weighing and copy of the recorded weights.
- .4 Where the cumulative increase to the deadweight of the car is 115 kg (255 Lbs.) or less, including all weight changes since the car was originally installed, the following requirements shall apply:
 - .1 Cars and counterweights shall be weighed prior to the alteration to establish starting weights.

- .2 Materials added or removed during the alteration shall be weighed in or out, or the car shall be weighed after the alteration to establish final weight changes.
- .3 Add on weight (or decreased weight) shall be recorded on an auxiliary data tag and permanently posted on the crosshead. The auxiliary data tag shall as a minimum contain;
 - .1 the date of the alteration,
 - .2 the weight added or removed from the car
 - .3 the weight added or removed from the counterweight
 - .4 the name of the alteration contractor
 - .5 the measured car weight prior to the alteration
- .5 Where there is an increase in the deadweight of the car by more than 115 kg (255 Lbs.) or more that then 5% of car and capacity as originally installed including all weight changes since the car was originally installed, the following requirements shall apply;
 - .1 All requirements of 3.4.4.
 - .2 An engineering assessment, including structural assessment, shall be completed to confirm compliance of any components affected by the weight change including but not limited to:
 - .1 machines
 - .2 car and counterweight frames
 - .3 buffers
 - .4 traction and overbalance
 - .5 ropes
 - .6 safeties
- .6 Provide and fill in a permanently installed Auxiliary Weight Data Tag on the crosshead.

3.5 Welding

- .1 Refer to section 010010.
- .2 Where welding is used prepare joints and weld in approved manner using welders fully qualified to the requirements of CSA standards.
- .3 Obtain all required Hot Work Permits prior to carrying out any welding.
- .4 Notify the Departmental Representative for Fire Alarm isolation prior to welding, 24 hours before work is to be carried out.

3.6 Installation

- .1 Provide all necessary fastenings, bearing plates and transfer arrangement to accomplish appropriate fastening of machine to the car rails.
- .2 Arrange equipment in machine space so functioning equipment and other equipment can be removed for repairs or replacement without dismantling or removing other equipment components.
- .3 Mount copy of master schematic wiring diagrams in framed glass or plastic enclosure on machine room wall. If number of wiring drawings exceeds five (5), then mount drawings protected with clear plastic on rack permanently attached to machine room wall.

3.7 Storage

- .1 Co-ordinate delivery and storage of materials with Departmental Representative.

3.8 Coordination

- .1 Coordinate work with the work of the other trades on the job site. Plan elevator work so as not to hinder other work not included in this contract but which must be carried out at the same time and location. In instances of conflict with other trades, make substantial attempt to co-operate before notifying Owner's representative of conflict.
- .2 Expect to have work interrupted or suspended from time to time because of work which must be performed at the same time by another Sub-contractor. Mutually coordinate with the other Sub- contractor.

3.9 Field Quality Control

- .1 Perform and meet tests required by ASME A17.1/CSA-B44-10 Safety Code. Supply instruments and carry out these and other tests specified herein.
- .2 Provide 7 days written notice to Departmental Representative of the date and time of tests.
- .3 Have a copy of the Specifications on site and available to the installation mechanic.
- .4 Provide Departmental Representative with copy of all speeds and current readings taken at the time of Provincial regulatory agency inspection.

3.10 Finishing and Painting

- .1 At the completion of the project paint the floor of complete elevator machine room.
 - .1 One coat enamel CGSB 1-GP-66M reduced by addition of 1 part CGSB 1-GP-70M thinner to eight parts enamel.
 - .2 One coat enamel CGSB 1-GP-66M.

.2 Paint the following equipment in the hoistway:

- .1 All pit equipment including floor.
- .2 Car tops and crossheads.
- .3 Rails and strut angles and fascia plates.
- .4 Use paint materials listed on the CGSB qualified products list only.
- .5 Paint materials for each coating formulae to be products of a single manufacturer.
- .6 Paint all new metal screens at ledges (platforms) at each side of hoistway.

3.11 Cleaning

.1 Completely remove protective coverings from finished surfaces and components.

.2 Clean surfaces and components before project completion.

.3 Metals; Consult Professional Metals Conservation Specialist before cleaning;

- .1 DO NOT use wet cleaning methods including sprays, damp cloths, sponges etc. Surface dirt is turned into mud and ground into and left behind in the recesses and crevices of castings.
- .2 DO NOT use polishes on any surface unless specifically directed.
- .3 DO NOT use polishes which leave residues in corners and recesses.
- .4 DO NOT use polishes on any surface that has any kind of clear coat applied.
- .5 Do use soft brushes and a vacuum to remove dust and dirt from surfaces.
- .6 Do use soft dry cloths to wipe surfaces.
- .7 Clear coat surfaces should be cared for as an automotive finish. Harsh industrial cleaners are never to be used.
- .8 Untreated bronze/brass should have fingerprints removed using "Never-Dull" polish wadding.
- .9 Clear coat patina surfaces to preserve patina and reduce the need for the use of wet cleaning.

.4 Wood; Consult Professional Wood Conservation Specialist before cleaning;

- .1 Wipe wood with a cloth dipped in the suds of a mild solution of Murphy's oil soap.

3.12 Burning Torches

.1 Do not employ burning torches in the work. Work with burnt-out holes will be rejected.

3.13 Notification to Departmental Representative

Notification shall be as follows:

- .1 One week prior to commencement of work.
- .2 On delivery of materials to site.
- .3 On establishment of a moving platform.
- .4 On booking of each Provincial inspection and test.
- .5 On completion of all deficiencies.

3.14 Commissioning

- .1 Designate one staff person as Contractor's commissioning manager for the project. Manager to be of Adjuster, Supervisor or Manager level or higher.
- .2 Perform and meet tests required by ASME A17.1-2013/CSA-B44-13 Safety Code for Elevators.
 - .1 Supply instruments and carry out full load and balance loads tests.
 - .2 Furnish test and approval certificates issued by jurisdictional authorities within 24 hours of their being issued.
 - .3 Provide 2 weeks advance written notice of date and time of tests.
- .3 Attend at job site meetings pertaining to the Work.
- .4 After Provincial inspection of the elevator and before turn-over for customer use, test the elevator in simulated automatic operation without passenger access.
 - .1 Test for two (2) consecutive hours with no load operating from floor to floor, with or without door operation.
 - .2 Test for two (2) consecutive hours with 100% load operating from floor to floor, with or without door operation.
 - .3 Test for two (2) consecutive hours operating from floor to floor with door operation. Provide barricades and signage to indicate that an elevator test is in progress.
- .5 Before turn-over for customer use, test elevator as following:
 - .1 Running current in up direction with 42% car load.
 - .2 Running current in down direction with 42% car load.
 - .3 Governor overspeed setting.
 - .4 Safety trip setting.
 - .5 Door timings and dwell settings.
 - .6 Operating speed up.
 - .7 Operating speed down.
 - .8 Door close force.
 - .9 Door detector interrupt setting.
- .6 During warranty maintenance period closely monitor equipment for malfunctions and track reliability. Not achieving a reliability rate of # 0.6 malfunctions per month during the three month period preceding the expiration of the warranty maintenance period will extend the warranty maintenance, including full parts and labour, on the malfunctioning elevator(s) until the (moving window) 90 day reliability target has been achieved.
- .7 In the presence of the Departmental Representative and building staff, during silent hours of the building, use trained persons to demonstrate:
 - .1 Emergency Recall and In Car Emergency Operation under both normal and emergency power conditions.
 - .2 Dispatching features, Independent Service Operation and the operation of any other devices necessary for the operation of the elevators, by the building staff.
 - .3 There shall be no additional cost for after hour testing.

Table 1- Commissioning Data to Be Submitted by Contractor Per Elevator

PARAMETER	MEASURED (Prior to Modernization)	MEASURED (After Modernization)
Car speed UP (fpm)		
Car speed DOWN (fpm)		
Brake to Brake UP (sec)		
Brake to Brake DOWN (sec)		
Running current UP (amps)		
Running current DOWN (amps)		
Door open (sec)		
Door close (sec)		
Car call dwell (sec)		
Hall call dwell (sec)		
Governor pull through (pounds)		
Governor overspeed switch. mechanical (fpm)		
Governor overspeed switch electrical (fpm)		
Safety trip speed (fpm)		
Door stall force (pounds)		
Door timeout (sec)		

Table 2 - Firefighter's Emergency Operation and Fire Alarm Verification Submitted by Contractor

Recall Test Date:		
Elevator Contractor:		
Fire Alarm Testing Contractor:		
Test performed By:		
Devices Activated:	B44 Code Requirement	B44 Code Compliance
Hoistway Detector	All cars in the hoistway returned to the designated level with fire hats flashing inside the car.	YES / NO
Machine room detector	All cars returned to the designated level with fire hats flashing inside the car.	YES / NO
General Fire Alarm Activation Devices from Hall Lobbies	All cars returned to the designated level - fire hats in cars stay illuminated but did not flash.	YES / NO
Dedicated detector at Designated Level	All cars returned to the alternate floor - fire hats in cars stay illuminated but did not flash.	YES / NO
Recall Switch at the Main Floor	Indicator light illuminated on automatic or manual recall.	YES / NO

ANNEX A

Specifications

for

Elevating Devices Maintenance

Project Name: 451 Talbot Street,
London, Ontario

Specification Number: 8M25-0000

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1. SCOPE

The Contractor shall furnish all necessary tools, equipment, materials and labour to maintain, inspect, test, provide software updates and/or upgrades and service the elevating devices described in Section 2, Particular Requirements, of the Specifications.

