

REPLACEMENT OF FOUR ELEVATOR CYLINDERS/PLUNGERS

700 LEIGH CAPREOL

DORVAL, QUÉBEC

SPECIFICATIONS

PROJECT NO: R.072535.001

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**Part 1            General**

**1.1                WORK COVERED BY CONTRACT DOCUMENTS**

Work of this Contract comprises of the following:

1.1 The removal and replacement of four hydraulic elevator cylinders and plungers

1.2 The addition of sprinklers and GFCI receptacles and circuit breakers.

1.3 The removal and replacement of the pump/motor and oil tank system.

1.4 Upgrading the PLC in controllers #1, 3 &4 and mounting all the controllers on independent supports. The PLC was recently replace on #2 controller.

1.5 Remove and replace the hydraulic fluid.

1.6 Remove and replace all Victaulic coupling on all piping in the machine room.

1.7 Install a new automatic oil interceptor in each elevator pit.

1.8 Remove existing cathodic protection system.

**1.2                WORK BY OTHERS**

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly in writing, any defects which may interfere with proper execution of Work.

**1.3                FUTURE WORK.**

- .1 Insure that Work avoids encroachment into areas required for future work.

**1.4                WORK SEQUENCE**

- .1 Construct Work in stages to accommodate Owner's use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.
- .3 Construct Work in stages 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.

**1.5                CONTRACTOR USE OF PREMISES**

- .1 Unrestricted use of site until Substantial Performance.

- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .4 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work.
- .5 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

**1.6 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises.

**1.7 EXISTING SERVICES**

- .1 Notify owner and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations.
- .3 Establish location and extent of service lines in area of work before starting Work.
- .4 Submit schedule to and obtain approval from Consultant for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .5 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.
- .6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .7 Record locations of maintained, re-routed and abandoned service lines.

**1.8 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.

- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

**Part 1            General**

**1.1            ACCESS AND EGRESS**

- .1      Design, construct and maintain temporary "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.

**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.

**1.2            ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1      Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

**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.

**1.5            SPECIAL REQUIREMENTS**

- .1      Carry out noise generating Work Monday to Friday from 18:00 to 07:00 hours and on Saturdays, Sundays, and statutory holidays.
- .2      Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.
- .3      Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

- .4 Keep within limits of work and avenues of ingress and egress.
- .5 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.

## **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. Obtain clearance, as instructed, for each individual who will require to enter premises.
  - .2 Obtain requisite clearance, as instructed, for each individual required to enter premises.
  - .3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
  - .4 Contractor's personnel will require satisfactory RCMP initiated security screening in order to complete Work in premises and on site.
- .3 Security escort:
  - .1 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.
  - .2 Submit an escort request to Departmental Representative at least 14 days before service is needed. For requests submitted within time noted above, costs of security escort will be paid for by Departmental Representative. Cost incurred by late request will be Contractor's responsibility.
  - .3 Any escort request may be cancelled free of charge if notification of cancellation is given at least 24 hours before scheduled time of escort. Cost incurred by late request will be Contractor's responsibility.
  - .4 Calculations of costs will be based on average hourly rate of security officer for minimum of 8 hours per day for late service request and of 4 hours for late cancellations.

## **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.

**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, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within 10 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 PROJECT MILESTONES**

- .1 Project milestones form interim targets for Project Schedule.
  - .1 Interim Certificate (Substantial Completion) within 150 calendar days of Award of Contract date.

### **1.5 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 Structural Steel.
- .6 Electrical.
- .7 Piping.
- .8 Controls.
- .9 Heating, Ventilating, and Air Conditioning.
- .10 Testing and Commissioning.
- .11 Supplied equipment long delivery items.

**1.7 PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on weekly basis 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, 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.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

.1 Not used.

**END OF SECTION**

**Part 1 General**

**1.1 ADMINISTRATIVE**

- .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.