2. PERFORMANCE

The Contractor shall maintain the elevating devices described in Section 2, Particular Requirements, of the Specifications using all reasonable care to maintain the equipment in proper and safe working conditions.

2.1 Elevating Devices, Maintenance Log

The Contractor shall maintain the PWGSC supplied Elevating Devices, Maintenance Log associated with each piece of equipment, in a manner that will identify the Contractor's conformance to 2.2 Maintenance Services below, and the applicable Codes and Standards, as described below in 2.4 Safety Codes. This Log may be used as proof of delivery should there be a discrepancy between services rendered and the services invoiced. The maintenance requirements and intervals provided within the Elevating Devices Log must be adhered to as a minimum. Should the contractor deem the maintenance requirements and intervals be increased, the contractor may do so but shall advise the Departmental Representative and the increased maintenance requirements and intervals must be noted in the Maintenance Log Book.

2.2 Maintenance Services

- .1 The Contractor shall regularly and systematically, at the frequency specified in Section 2, Particular Requirements, of the Specifications, examine, clean, adjust, calibrate and lubricate all components of the equipment. If conditions warrant, the Contractor shall repair or replace all components using only genuine replacement parts.
- .2 For the purposes of the contract "**Genuine Replacement Parts**" means only:
 - .1 parts made by the original manufacturer;
 - .2 parts approved for use by the original manufacturer; or
 - .3 parts approved for proposed application by the Departmental Representative in writing; the Departmental Representative reserves the right to have such replacement parts certified for their proposed application by an independent laboratory of its choice, at the expense of the Contractor, prior to granting approval.
- .3 The Contractor shall:
 - .1 provide lubricants, hydraulic fluids, car fluorescent ballasts starters and tubes, signal lamps, pit lamps, lamps on car top, lamps in relevant machinery spaces, all buried hydraulic equipment, cathodic protection and car sub flooring and floor finishing (except carpets);
 - .2 clean hoistways, pits, car tops, car ceilings, ceiling cavities, suspended ceilings and trusses.

2.3 Safety Devices and Tests

- .1 The Contractor shall inspect and adjust all safety devices as often as necessary and perform all tests as required by the applicable Codes and Standards described in paragraph 2.4 below. Where regulations require the enforcing/inspection authority to witness such tests, the Contractor shall conduct the test in their presence.
- .2 The Contractor shall co-ordinate and assist the enforcing/inspection authority in the performance of their annual inspection and tests of equipment.

2.4 Safety Codes

- .1 The Contractor shall conform to, but not limit work to, the edition of Codes and Standards applicable at the time of entering into the Contract as follows:
 - .1 ASME A17.1/CSA B44, Safety Code for Elevators and Escalators (including all Appendices),
 - .2 CSA B44.1/ASME A17.5 Elevator & Escalator Electrical Equipment
 - .3 B44.2 -07 Maintenance Requirements and Intervals for Elevators, Dumbwaiters, Escalators, and Moving Walks.
 - .4 CAN/CSA-B355, Standard for Lifts for Persons with Physical Disabilities (including Appendix A),
 - .5 National Building Code,
 - .6 National Fire Code,
 - .7 Provincial/Territorial Acts and Regulations and
 - .8 Municipal Bylaws,
 - .9 National Electrical Code.
- .2 Where concurrent regulations exist the most stringent set of regulations shall apply.

2.5 Operation

- .1 The Contractor shall maintain the original performance of the equipment within the limits outlined in the Codes and Standards described in paragraph 2.4 above, including but not limited to:
 - .1 rated speed,
 - .2 acceleration,
 - .3 deceleration,
 - .4 door opening and closing times and
 - .5 safeties and governor operation.

2.6 Group Dispatching System

- .1 The Contractor shall conduct periodic tests of the group dispatching system to ensure all circuits and time settings are properly adjusted to suit building traffic requirements, in accordance with the design capabilities of the system and applicable Codes.
- .2 Upon award of the contract and within the first three (3) months the contractor shall complete a traffic study of all group passenger elevators and provide statistical data the Departmental Representative. In compliance with requests, by the Departmental Representative, the Contractor shall provide additional traffic studies that include relevant statistical data.

2.7 Exclusions

- .1 The Contractor is not required to make renewals or repairs due to:
 - .1 negligent operation or misuse of equipment by others and
 - .2 causes beyond the Contractor's control except those due to ordinary wear and tear of equipment.
- .2 The Contractor is not responsible for
 - .1 refinishing, protecting, repairing or the replacement of the car enclosure, balustrades, car and hoistway door panels, frames and sills,
 - .2 cleaning, washing, waxing and polishing of car floors and
 - .3 the performance of safety tests additional to those specified in the contract, the installation of additional parts on the equipment nor the substitution of any parts with parts of a design different from those that constituted the equipment at the time the contract was signed, regardless of whether or not these measures are recommended or directed by an insurance company or by an enforcing/inspection authority.

.3 Further exclusions may be specified in Section 2, Particular Requirements, of the Specifications.

2.8 Working Hours

The Contractor shall perform all work during the regular working hours (07:00 hours to 17:00 hours) of the regular working days (Monday to Friday excluding legal holidays), unless otherwise specified in Section 2, Particular Requirements, of the Specifications.

2.9 Answering Service

The Contractor shall provide a comprehensive answering service 24 hours a day, 7 days a week.

2.10 Callback Service

The Contractor shall provide callback service between regular examinations within the response time specified in Section 2, Particular Requirements, of the Specifications, at no additional cost.

2.11 Stock of Parts for Maintenance Service

- .1 The Contractor shall maintain, in each building, an adequate stock of frequently replaced parts organized neatly in a cabinet.
- .2 The Contractor shall have available any part requiring replacement. The Contractor shall provide all parts promptly to ensure repair or replacement work is completed in an expeditious manner to minimize equipment outage time. Canada shall not assume responsibility for the safekeeping of parts stored on its premises.

2.12 Repairs

- .1 The Contractor shall immediately inform the Departmental Representative, in writing, of the need for repairs that are excluded from the contract.
- .2 Problem Solving Escalation Procedures: if, within the first four (4) hours of working on the equipment, the technician has not made significant progress in effecting repairs and returning the equipment to normal operation, the contractor shall make arrangements for a technician with the appropriate expertise to be on site without undue delay to facilitate the repair. This escalation process must not result in any additional costs to the Departmental Representative.
- .3 Disputes: in the event of a dispute over equipment operation, repairs, billing, invoices or any other item, work must continue during the dispute to ensure the operation and/or reliability of the equipment is not jeopardized.

2.13 Cleaning and Painting

- .1 The Contractor shall thoroughly clean and paint within one (1) year of the commencement date stipulated in under Article "Period of Contract" of the resultant contract, and every five (5) years thereafter:
 - .1 all elevator machine room equipment and
 - .2 the elevator machine room and pit floors.

2.14 Wiring Diagrams, Adjustment Procedures and Operational Descriptions

- .1 The Contractor shall prove to the satisfaction of the Departmental Representative:
 - .1 possession of complete schematic wiring diagrams,
 - .2 possession of detailed adjustment procedures and
 - .3 possession of detailed operational descriptions of all equipment included in the contract.

- .2 The Contractor shall conspicuously post in every elevator machine room framed copies of approved schematic wiring diagrams. The Contractor shall keep these diagrams up to date during the entire Term of the contract by indicating any change to circuitry. Engineer approved copy of the original and revised diagrams shall be provided to the Departmental Representative upon request. Where wiring diagrams, adjustments procedures and operational descriptions are available in electronic form, the Contractor shall update the documents in electronic form consistent with PWGSC standards and provide copies to the Departmental Representative upon request.

2.15 Reporting Requirements

- .1 The Contractor shall maintain, as a minimum, records of all maintenance activities, adjustments, verifications, tests, repairs and modifications for the duration of the contract, and provide them to the Departmental Representative upon request.
- .2 When malfunctioning elevating equipment cannot be returned to service within the same day, the Contractor shall provide, by the end of the following working day, a written report to the Departmental Representative describing the nature of the problem and the expected date of the service resumption.
- .3 When it is necessary to take all or part of the system(s) out of service, for inspections, tests and/or maintenance/service repairs etc., arrangements must be made with the Departmental Representative a minimum of seventy two (72) hours in advance. Details must be provided electronically to the Departmental Representative outlining the scope of the work to be done, anticipated time frame and the equipment involved.
- .4 The Contractor shall employ proven information collection and delivery techniques, methodologies and systems to meet PWGSC requirements.
- .5 The Contractor shall ensure that computer systems and information are protected with due regard to security, and ensure information disaster recovery and backup plans and procedures are in place.
- .6 Copies of all maintenance related work tickets and visitation records must be provided with the monthly invoicing for verification that the frequencies as stated in the contract have been met.

2.16 Environmental Protection

- .1 Without restricting the generality of Section 6 Applicable Laws, of the General Conditions - Services, the Contractor shall ensure that
 - .1 there is no contaminated waste left on site and
 - .2 disposal of all waste or volatile materials such as paints, oils, thinners, cleansers, etc. is completed through proper means and not waterways, storm or sanitary sewers.

**ELEVATING DEVICES MAINTENANCE
SPECIFICATIONS**

Building Name and Address: 451 Talbot Street,
London, Ontario

Equipment Inventory: TSSA Inst. # 029177, 029179, 029180, 029181, 029182

1. **SPECIAL EXCLUSIONS:** NONE
2. **PRO-RATION:** NONE
3. **SPECIAL LABOUR:** Contractor to provide a cost breakdown for each elevating device, per inspection, based on the EXAMINATION FREQUENCY requirements indicated in item 5 below.
4. **OTHER SPECIAL CONDITIONS:** Include treatment to escalator skirt panels with friction-reducing materials in compliance with the "CSA B44.2-07 Maintenance requirements and intervals for elevators, dumbwaiters, escalators, and moving walks." A written Maintenance Control Program shall be in place to maintain the equipment in compliance with the requirements of ASME A17.1 - B44-07 & CSA B44.2-07. This program shall be available, upon request, for review/acceptance by the Departmental Representative. Note maintenance items, included as part of this specification, on page entitled "Pre-maintenance Items".
5. **EXAMINATION FREQUENCY:** Semi-Monthly (twice per month) a minimum of 2.5 hours per visit shall be dedicated for the on-site maintenance of the devices within the inventory of this facility.

Task inspections and frequency intervals as described in the "CSA B44.2-07 Maintenance requirements and intervals for elevators, dumbwaiters, escalators, and moving walks", shall be adhered to as a minimum. (See tables provided on Pages 2 & 3 of Particular Requirements, for minimum frequencies).
However if the manufacturer or contractor deems that frequencies and intervals be increased they shall be permitted to do so but there shall be no increase in maintenance costs.
6. **CALLBACK SERVICE:** Include Twenty four (24) hour per day seven (7) days per week callback service, required by equipment stoppage or malfunction, at no additional cost.
7. **RESPONSE TIME:** For release of trapped passengers, on-site, response times are: one (1) hour during regular working hour calls and within one and one half (1.5) hours for after hour calls.
On-site response time for all other calls: within one (1) hour from receipt of call.

.8 MAINTENANCE TASK & FREQUENCY TABLE ELEVATORS:

Table 1

Elevator and dumbwaiter - Minimum maintenance frequencies
(see Clause 4.)

Note: All clause references provided below refer to CSA B44.2-07 *Maintenance requirements and intervals for elevators, dumbwaiters, escalators, and moving walks*

Every month clause reference	Every 12 months (clause reference)	Every 2 years (clause reference)	Every 5 years (clause reference)
Landing and car doors (4.5(a))	Safeties (4.2.2)	Hoisting ropes- Drum machines (8.6.12.4.2.1(b) of ASME A17.1 / CSA B44)	Governors (4.3.3)
Governors (4.3.1)	Governors (4.3.2(a))		Buffers (4.7)
	Wire ropes (4.4)		
	Landing and car doors (4.5(b))		
	Brakes (4.6)		
	Relief valve Setting (4.8)		
	Cylinders (4.9)		
	Emergency lighting (4.10)		
	Speed protection (4.11)		
	Hoisting ropes - Drum machines (8.6.12.4.2.1(a) of ASME A17.1/CSA B44)		

.9 Maintenance Task & Frequency Table Escalators

Table 2

Escalators and moving walks- Minimum maintenance frequencies
(see Clause 5.1.)

Note: All clause references provided below refer to CSA B44.2-07 *Maintenance requirements and intervals for elevators, dumbwaiters, escalators, and moving walks*

Every month (clause reference)	Every 6 months (clause reference)	Every 12 months (clause reference)
Stop buttons (5.2.1(a))	Broken step-chain device (5.3(a))	Speed governor (5.4(a))
Skirt switches (5.2.1(a))	Broken drive-chain device (5.3(b))	Stop switch in machinery space (5.4(b))
Handrail drive test (5.2.1(c))	Step obstruction device (5.3.(c))	Anti-reversal switch (5.4(c))
Clearance between skirt guards and steps (5.2.1.(d))		Step upthrust device (5.4(d))
Combplates (5.2.1(e))		Brakes (5.4(e))
Skirt panels (5.2.1(f))		Permission stretch in chains (5.4(f))
Step treads and risers (5.2.1(g))		Annual examination and cleaning (5.4(g))
Caution signs (5.2.1(h))		

Pre-maintenance repairs

The following repairs and/or adjustments must be completed within the time frames indicated:

1. Blow out all motor generators, hoist machines & brush rigging. Replace all worn brushes.
Within one (1) week after award of contract.
2. Clean all governors and perform Code compliant safety tests, enter test results in the on site log books.
Within one (1) week after award of contract.
3. Replace improper sized fuses with correct sized fuses.
Within one (1) week after award of contract.
4. Clean all car door and door operator equipment and verify proper operation of same.
Within two (2) weeks after contract award.
5. Clean/verify all door locks and related equipment to ensure proper operation.
Within two (2) weeks after award of contract.
6. Investigate and perform corrective action necessary to achieve proper door nudging function on TSSA installation # 029177.
Within two (2) weeks after contract award.
7. Vacuum all car top exhaust fans and ensure proper function of same.
Within two (2) weeks after contract award.
8. Resurface all motor generator and hoist machine commutators to remove burnt spots and eliminate any brush chatter.
Within three (3) weeks after contract award.
9. Investigate & eliminate noise evident on elevator TSSA # 029177 as the car travels in the hoistway.
Within two (2) weeks after contract award.
10. Thoroughly clean car tops and paint car top refuge areas.
Within one (1) month after award of contract.
11. Thoroughly clean and paint pit floors and refuge areas.
Within one (1) month after award of contract.
12. Thoroughly clean and paint machine room floors.
Within one (1) month after award of contract.
13. Complete all over due one (1) year and five (5) year tests and enter results in the on site log books.
Within one (1) month after award of contract.
14. Replace all worn and/or missing hoistway door closer felts to eliminate noise evident during open/close operations.
Within one (1) month after award of contract.
15. Provide all missing hoist rope data tags.
Within two (2) months after award of contract.
16. Complete information required on counterweight runby signage.
Within two (2) months after award of contract.

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- 17. Remove all unnecessary rods protruding from bottom of counterweights.
Within two (2) months of contract award.**
- 18. Verify equipment operations are as designed, verify all circuitry related to dispatching, leveling, acceleration, deceleration, safety circuits and ancillary systems and provide a report of all adjustments, repairs and/or changes made to achieve safe and reliable elevator operations.
Within one (1) month after award of contract.**
- 19. Ensure all persons involved in maintaining, adjusting and/or repairing these elevators sign the signatory page of the on-site Log Book and in all other appropriate pages of same, continually.**

PART 1 - GENERAL

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93.
- .6 Approvals:
 - .1 Submit 3 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.

- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Consultant will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings and specifications:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings and specifications.
 - .5 Submit completed reproducible as-built drawings and specifications with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings and specifications for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.
- .3 MECHANICAL SYSTEMS COMMISSIONING - The mechanical systems of this project will be thoroughly commissioned by a Third Party Commissioning Agent. Assist and cooperate with the commissioning agent as required. Refer to Section 01 91 13 for additional details. Include all related costs in the Base Bid.

1.3 MAINTENANCE

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

- .1 Sizes: as follows:
 - .1 For body entry: 600 x 600 mm minimum.
 - .2 For hand entry: 300 x 300 mm minimum.
- .2 Construction: rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180 degrees. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.
- .3 Materials:
 - .1 Tiled or marble surfaces: stainless steel with brushed satin finish.
 - .2 Other areas: prime coated steel.

PART 3 - EXECUTION

3.1 REPAIRS/RESTORATION

- .1 To Section 09 91 24.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged extensively for priming and touch-up.

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 DEMONSTRATION

- .1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.6 FIRESTOPPING

- .1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:
 - .1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.
 - .2 Certification that proposed firestopping materials and assemblies comply with CAN ULC S115 "Standard Method of Fire Test for Firestopping Systems".
 - .3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.
- .2 Mark penetration types and locations on set of white prints. At completion of project, transfer this information to As Built Drawings.
- .3 Comply with all requirements of Ontario Building Code Clause 3.1.9, "Building Services in Fire Separations and Fire Rated Assemblies".
- .4 All firestopping must be thoroughly reviewed by the Technical Representative of the systems manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Technical Representative to complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractors choice. Contractor to replace fire stopping system after destructive test has been completed. Submit a copy of the report to the Consultant. Report to include as a minimum, confirmation fire stopping shop drawings were used during review, locations where destructive testing was completed, confirmation all fire stopping locations were reviewed and installed systems meet the manufacturer requirements.

3.7 ACCESS DOORS

- .1 Supply access doors wherever equipment, valves, dampers, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by Division 9.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM B32-08, Standard Specification for Solder Metal.
 - .2 ASTM B306-09, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564-11, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CSA B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125.3-11, Plumbing Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: separate and recycle waste materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground condensate, sanitary, storm and vent Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.3.
 - .2 Wrought copper: to CAN/CSA-B125.3.
 - .2 Solder: tin-lead, 50:50, type 50A or lead free, tin- 95:5, type TA, to ASTM B 32.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 In accordance with Section 23 05 01.
- .2 Install in accordance with National Plumbing Code, OBC and local authority having jurisdiction.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
 - .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
 - .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .3 Fold up metal and plastic banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.

- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

- .1 Install manual air vents at high points in piping systems. Install automatic vents where shown on drawings.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
 - .7 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .15 Check Valves:
 - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
 - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRESTOPPING

- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 supplemented as specified in relevant mechanical sections.
- .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Consultant 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.13 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Consultant.
- .2 Request written approval 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.