**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 Quebec, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 10 days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

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

- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copies of 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 electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by 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 CERTIFICATES AND TRANSCRIPTS**

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

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2 SUBMITTALS**

- .1 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 operation found in work plan.
- .2 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
- .3 Submit copies of incident and accident reports.
- .4 Submit WHMIS MSDS - Material Safety Data Sheets.
- .5 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 days after receipt of comments from Departmental Representative.
- .6 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .7 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .8 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

**1.3 FILING OF NOTICE**

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

**1.4 SAFETY ASSESSMENT**

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

## **1.5 MEETINGS**

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

## **1.6 GENERAL REQUIREMENTS**

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

## **1.7 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.

## **1.8 COMPLIANCE REQUIREMENTS**

- .1 Comply with Occupational Health and Safety Act, Industrial and Commercial Establishments Regulation.
- .2 Comply with Occupational Health and Safety Regulations, 1996.
- .3 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

## **1.9 UNFORSEEN HAZARDS**

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

## **1.10 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.
  - .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.

**1.11 POSTING OF DOCUMENTS**

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

**1.12 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.

**1.13 BLASTING**

- .1 Blasting or other use of explosives is not permitted.

**1.14 POWDER ACTUATED DEVICES**

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

**1.15 WORK STOPPAGE**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 HOISTING**

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

**1.4 SITE STORAGE/LOADING**

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

**1.5 CONSTRUCTION PARKING**

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.

**1.6 SECURITY**

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

**1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in 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 manner to cause least interference with work activities.

**1.8 SANITARY FACILITIES**

- .1 Permanent facilities may be used on approval of Departmental Representative.

**1.9 CONSTRUCTION SIGNAGE**

- .1 No signs or advertisements, other than warning signs, are permitted on site.
- .2 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .3 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.

**1.10 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

**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        Within text of each specifications section, reference may be made to reference standards..
- .2        Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3        If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4        Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

**1.2            QUALITY**

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

**1.3            AVAILABILITY**

- .1        Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store 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.
- .7 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .8 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### **1.5 TRANSPORTATION**

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

#### **1.6 MANUFACTURER'S INSTRUCTIONS**

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

#### **1.7 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.

#### **1.8 CO-ORDINATION**

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

#### **1.9 REMEDIAL WORK**

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

#### **1.10 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.

#### **1.11 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 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.
- .4 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

#### **1.12 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.
- .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.



**1.13 PROTECTION OF WORK IN PROGRESS**

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

**1.14 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 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
  - .1 Structural integrity of elements of project.
  - .2 Efficiency, maintenance, or safety of operational elements.
  - .3 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 - Submittal Procedures.

**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.

**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 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .6 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .7 Restore work with new products in accordance with requirements of Contract Documents.
- .8 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1            ADMINISTRATIVE REQUIREMENTS**

- .1    Acceptance of Work Procedures:
  - .1    Contractor's Inspection: Contractor: conduct 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 submit verification that corrections have been made.
    - .2    Request Departmental Representative inspection.
  - .2    Departmental Representative Inspection:
    - .1    Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
    - .2    Contractor to correct Work as directed.
  - .3    Completion Tasks: submit written certificates in English or French that tasks have been performed as follows:
    - .1    Work: completed and inspected for compliance with Contract Documents.
    - .2    Defects: corrected and deficiencies completed.
    - .3    Equipment and systems: tested, adjusted, balanced and fully operational.
    - .4    Operation of systems: demonstrated to Owner's personnel.
    - .5    Commissioning and Decommissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and electronic copies of final Commissioning Report submitted to Departmental Representative.
    - .6    Work: complete and ready for final inspection.
  - .4    Final Inspection:
    - .1    When completion tasks are done, request final inspection of Work by Departmental Representative.
    - .2    When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
- .5    Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
- .6    Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

- .7 Final Payment:
  - .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
  - .2 When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

**1.2 FINAL CLEANING**

- .1 Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 ADMINISTRATIVE REQUIREMENTS**

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

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 FORMAT**

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

- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
  - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD.

#### **1.4 CONTENTS - PROJECT RECORD DOCUMENTS**

- .1 Table of Contents for Each Volume: provide title of project;
  - .1 Date of submission; names.
  - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

#### **1.5 AS -BUILT DOCUMENTS AND SAMPLES**

- .1 Maintain, at site for Departmental Representative one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
  - .1 Provide files, racks, and secure storage.

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
  - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

## **1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS**

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Contract Drawings and shop drawings: 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.
- .4 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

## **1.7 EQUIPMENT AND SYSTEMS**

- .1 For each item of equipment and each system include description of unit or system, and component parts.
  - .1 Give function, normal operation characteristics and limiting conditions.
  - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.



- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
  - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
  - .2 Include 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 installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 91 13 - General Commissioning (Cx) Requirements.
- .15 Additional requirements: as specified in individual specification sections.

## **1.8 MAINTENANCE MATERIALS**

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

- .4 Receive and catalogue items.
  - .1 Submit inventory listing to Departmental Representative.
  - .2 Include approved listings in Maintenance Manual.

**1.9 DELIVERY, STORAGE AND HANDLING**

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

**1.10 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.

- .9 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
  - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include HVAC balancing, commissioned systems.
  - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
    - .1 Name of item.
    - .2 Model and serial numbers.
    - .3 Location where installed.
    - .4 Name and phone numbers of manufacturers or suppliers.
    - .5 Names, addresses and telephone numbers of sources of spare parts.
    - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
    - .7 Cross-reference to warranty certificates as applicable.
    - .8 Starting point and duration of warranty period.
    - .9 Summary of maintenance procedures required to continue warranty in force.
    - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
    - .11 Organization, names and phone numbers of persons to call for warranty service.
    - .12 Typical response time and repair time expected for various warranted equipment.
  - .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
  - .5 Procedure and status of tagging of equipment covered by extended warranties.
  - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

#### **1.11 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.

- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.
  - .5 Warranty period.
  - .6 Inspector's signature.
  - .7 Construction Contractor.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED REQUIREMENTS**

- .1       All division 01, 14, 21 and 26 sections.

**1.2               ADMINISTRATIVE REQUIREMENTS**

- .1       Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of final inspection.
- .2       Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3       Preparation:
  - .1       Verify that conditions for demonstration and instructions comply with requirements.
  - .2       Verify that designated personnel are present.
  - .3       Ensure equipment has been inspected and put into operation.
  - .4       Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .4       Demonstration and Instructions:
  - .1       Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times.
  - .2       Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - .3       Review contents of manual in detail to explain aspects of operation and maintenance.
  - .4       Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

**1.3               QUALITY ASSURANCE**

- .1       When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
  - .1       Instruct Owner's personnel.
  - .2       Provide written report that demonstration and instructions have been completed.

**1.4               DEMONSTRATION AND INSTRUCTIONS**

- .1       Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated locations.
- .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.
- .5 Demonstrate start, stop, sequencing/staging of all elevator systems. Demonstrate proper integration and operation of all controls and devices.

## **1.5 TIME ALLOCATED FOR INSTRUCTIONS**

- .1 Ensure adequate amount of time required for instruction of each item of equipment or system is allowed until the entire Elevator System is functional as to the satisfaction of Consultant/Owner and as per the design intent. These instructions are over and above the routine start-up and commissioning. The training and instructions must be provided in both English and French as required.
- .2 As a minimum allow for the following in each language:
  - .1 Elevator: 8 hours
  - .2 EMCS: 8 hours;
  - .3 Electrical 8 hours;
  - .4 Total of 24 hours in each language as per the above items 1 to 4.

## **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 SUMMARY**

.1 Section Includes:

- .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to Performance & Verification of components, equipment, sub-systems, systems, and integrated systems.

**1.2 RELATED SECTIONS**

- .1 All division 01, 14, 21 and 26 sections.

**1.3 GENERAL**

- .1 Commissioning is the responsibility of this Contractor and his Sub-Contractors. Provide all services and co-ordinate the commissioning of the equipment and systems specified under this Division and those items of other Divisions (14, 21 & 26) which interact with work of this Division as outlined herein and as required.
- .2 Provide all necessary trades to carry out the commissioning of systems as required.
- .3 The Departmental Representative shall attend at their discretion and advise in the commissioning process.
- .4 Carry out additional tests as required to verify the proper operation of each piece of equipment and each system.
- .5 Retain ACCS Control-Tech for Commissioning of Controls.
- .6 Be responsible for the performance and commissioning of all equipment supplied under the Divisions 14, 21 and 26. Commissioning consists of ensuring the system's full working order to specified requirements. It is the start-up of the completed installation. The cooperation of all trades is essential for an efficient and planned process. The commissioning team comprises of the following:
  - .1 Commissioning Manager/Agent (From Contractor or Independent agent)
  - .2 Departmental Representative
  - .3 Contractor
  - .4 Divisions 14, 21 & 26
  - .5 Building Operations
  - .6 Controls sub-contractor
  - .7 Authorities Having Jurisdiction