3.14 CLEANING

- .1 Clean in accordance with Section 01 74 11.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ASME B31.1-2012, Power Piping.
 - .2 ANSI/ASME B31.3-2006, Process Piping.
 - .3 ASME Boiler and Pressure Vessel Code BPVC-2010:
 - .1 BPVC 2010 Section I: Power Boilers.
 - .2 BPVC 2010 Section V: Nondestructive Examination.
 - .3 BPVC 2010 Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206-[03], Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1M/C1.1-2000(R2006), Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1-2005, Safety in Welding, Cutting and Allied Process.
 - .3 AWS W1-2000, Welding Inspection Handbook.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA W47.2-M1987(R2008), Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51-03(R2007), Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2-2006, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1-2008, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2-2008, Certification of Welding Inspectors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Welders:
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Submit welder's qualifications to Departmental Representative.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
 - .2 Inspectors:
 - .1 Inspectors qualified to CSA W178.2.
 - .3 Certifications:
 - .1 Registration of welding procedures in accordance with CSA B51.
 - .2 Copy of welding procedures available for inspection.

.4 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Separate and recycle waste materials in accordance with Section 01 74 20.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .6 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 QUALITY OF WORK

- .1 Welding: in accordance with ANSI/ASME B31.1, B31.], ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Mechanical Divisions applicable requirements of provincial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.

- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

- .1 General:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2 and approved by Departmental Representative.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test 10% of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by Consultant of total of up to 10% of welds, selected at random by Consultant by particle tests.

3.6 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.
- .2 In addition, hot and chilled water systems:
 - .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
 - .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.

- .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
- .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
- .5 Repair cracks and defects in excess of 0.8 mm in depth.
- .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic particle tests.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2012, Power Piping.
- .2 ASTM International
 - .1 ASTM A125-96(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Canada Green Building Council (CaGBC)
 - .1 LEED Canada For New Construction and Major Renovations 2009.
 - .2 LEED Canada For Core and Shell 2009.
 - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .4 Factory Mutual (FM)
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.

- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP 58.
- .2 Performance Requirements:
 - .1 Design supports, platforms, catwalks, hangers to withstand seismic events as specified Section 23 05 48.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58 and ASME B31.1.

- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and retaining clip.
 - .1 Rod: 13 mm FM approved.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, to MSS-SP 58 and MSS-SP 69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, to MSS SP 69.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP 69.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
 - .3 Sway braces for seismic restraint systems: to Section 23 05 48.
- .6 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel black galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP 69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, FM approved.
- .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

2.6 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23. Submit calculations with shop drawings.

2.7 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.8 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00.

2.9 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23.
- .2 Submit structural calculations with shop drawings.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

- .1 Plumbing piping: to Canadian Plumbing Code, OBC.
- .2 Fire protection: to applicable fire code.
- .3 Copper piping: up to NPS 1/2: every 1.5 m.
- .4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m
5	4.3 m	
6	4.3 m	
8	4.3 m	

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
 - .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-B149.1-10, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2010, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2010, Standard for the Installation of Standpipe and Hose Systems.

1.2 SUBMITTALS

- .1 Product Data: submit product data for each item specified.
- .2 Submittals: in accordance with Section 01 33 00.
- .3 Product data to include paint colour chips, other products specified in this section.

1.3 QUALITY ASSURANCE

- .1 Quality assurance submittals: submit following in accordance with Section 01 33 00.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Dispose of unused paint coating material at official hazardous material collections site approved by Departmental Representative.
 - .3 Do not dispose of unused paint coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
 - .1 Conform to following table:

Size #	mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1		10 x 50	1	3
2		13 x 75	1	5
3		13 x 75	2	3
4		20 x 100	1	8
5		20 x 100	2	5
6		20 x 200	1	8
7		25 x 125	1	12
8		25 x 125	2	8
9		35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- .4 Identification for PWGSC Preventive Maintenance Support System (PMSS):
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: size #9.
 - .2 Source and Destination identifiers: size #6.
 - .3 Terminal cabinets, control panels: size #5.
 - .3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Sprinklers: to NFPA 13.
 - .2 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive [plastic-coated cloth] [vinyl] with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from Departmental Representative.
 - .2 Colours for legends, arrows: to following table:

<u>Background colour:</u>	<u>Legend, arrows:</u>
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Low Pressure Steam	Yellow	LOW PRESSURE STEAM
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.
- .2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item. Update existing valve charts to reflect added or removed valves.

2.8 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

- .1 Identification in English and French.
- .2 Use one nameplate and label for both languages.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

- .1 Provide identification only after painting specified Section 09 91 24 has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC or CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-07, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-08, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-[89], Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-[95], Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 2012, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide(Revised 2005).
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 ULC-S702.2-10, Standard for Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.2 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.

- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.
- .5 TIAC Code C-2: mineral fibre blanket faced [with] [without] factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to [CAN/ULC-S702] [ASTM C547].
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to [CAN/ULC-S702] [ASTM C547].
- .6 TIAC Code A-6: flexible unicellular tubular elastomer.
 - .1 Insulation: [with vapour retarder jacket] [_____].
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: [_____].
 - .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting on mineral wool, to ASTM C449.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colours: Consultant
 - .3 Minimum service temperatures: -20 degrees C.
 - .4 Maximum service temperature: 65 degrees C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 20 mil.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
- .2 Aluminum:
 - .1 To ASTM B209M.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: smooth.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
- .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: aluminum.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: SS wire bands at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.

- .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: SS wire bands at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
 - .1 Seals: lap seal adhesive, lagging adhesive.
- .5 TIAC Code: C-2 with vapour retarder jacket.
 - .1 Seals: lap seal adhesive, lagging adhesive.
 - .2 Installation: TIAC Code: 1501-C.
- .6 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degree °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over	
Steam		[A-3]	65	65	65	65	80	80
Domestic Hot		[A-3]	25	25	25	38	38	38
Domestic CWS		[A-3]	25	25	25	38	38	38
Chilled Water		[A-3]	25	25	25	38	38	38
Storm		[A-3]	25	25	25	25	25	25
Condensate		[C-2]	25	25	25	25	25	25
Hot Water Heating		[A-1]	38	38	38	50	50	50
Refrigerant HG		[A-6]	25	38	38	38	38	38
Refrigerant Suction		[A-6]	25	38	38	38	38	38
Refrigerant Liquid		[A-6]	25	38	38	38	38	38

- .7 Finishes:
 - .1 Exposed indoors: PVC jacket.
 - .2 Mechanical rooms: PVC jacket.
 - .3 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .4 Finish attachments: SS screws bands, at 150 mm on centre. Seals: wing closed.
 - .5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for copper tubing and fittings for refrigerant.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.22-01, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
 - .2 ASME B16.24-02, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
 - .3 ASME B16.26-88, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .4 ASME B31.5-01, Refrigeration Piping and Heat Transfer Components.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B 280-03, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B52-99, Mechanical Refrigeration Code.
- .4 Environment Canada (EC)
 - .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
- .3 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
 - .2 Submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.
- .4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Instructions: submit manufacturer's installation instructions.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
 - .2 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
 - .2 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Hard copper: to ASTM B 280, type ACR.
 - .2 Annealed copper: to ASTM B 280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.3 FITTINGS

- .1 Service: design pressure 2070 kPa and temperature 121 degrees C.
- .2 Brazed:
 - .1 Fittings: wrought copper to ASME B16.22.
 - .2 Joints: silver solder, 15% Ag-80% Cu-5%P or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
- .3 Flanged:
 - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A 307, heavy series.
- .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.4 PIPE SLEEVES

- .1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.5 VALVES

- .1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.
- .2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

- .1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5 Section 23 05 01 - Installation of Pipework.

3.3 BRAZING PROCEDURES

- .1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:

.1 Soft annealed copper tubing: bend without crimping or constriction
Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:

.1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
.2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
.3 Provide inverted deep trap at top of risers.
.4 Provide double risers for compressors having capacity modulation.
.1 Large riser: install traps as specified.
.2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:

.1 Twice to 14 Pa absolute and hold for 4 h.
.2 Break vacuum with refrigerant to 14 kPa.
.3 Final to 5 Pa absolute and hold for at least 12 h.
.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
.5 Submit test results to Consultant.

- .7 Charging:
 - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
 - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
 - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
 - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report measurements to Consultant.
- .9 Manufacturer's Field Services:
 - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its product[s] and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
 - .4 Obtain reports, within 3 days of review, and submit, immediately, to Consultant.
- .10 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Certified Wood.
 - .8 Low-emitting materials.

3.7 DEMONSTRATION

- .1 Instructions:
 - .1 Post instructions in frame with glass cover in accordance with Section 01 78 00 - Closeout Submittals and CSA B52.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
 - .1 ANSI/ARI 210/240-2003, Unitary Air Conditioning and Air-Source Heat Pump Equipment.
- .2 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
 - .1 ANSI/ASHRAE Standard 15-2010, Safety Standard for Refrigeration Systems.
- .3 Air-Conditioning and Refrigeration Institute (ARI)
 - .1 ARI 320-1998, Standard for Water-Source Heat Pumps.
 - .2 ARI 325-98, Standard for Ground Water - Source Heat Pumps.
- .4 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
 - .2 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
 - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
 - .4 LEED Canada-EB: O&M-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .5 CSA International
 - .1 CAN/CSA-C656-05(R2010), Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.
 - .2 CAN/CSA-C13256-2001(R2011), Water-Source Heat Pumps-Testing and Rating for Performance, Part 1 Water-to-Air and Brine-to-Air Heat Pumps.
- .6 Environment Canada, (EC) / Environmental Protection Services (EPS)
 - .1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.
 - .2 Environment Canada-[1994], Ozone-Depleting Substances Alternatives and Suppliers List.
- .7 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-[2009], Standard for Installation of Air Conditioning and Ventilating Systems.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.

- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for split system air conditioning system for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
 - .4 Dispose of unused adhesive material at official hazardous material collections site.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- .1 Heat pumps: to EPS 1/RA/2, CSA approved and with ARI or CSA certification seal.

2.2 REFRIGERANTS

- .1 Type of Refrigerant: R410A.

2.3 DRAIN PANS

- .1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 SPLIT SYSTEM AIR CONDITIONING UNITS

- .1 General:
 - .1 Variable refrigerant flow split system consisting of indoor DX evaporator units, outdoor air-cooled condensing unit and associated controllers, as shown on the drawings. All components to be CSA approved.
 - .2 Provide optional condensate lift pump, where required. Coordinate with Contractor.
- .2 Performance data: As shown on Schedule on Drawings.
- .3 Outdoor unit:
 - .1 Unit to use variable speed drive scroll hermetic compressor to serve multiple indoor evaporator units.
 - .2 Compressor to be a DC (brushless) motor with auto tuning inverter drive, hermetic scroll type capable of operation down to 19% of rated capacity. Provide crankcase heater. Equip compressor with internal thermal overload. Provide flexible mounts.
 - .3 The unit shall be equipped with all necessary components for ultra-low ambient operation to -40C.
 - .4 Unit shall have a sound pressure level no higher than 58 dBA measured in an anechoic chamber at a horizontal distance of 1m from the unit.
 - .5 Unit shall have an accumulator with refrigerant level sensors and controls, a high efficiency oil separator, a high pressure safety switch, over-current protection, DC bus protection and controls to ensure adequate oil volume is maintained in the compressor.
 - .6 Unit casing to be of galvanized steel, bonderized and finished with a powder coated baked enamel able to withstand 96 hours of salt spray in accordance with JRA9002 testing.
 - .7 Use a variable speed condenser fan, direct drive, inverter driven, variable speed, propeller type. Included motor protection, permanently lubricated bearings, flexible motor mounts. Provide a raised wireguard on fan outlet.
 - .8 Use a wraparound style condenser coil with non-ferrous plate fins on copper tubing. Provide a factory applied blue-fin coating on coil. The coil shall include four circuits with two position valves for each circuit. Protect coil with an internal metal guard.
 - .9 Unit shall support the horizontal and vertical piping arrangements and lengths shown on the drawings.
 - .10 Provide wind guard for each condensing unit.
 - .11 Unit to be mounted on a manufacturer approved galvanized steel modular support frame with UV stabilized plastic support pads designed to support the unit above roof surface. Provide a vibro pad at each condensing unit support point.
- .4 Indoor Units:
 - .1 Use exposed wall-mounted units which are factory assembled, wired and run tested, with multiple, adjustable outlet linear diffusers, two-speed direct drive fan(s), modulating linear expansion device, permanently lubricated bearings, drain pump and copper tubing heating/cooling coil with non-ferrous smooth plate fins.

- .5 Refrigeration piping:
 - .1 Between compressor, outdoor coil and indoor coil, complete with refrigerant metering devices and valves.
 - .2 Refer to Section 23 23 00.

- .6 Controls:
 - .1 Provide a controller for each VRF indoor unit. Unit to include return air temperature sensor, temperature setpoint adjustment, ON/OFF selection and fan speed selection.
 - .2 Mount controller as shown on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for heat pumps installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install where indicated and in accordance with manufacturer's instructions.
- .2 Install outdoor units on rooftop support stands as specified.
- .3 Secure with hold-down bolts in accordance with manufacturer's recommendations.
- .4 Make piping connections. Provide shutoff valves on lines at condensing unit.
- .5 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.3 DRAIN PANS

- .1 Install so that no water can accumulate. Arrange easy access for cleaning.
- .2 Include internal or external trap for proper draining.

3.4 START-UP AND COMMISSIONING

- .1 Have manufacturer certify installation and size refrigerant piping.
- .2 Have manufacturer present during start-up and certify performance.
- .3 Submit written start-up and commissioning reports to Consultant.

3.5 CLOSEOUT ACTIVITIES

- .1 Manufacturer to deliver verbal, and written instructions to operating personnel.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by split system air conditioning system installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1-2015, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
- .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 The Ontario Electrical Safety Code 2015, and all bulletins (Ontario).
- .4 Hydro requirements and local applicable codes and regulations.

1.2 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Product Data: submit WHMIS MSDS.
- .3 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass in glazed frames at fire alarm control panel and annunciator.
- .4 Quality Control: in accordance with Section 01 45 00.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction inspection authorities for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees and obtain electrical permit. Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
 - .6 Submit certificate of acceptance from Electrical Inspection Department authority having jurisdiction upon completion of Work to Departmental

Representative.

- .7 Manufacturer's Field Reports: submit to Departmental Representative, manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .8 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner's safety and security policies and procedures and conform to all regulations of the current Occupational Health & Safety Act. After completion of the work, furnish to Consultant a Certificate of Unconditional Approval from Inspecting Authorities.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial 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:
 - .1 In accordance with Section 01 32 19.
 - .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL,, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.
- .5 ELECTRICAL SYSTEMS COMMISSIONING - The electrical systems of this project will be thoroughly commissioned by a Third Party Commissioning Agent engaged by the Owner. Assist and cooperate with the commissioning agent as required. Include all related costs in the Base Bid.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.6 SYSTEM STARTUP

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 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.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction and inspection authorities before delivery to site and submit such approval as described in PART 1 - Submittals.
- .3 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction, inspection authorities and Departmental Representative.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
.1 Nameplates: plastic laminate lamacoid 3 mm thick plastic engraving sheet melamine, black matt white finish face, black white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. " as directed by Departmental Representative .
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered 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 coding: to CSA-C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	<u>Prime</u>	<u>Auxiliary Systems</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Other	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish".
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

2.9 SPRINKLER SHIELDS

- .1 The building will be fully sprinklered. All surface or standalone mounted electrical equipment is to include a sprinkler shield to prevent water infiltration.

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 CAN/CSA-C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe plastic sheet metal, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm, maximum 1200 mm for accessible space.
 - .2 Wall receptacles:
 - .1 General: 300 mm, minimum 400 mm for accessible space.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted telephone and interphone outlets for non-accessible locations: 1500 mm.
 - .6 Fire alarm stations: 1500 mm maximum 1200 mm for accessible space.
 - .7 Fire alarm bells: 2100 mm.
 - .8 Wall mounted speakers: 2100 mm.
 - .9 Door bell pushbuttons: 1500 mm, maximum 1200 mm for accessible space.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses

are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current 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 following tests in accordance with Section 01 45 00:
 - .1 Circuits originating from branch distribution panels.
 - .2 Lighting and its control.
 - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .4 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 20 and Section 01 35 21.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper, copper alloy sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
 - .1 Connector body and stud clamp for stranded round copper aluminum conductors tube bar.
 - .2 Clamp for stranded round copper conductors bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors bar.
 - .5 Sized for conductors tubes bars as indicated.
- .4 Clamps or connectors for armoured cable, TECK cable aluminum sheathed cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and cables and:
 - .1 Apply coat of zinc joint compound on conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
 - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .4 Install bushing stud connectors.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RW for indoor, Non Jacketted. For use with variable frequency drives.

2.2 ARMOURED CABLES

- .1 Conductors: insulated, copper size as indicated.
- .2 Type: AC90
- .3 Armour: interlocking type fabricated from galvanized steel.
- .4 Connectors: anti short connectors.
- .5 To be factory coated Red for final connection to Fire Alarm Devices. Cable to match Fire Alarm manufacturer's requirements.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 33 71 73.02.
- .2 Lay cable in cable trays in accordance with Section 26 05 36.
- .3 Terminate cables in accordance with Section 26 05 20.
- .4 Cable Colour Coding: to Section 26 05 00.
- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In surface and lighting fixture raceways in accordance with Section 26.
 - .3 In wireways and auxiliary gutters in accordance with Section 21.
 - .4 Overhead service conductors in accordance with Section 21.

3.4 INSTALLATION OF ARMoured CABLES

- .1 Group cables wherever possible on channels.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

- .1 Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.41-07, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2 No. as required sized for conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment] and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, copper conductors, size as indicated.
- .3 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 Bonding jumpers, straps.
 - .5 Pressure wire connectors.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Install zig-zag grounding transformer where required as indicated on line side of main interrupter.
- .9 Connect building structural steel and metal siding to ground by welding copper to steel.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point street side of water pipe. Avoid loop connections.
- .11 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .12 Ground secondary service pedestals.

3.2 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of primary V system, secondary V system].

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.4 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.
- .2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.5 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 and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended, set in poured concrete walls and ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 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.

- .7 For surface mounting of two or more conduits use channels spaced to meet electrical code.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, 22nd Edition.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00.
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 SPLITTERS

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

2.2 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on flat covers.

2.3 CABINETS

- .1 Construction: welded sheet steel hinged door, handle and catch

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

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

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-2015, Canadian Electrical Code, Part 1, 23rd Edition.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit samples for floor box in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 0.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .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.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

- .1 Flush poke through device boxes as indicated on plans and detail drawings.

2.6 CONDUIT BOXES

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

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.8 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 35 mm 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 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CAN/CSA-C22.2 NO. 18.1-04, Metallic Outlet Boxes.
 - .3 CAN/CSA-C22.2 NO. 18.2-06, Nonmetallic Outlet Boxes.
 - .4 CAN/CSA-C22.2 No. 18.3-04(R2009), Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
 - .5 CSA C22.2 No. 45.1-07, Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and NMX-J-534-ANCE-2007).
 - .6 CSA C22.2 No. 56-04(R2009), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .7 CSA C22.2 No. 83-M1985(R2008), Electrical Metallic Tubing.
 - .8 CSA C22.2 No. 211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.
 - .9 CAN/CSA-C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings All conduits for fire alarm system to be factory coated red.
- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits NPS 2 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than [NPS 2] [50 mm].
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits spaced to meet code.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for NPS 1 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.
- .3 Use electrical metallic tubing (EMT) [except in cast concrete above 2.4 m not subject to mechanical injury.
- .4 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures work in movable metal partitions.
- .5 Use liquid tight flexible metal conduit for [connection to motors or vibrating equipment in damp, wet or corrosive locations
- .6 Minimum conduit size for lighting and power circuits: NPS 3/4 19 mm.
- .7 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits [NPS 1] [25 mm] and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.6 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA-C22.2 No.42.1-00 (R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55-M1986 (R2008), Special Use Switches.
 - .4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SWITCHES

- .1 20A, 120 V and 347 V (as required), single pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.
- .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads and / or heating loads.
- .4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R or 5-20R (as indicated on plans), 125 V, 15 A/20 A, U ground, to: CSA C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.

2.3 WIRING DEVICES FOR COMPUTER ROOMS

- .1 To same standards as listed in 2.2 above. Refer to floor plans and details for CSA configuration of receptacles in computer rooms.

2.4 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, vertically brushed 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

- .6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.5 LABELLING

- .1 Identify the panel and circuit number for each wiring device with self-adhesive label on the coverplate. Use clear tape with black 14 pt Arial or Helvetica typeface. Locate labels for receptacles on front of coverplate and labels for switches on rear of coverplate.

2.6 SOURCE QUALITY CONTROL

- .1 Cover plates from one manufacturer throughout project.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 Install GFI type receptacles as indicated.
- .3 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Shop Drawings:
 - .1 Provide shop drawings in accordance with Section 01 33 00.
 - .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet moisture free location.

1.3 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00.

PART 2 - PRODUCTS

2.1 FUSES - GENERAL

- .1 Fuse type references J1 have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

- .1 Class J fuses.
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Provide 3 spare fuses of each size used on project.

2.3 FUSE STORAGE CABINET

- .1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .2 CSA International (CSA)
 - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store circuit breakers off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, Circuit breakers, and ground-fault circuit-interrupters, fused circuit breakers, and accessory high-fault protectors: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .4 Common-trip breakers: with single handle for multi-pole applications.
- .5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .6 Circuit breakers with interchangeable trips as indicated.
- .7 Circuit breakers to have minimum 22000 symmetrical rms interrupting capacity rating. For panels/switchboards with higher interrupting rating, breakers to match panel/switchboard.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install circuit breakers as indicated.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 PAYMENT

- .1 Payment for field testing of ground fault equipment performed by Contractor independent testing laboratory equipment manufacturer in accordance with Section 01 29 83.

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.144-M91 (R2011), Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2-1999(R2009), Application Guide for Ground Fault Protection Devices for Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144 NEMA PG 2.2.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single or Two pole ground fault circuit interrupter for circuits as noted on plans c/w test and reset facilities.

2.4 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:
 - .1 Solid state ground sensing device.
 - .2 Facility for testing and reset.
 - .3 CSA Enclosure 1, surface flush mounted with stainless steel painted face plate.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 and co-ordinate with Section 01 45 00 if required.

- .2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.
- .3 Demonstrate simulated ground fault tests.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20 and 01 35 21.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible and non-fusible, as indicated, horsepower rated disconnect switch in CSA Enclosure drip proof type, size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, to Section 26 28 14.
- .5 Fuseholders: relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Indicate name of load controlled on size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .2 CSA International
 - .1 CSA C22.2 No.14-10, Industrial Control Equipment.
- .3 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 2-2000(R2005), Controllers, Contactors and Overload Relays Rated 600 V.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for contactors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.
- .3 Include operating information required for start-up, synchronizing and shut-down of generating units.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect contactors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 CONTACTORS

- .1 Contactors: to CSA C22.2 No.14.
- .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Fused switch combination contactor as indicated.
- .4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .5 Mount in NEMA Enclosure unless otherwise indicated.
- .6 Include following options in cover:
 - .1 Red indicating lamp.
 - .2 Stop-Start pushbutton.
 - .3 Hand-Off-Auto selector switch - as noted
 - .4 On-Off selector switch - when Hand-Off-Auto not used.
- .7 Control transformer: in accordance with Section 26 29 03, factory wired and installed in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00.
- .2 Size 4 nameplate indicating name of load controlled as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install contactors and connect power wires and auxiliary control devices.
- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by contactor installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1-2004, American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
 - .1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
- .5 ICES-005-07, Radio Frequency Lighting Devices.
- .6 Underwriters' Laboratories of Canada (ULC)
- .7 IESNA LM-80-08 "Approved Method: Measuring Lumen Maintenance of LED Light Sources" and IESNA LM-79-08 "Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products"

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
 - .3 Photometric data to include: VCP Table where applicable spacing criterion.
- .3 Quality assurance submittals: provide following in accordance with Section 01 45 00.
 - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Disposal and recycling of fluorescent lamps as per local regulations.
- .4 Disposal of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 LAMPS

- .1 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80 or as indicated.

2.2 BALLASTS

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic
 - .1 Rating: 60 Hz voltage as indicated for use with 2-32W, instant start lamps.
 - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
 - .3 Power factor: minimum 95% with 95% of rated lamp lumens.
 - .4 Current crest factor: 1.7 maximum.
 - .5 Harmonics: 10% maximum THD.
 - .6 Operating frequency of electronic ballast: 20 kHz minimum.
 - .7 Total circuit power: 62 Watts.
 - .8 Ballast factor: greater than 0.90.
 - .9 Sound rated: Class A.
 - .10 Mounting: integral with luminaire.

2.3 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES

- .1 As indicated in luminaire schedule.

2.5 LED LUMINAIRES

- .1 All LED luminaires must bear an approved certification mark as per Ontario Electrical Safety Code Bulletin 2-7-29. A UL certification mark without the 'c' is not an approved certification mark.

- .2 Luminaires designed for LED lamps with integral driver as specified below shall adhere to LED lamp manufacturer guidelines, certification programs, and test procedures for thermal management to guarantee the minimum lamp life and lumen maintenance as specified below. Luminaire manufacturers must reference LM-80 publication in manufacture and design of luminaire.
- .3 Luminaires designed with integrated custom LED's. shall be as specified on drawings or approved equal meeting the following requirements:
 - .1 Only products from manufacturers that have been in the lighting manufacturing business for minimum of 10 years will be considered.
 - .2 Modularity, shall be designed to allow for replacement of; driver, LED's, without specialized tools and without removing luminaire from the ceiling.
 - .3 Performance - LED luminaire with custom lamps must exceed LED lamp parameters specified below for efficacy and lumen maintenance by minimum 15%
 - .4 Lumen Maintenance - at least 70% of initial lumens for at least 50,000 hours.
 - .5 Minimum luminous efficacy 50 lumens per watt (lm/W)
 - .6 Warranty - Written warranty covering repair or replacement for a minimum of five (5) years from the date of purchase. Warranty must be included with maintenance manuals and have a toll free (e.g., "800") number, or mailing address, or web site address for consumer complaint resolution and future LED replacement upgrade.

2.6 LUMINAIRES

- .1 As indicated in luminaire schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling support using chain hangers to structure in accordance with local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

3.6 LUMINAIRES IN SUSPENDED CEILINGS

- .1 Provide adequate additional chain hanger supports for all luminaires in suspended ceiling systems to approval of the Consultant, and in accordance with Ontario Electrical Safety Code Bulletin No. 30-4-4.1996.
- .2 All existing luminaires to be removed and reinstalled are to have new chain hangers provided.
- .3 Coordinate with the Architect and Ceiling Contractor to determine which ceilings have been designed and constructed to carry the weight of the luminaires, so the support chains can be eliminated. Ensure all luminaires are mechanically secured to the ceiling system with manufacturer approved clips.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525-07, Audible Signal Devices for Fire Alarm Systems, Including Accessories.
 - .3 CAN/ULC-S526-07, Visual Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC-S527-99, Standard for Control Units for Fire Alarm Systems.
 - .5 CAN/ULC-S528-05, Manual Pull Stations for Fire Alarm Systems.
 - .6 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S530-91 (R1999), Heat Actuated Fire Detectors.
 - .8 CAN/ULC-S531-02, Standard for Smoke Alarms.
 - .9 CAN/ULC-S536-04, Inspection and Testing of Fire Alarm Systems.
 - .10 CAN/ULC-S537-04, Verification of Fire Alarm Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for multiplex fire alarm system and voice communication systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings marked "Reviewed" by Contractor.
 - .2 Indicate on shop drawings:
 - .1 Detail assembly and internal wiring diagrams for control units.
 - .2 Overall system riser wiring diagram identifying control equipment, initiating zones, signaling circuits; identifying terminations, terminal numbers, conductors and raceways.
 - .3 Details for devices.
 - .4 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.
 - .5 Step-by-step operating sequence, cross referenced to logic flow diagram.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for fire alarm and voice communication systems for incorporation into manual.
- .3 Include:
 - .1 Instructions for complete fire alarm system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.
- .4 List of recommended spare parts for system.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Extra Stock Materials: submit 2 spare glass rods for manual pull box stations if applicable.

1.5 QUALITY ASSURANCE

- .1 Inspection tests to conform to: CAN/ULC-S536.
- .2 Submit inspection report, to Consultant.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- .1 Provide expansion and finish installation of Simplex 4100 ES Fire Alarm System.
- .2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general two-stage alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency or fire department.
- .3 Zoned, non-coded two stage with voice communication dual channel.
- .4 Modular in design to allow for future expansion.
- .5 Operation of system shall not require personnel with special computer skills.
- .6 System includes:
 - .1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling; master telephone microphone with necessary switches and controls.

- .2 Data Gathering Panels/Transponders with stand-alone capabilities.
 - .3 Power supplies.
 - .4 Initiating/input circuits.
 - .5 Output circuits.
 - .6 Telephone circuits.
 - .7 Auxiliary circuits.
 - .8 Amplifiers.
 - .9 Wiring.
 - .10 Manual and automatic initiating devices.
 - .11 Audible and visual signalling devices with voice reproducing capability.
 - .12 Emergency telephones.
 - .13 End-of-line resistors.
 - .14 Local and Remote annunciators displays.
 - .15 Printer Event log memory chip.
 - .16 Historic event recorder.
-
- .7 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
 - .8 Power supply: to CAN/ULC-S524.
 - .9 Audible signal devices: to CAN/ULC-S525.
 - .10 Control unit: to CAN/ULC-S527.
 - .11 Manual pull stations: to CAN/ULC-S528.
 - .12 Thermal detectors: to CAN/ULC-S530.
 - .13 Smoke detectors: to CAN/ULC-S529.
 - .14 Smoke alarms: to CAN/ULC-S531.
 - .15 Speakers: to CAN/ULC-S541.
 - .16 Regulatory requirements:

2.2 SYSTEM OPERATION: VOICE COMMUNICATION - 2 STAGE - DUAL CHANNEL

- .1 Actuation of any alarm initiating device on first stage to:
 - .1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder DVAC as per local fire authority.
 - .2 Indicate zone of alarm at central control unit and remote annunciator display.
 - .3 For Alarm signal:
 - .1 Cause audible devices throughout building to sound an alert signal
 - .2 Cause audible devices in zone of alarm to sound continuously while other audible devices throughout building sound at 20 strokes per minute.
 - .4 Transmit signal to fire department via master fire alarm box.
 - .5 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement.
 - .6 Cause fire doors and smoke control doors, if normally held open, to close automatically.

- .7 Cause elevators to return to floor of egress, or to alternate floor, as required.
- .2 Actuation of alarm initiating device on second stage to:
 - .1 Cause speakers to sound evacuation tone throughout building.
- .3 If first stage alarm is not acknowledged within 5 minutes, system to automatically go into second stage.
- .4 Possible to transmit voice message from central control unit to specific floor, group of floors, area, zone, group of zones, while maintaining alert/evacuation tone to other floors, areas, zones, by means of master microphone and speaker circuit selection switches. Activating push-to-talk switch on master microphone to silence tones and allow one-way voice messages over system speakers. Releasing microphone switch to re-activate tones on speakers unless tones have been silenced. See Appendix 'C' for required sequence of operation to be programmed by Simplex in time for training and verification.
- .5 Acknowledging alarm: indicated at central control unit.
- .6 Possible to silence signals by "alarm silence" switch at control unit, after silencing inhibit timer has timed out.
- .7 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.
- .8 Actuation of supervisory device to:
 - .1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.
 - .2 Indicate respective supervisory zone at local and remote annunciator display.
 - .3 Cause audible signal at central control unit to sound.
 - .4 Activate common supervisory sequence.
- .9 Resetting alarm supervisory device not to return system indications/functions back to normal until control unit has been reset.
- .10 Trouble on system to:
 - .1 Indicate circuit in trouble on central control unit.
 - .2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.
- .11 Troubles on system: suppressed during course of alarm.
- .12 Trouble condition on any circuit in system not to initiate alarm conditions.

2.3 CONTROL PANEL

- .1 Central control unit (CCU): Is an existing Simplex 4100ES with True Site Graphic.
 - .1 Provide expansion as required to suit new zones, signal circuit capacity and controls.

- .2 Provide programming for Sequence of Operation as shown in Appendix 'B'.
- .2 Two-way voice communication system.
 - .1 Two-way voice communication to each floor or zone: via Emergency Telephones. Master telephone and power supply: housed in central control panel, c/w flexible, coiled, self-winding, 1.5 m extension cord.
 - .2 Manual selection of telephone circuits on floor-by-floor area-by-area basis. Each telephone circuit to have own selection switch at control panel. Incoming call from remote telephone to activate call-in signal and flash circuit status indicator. Lifting master handset and operating circuit selector switch to illuminate circuit status indicator steady, and connect circuit to telephone voice channel, selected by microprocessor at control panel. Subsequent call-ins: indicated with flashing indicator at control panel, connected after their circuit selector switch is activated.
- .3 Permit announcements/voice messages to be made from remote telephone to certain area floor or whole building over system speakers, through phone/paging interface at control panel.

2.4 DATA GATHERING PANELS (DGP'S) / TRANSPONDERS

- .1 Existing panels are Simplex 4100 ES platform. Provide expansion as required. Fire control modules: distributed throughout building complex in separately enclosed units (DGP'S) and interconnected to central control unit utilizing multiplex data transmission techniques.

2.5 POWER SUPPLIES

- .1 120 V, 60 Hz as primary source of power for system.
- .2 Voltage regulated, current limited distributed system power.
- .3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.
- .4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.
- .5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.
- .6 Standby batteries: sealed, maintenance free.
- .7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.6 INITIATING / INPUT CIRCUITS

- .1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLA configuration to central control unit DGP's/transponders .
- .2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

- .3 Actuation of alarm initiating device: cause system to operate as specified in "System Operation".
- .4 Receiving circuits for supervisory, N/O devices. Devices: wired in DCLA configuration to central control unit DGP's/transponders.
- .5 Actuation of supervisory initiating device: cause system to operate as specified in "System Operation".

2.7 ALARM OUTPUT CIRCUITS

- .1 Alarm output circuit: connected to signals, speakers, wired in Class B configuration to central control unit DGP's/transponders.
 - .1 Signal circuits' operation to follow system programming; capable of sounding bells, chimes, horns continuously at 20 spm. Each signal circuit: rated at 2A, 24 V DC; fuse-protected from overloading/overcurrent.
 - .2 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.
 - .3 Speaker circuits operation: follow system programming; capable of reproducing tones and voice fed by audio channels.
 - .4 Audio channel available to each speaker circuit to be automatically and dynamically selected by system's microprocessor.
 - .5 Manual selection and operation of alarm tones to be provided on floor-by-floor area-by-area basis.
 - .6 Manual selection for emergency paging to be provided on floor-by-floor area-by-area basis.
 - .7 Proprietary evacuation control switch to be provided to shunt out automatic system programming once manual control of system has been assumed by authorized personnel.

2.8 EMERGENCY TELEPHONE CIRCUITS

- .1 Telephone circuits for connection of remote emergency telephones: wired in Class B configuration to central control unit DGP's/transponders.
- .2 Two way communication via telephone voice circuits between master telephone handset and remote telephones. Telephone circuits: controlled by CCU.
- .3 Field wiring of telephone circuits between remote handsets and CCU DGP's/transponders: supervised for open circuits and grounds.

2.9 AUXILIARY CIRCUITS

- .1 Auxiliary contacts for control functions.
- .2 Actual status indication (positive feedback) from controlled device.
- .3 Alarm and / or supervisory trouble on system to cause operation of programmed auxiliary output circuits.
- .4 Two sets of separate contacts for elevator capture (to main floor of egress and to alternate floor of egress).

- .5 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.
- .6 Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system.
 - .1 Timing circuit: controlled by CCU.
- .7 Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected.

2.10 AMPLIFIERS

- .1 Modular in construction, solid state in design, with power output of 70 V RMS, for constant voltage distribution to speaker circuits.
- .2 Continuously supervised for proper operation. Loss of power, open or short circuit on input or output of amplifier, or total amplifier failure, to activate trouble sequence at central control unit with visual indication.
- .3 Housed in central control unit DGP's/transponders. Integral power supply powered through system power supply and supported by standby batteries in case of power failure.
- .4 Riser amplifiers: housed in central control unit, with outputs connected to voice communication risers.
- .5 Standby amplifiers: at central control unit every amplifier location; sized to meet requirements of largest amplifier in that location, with automatic transfer to be on priority basis.
- .6 Amplifiers: 25% spare capacity for future expansion.

2.11 WIRING

- .1 Copper conductors.
- .2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
- .3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
- .4 To speaker circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.
- .5 To telephone circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.
- .6 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
- .7 Risers: twisted, shielded pairs, 1 h fire-rated configured to eliminate interference and cross-talk.
- .8 For wiring to new speakers, provide armoured cable in accordance with manufacturer's recommendations.

2.12 MANUAL ALARM STATIONS

- .1 Manual alarm stations: pull lever, glass rod, wall mounted surface and general alarm key switch for two stage system English signage.
- .2 Addressable manual pull station:
 - .1 Pull lever, break glass rod, surface wall mounted type, double action, 2 stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.
- .3 Provide Simplex to match existing.

2.13 AUTOMATIC ALARM INITIATING DEVICES

- .1 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 88 degrees C, rate of rise 8.3 degrees C per minute.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector base in field.
- .2 Provide Simplex to match existing.
- .3 Addressable Smoke detector: photo-electric type air duct type with sampling tubes with protective housing.
 - .1 Twistlock plug-in type with fixed base.
 - .2 Wire-in base assembly with integral red alarm LED, and terminals for remote relay.
 - .3 Simplex to match existing.
- .4 Addressable smoke detector:
 - .1 Photo-electric type.
 - .2 Electronics to communicate detector's status to addressable module/transponder.
 - .3 Detector address to be set on detector base in field.
 - .4 Simplex to match existing.

2.14 AUDIBLE SIGNAL DEVICES

- .1 Speakers: To be Simplex to match existing.
 - .1 Cone type: Recessed round and surface square as per plans.
 - .1 Fire-retardant, moistureproof.
 - .2 Multiple taps adjustable from 0.25 to 2 W.
 - .3 Frequency response: 200 to 8000 Hz.
 - .4 Provide combination strobe/speakers as shown on plans to match existing. Provide adjustable candela settings to match levels shown on plans.

2.15 REMOTE EMERGENCY TELEPHONES

- .1 Constructed of ABS material and complete with 2 m coiled cord.
- .2 Telephone cabinet: steel, red, flush surface mounted, with lockable break glass door.

2.16 END-OF-LINE DEVICES

- .1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.17 GRAPHIC DISPLAY

- .1 Update True Site Graphic.

2.18 AS-BUILT RISER DIAGRAM

- .1 Fire alarm system riser diagram: in glazed frame on black lamacoid sheet with bevelled edges, white lettering and designations, minimum size 600 x 600 mm.

2.19 ANCILLARY DEVICES

- .1 Remote relay unit to initiate fan shutdown.

2.20 SMOKE HATCH OPERATION

- .1 The following outlines the smoke hatch sequence of operation.
 - .1 On activation of fire alarm system, service elevator returns to home position and is locked out.
 - .2 Once elevator is at home position, smoke dampers can be operated by controls in corridor on floor below (ground floor damper operated by control in EVAC Centre Panel). Maintain existing hard-wired control to pushbuttons and elevator interlock.
 - .3 Opening any smoke damper causes smoke hatches to open. Provide new addressable status indication on smoke dampers and hatches and addressable control on smoke hatch release.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for fire alarm and communication systems installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

- .1 Install systems to CAN/ULC-S524 and TBS OSH Fire Protection Standard.
- .2 Install central control unit and connect to ac power supply
- .3 Install manual alarm stations and connect to alarm circuit wiring.
- .4 Locate and install detectors and connect to alarm circuit wiring. Mount detectors more than 1 m from air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.
- .5 Connect alarm circuits to main control panel.
- .6 Install signal audible devices to CAN/ULC-S525 and visual signal devices to CAN/ULC-S526 and connect to signalling circuits.
- .7 Connect signalling circuits to main control panel.
- .8 Install end-of-line devices at end of alarm and signalling circuits.
- .9 Install remote annunciator panels and connect to annunciator circuit wiring.
- .10 Install door releasing devices.
- .11 Install remote relay units to control fan shut down.
- .12 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .13 Splices are not permitted.
- .14 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- .15 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .16 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.
- .17 Install speakers and connect to speaker circuits.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and to CAN/ULC-S536 and CAN/ULC-S537.
- .2 Contractor is to supply Consultant with a list of deficiencies indicating areas installation which deviate from ULC Standards. This list will be reviewed and authorized or rejected by Consultant prior to acceptance of certificate.

- .3 All construction work must be complete before verification of fire alarm system is started. Any modifications to the fire alarm installation after the verification has been commenced will require the entire system to be reverified. Where partial occupancies occur, the fire alarm system for the area to be occupied (including control units) shall meet the requirements of this Standard. Upon system completion, those parts of the fire alarm system tested to this Standard shall be retested in accordance with the requirements of CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems, prior to the release of the Verification Report.
- .4 Inspection Certification: On completion of the inspection and when all the above conditions have been complied with, the Contractor is to provide to the Consultant:
 - .1 A verification report identical to Appendix C of CAN/ULC-S537 completed by the fire alarm manufacturer's technician. Document C1 from CAN/ULC-S537 must be signed and dated by the technician upon completion of the verification.
 - .2 A certificate of verification confirming that the inspection has been completed showing the conditions upon which such inspection and certification have been rendered.
 - .3 Proof of liability insurance for the inspection.
- .5 Magnetic Locks: Provide a letter separate from the Verification Report stating that all "Magnetic Locks have been tested and are installed and working, in accordance with OBC 3.4.6.15(4)".
- .6 Fire alarm system:
 - .1 Test device and alarm circuit to ensure manual stations, thermal and smoke detectors, sprinkler system, transmit alarm to control panel and actuate first stage alarm general alarm ancillary devices.
 - .2 Check annunciator panels to ensure zones are shown correctly.
 - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
 - .4 Addressable circuits system style DCLA:
 - .1 Test each conductor on DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of 3 signals. Correct imposed fault after completion of each series of tests.
 - .2 Test each conductor on DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the signals. Correct imposed fault after completion of each series of tests.
 - .5 Addressable circuits system style DCLB:
 - .1 Test each conductor on DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open-circuit fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of 3 signals. Correct imposed fault after completion of each series of tests.
 - .2 Test each conductor on DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near electrically most remote device on each link.

Operate Acknowledge/Silence switch after reception of each of 3 signals.
Correct imposed fault after completion of each series of tests.

- .7 Provide final PROM program re-burn for system Consultant incorporating program changes made during construction.
- .8 Provide verification reports as each Phase of work is completed (per floor basis) and provide a final overall building wide annual test and full verification at completion of project.

3.5 DEMONSTRATION

- .1 Develop and deliver on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.6 MAINTENANCE

- .1 Provide one year's free maintenance with two inspections by manufacturer during warranty period.

3.7 TESTING AND VERIFICATION

- .1 Work in general is to be completed one floor at a time to minimize disruption.
- .2 Allow for testing with the Owner's representatives and Consultant: Elevator Homing, Smoke Hatch Release, Audibility Test (1 overall building wide test) up to 4 devices per floor, Fire Fighter's handsets and full sequence of operations.

3.8 FIRE WATCH - ALTERNATIVE MEASURES FOR OCCUPANT SAFETY

- .1 In the event of any shutdown of fire protection equipment or part thereof, the Fire Department and building occupants/owner should be notified. Instructions should be posted as to alternate provisions or actions to be taken in case of an emergency. These provisions and actions should be acceptable to the Chief Fire Official and be in accordance with the accepted Fire Safety Plan.
- .2 An attempt to minimize the impact of inoperative equipment should be made (i.e. where portions of a sprinkler, fire alarm system and standpipe system are taken out of service, the remaining portions will be maintained). Assistance and direction for specific situations should be sought from the Fire Department and be in accordance with the accepted Fire Safety Plan.
- .3 Procedures to be followed in the event of shutdown of any part of a fire protection system are as follows:
 - .1 Notify the Fire Department and the monitoring station. Give your name, address and a description of the work and when you expect it to be corrected. The Fire Department should be notified in writing of shutdowns longer than 24 h;

- .2 Post notices on all floors by elevators and at entrances, stating the work and when it is expected to be completed;
- .3 Unless noted otherwise in the Fire Safety Plan, have staff or other reliable person(s) patrol the affected area(s) at least once every hour; and
- .4 Notify the Fire Department, the fire signal receiving centre, and building occupants/owner when work has been completed and systems are operational.

3.9 TEMPORARY ELECTRICAL FACILITIES DURING CONSTRUCTION

- .1 Temporary Fire Alarm Devices
 - .1 Notify the monitoring company and Owner each and every time a part of the fire alarm system is shut down and reactivated.
 - .2 Provide new temporary hard wired fire alarm detectors, pull stations and notification appliances within the construction area.
 - .1 Provide one 135 F rate-of-rise heat detector for every 465 m² (5000 ft²) of floor area.
 - .2 Provide smoke detectors in all temporary corridors spaced maximum 10m (30 ft).
 - .3 Provide a manual pull station at every exit/entrance to the construction area.
 - .4 Provide one surface mounted bell for every 560 m² (6000 ft²) of floor area.
 - .3 Use #14 AWG, AC-90 cable for temporary wiring to devices.
 - .4 Connect devices to dedicated fire alarm zones, grouped on a floor-by-floor basis. Provide zone cards as required to suit existing fire alarm panel.
 - .5 Completely verify temporary fire alarm devices any time temporary devices are added, removed or relocated.
 - .6 Once the permanent fire alarm system is operational completely remove all temporary devices and wiring. Turn devices over to the Owner.

END OF SECTION