- .7 Submit a schedule and check list for the commissioning phase of the work. This schedule shall show:
  - .1 Completion dates for each trade.
  - .2 Timing of the various phases of the commissioning, testing, balancing and demonstration process.
  - .3 Prepare a commissioning statement including each of the four (4) phases of the commissioning process. In sequence, the phases shall be:
    - .1 Phase 1 - System Readiness
    - .2 Phase 2 - System Start-up, Testing, Balancing, etc.
    - .3 Phase 3 - Verification of System Commissioning
    - .4 Phase 4 - Demonstration and Instruction
    - .5 Each Phase is applicable to each major and/or separate system making up the work in Division 14 and 21 (plus interface as applicable with all other divisions, including Div 26).
- .8 Personnel
  - .1 Assign direct overall charge of commissioning to a person fully qualified through practical experience and a comprehensive knowledge of the interactive nature of the Elevator Systems, the building systems and their controls to understand the complete system and be available to carry the project through total completion.
  - .2 This person, a Principal or an employee of the Mechanical and Electrical Contractors or hired from an outside source, shall be responsible for: commissioning, demonstration to the Departmental Representative and Authorities Having Jurisdiction.
  - .3 Submit the name, address and phone number of the Commissioning Coordinator within two months of the award of the Contract.
- .9 Schedule
  - .1 Submit a schedule, as part of the construction schedules, for the commissioning phase of the work. This schedule shall include:
    - .1 Completion dates for each trade in each major section of the building.
    - .2 Submission dates for the various documents required prior to interim certificate.
    - .3 Timing of the various phases of the commissioning.
    - .4 The name and telephone numbers of the responsible person in each trade.
- .10 Review
  - .1 Within two (2) weeks of commencing with the project work, the person having direct overall charge of commissioning shall review design intent with the Departmental Representative.
  - .2 Two (2) months prior to the date of scheduled interim certificate, submit a detailed plan identifying the orderly progression of the pre-start commissioning check and subsequent commissioning performance check of each sub-system leading up to the ultimate commissioning of entire systems.



#### **1.4 QUALITY ASSURANCE**

- .1 Provide testing organization services.
- .2 Comply with applicable procedures and standards of the AABC/CAABC.
- .3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.
- .4 The commissioning process shall be consistent with the "Code of Practice for Commissioning Mechanical Systems in Buildings".
- .5 Within ten days (10) of the award of the General Contract, supply the name, Qualifications, and experience of the commissioning coordinator for the review and approval by the Departmental Representative.
- .6 Unless specifically noted otherwise, the commissioning and balancing shall be carried out by separate companies.
- .7 Test control devices and controller PID loops.

#### **1.5 REFERENCES**

- .1 Associated Air Balance Council (AABC): National Standards For Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems.
- .2 Code of Practice for Commissioning Mechanical Systems in Buildings.
- .3 ASME/ANSI A17.1-200 Elevator Safety Code.
- .4 Refer to applicable sections for references.

#### **1.6 SUBMITTALS**

- .1 Prior to start of Work, submit name of organization and/or Contractor personnel proposed to perform commissioning services. Include the name of the person who is designated for managerial responsibilities for coordination of entire testing, adjusting, balancing and commissioning work.
- .2 Submit documentation to confirm organization and/or personnel compliance with quality assurance provision.
- .3 Submit 3 preliminary specimen copies of each of the report forms proposed for use.
- .4 Fifteen days prior to Interim Certificate, submit 3 copies of final reports on the applicable forms.
- .5 Submit reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

## **1.7 PROCEDURES - GENERAL**

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

## **1.8 VERIFICATION FORMS**

- .1 The Departmental Representative may supply sample forms to the Contractor, in addition to Commissioning agent's or Contractor's forms for testing and verification of components and systems. Sample verification forms and checklists are supplied as a guide. The Contractor shall modify forms as required to complete all testing and verification of components and systems in accordance with code and Authority Having Jurisdiction requirements and to the satisfaction of the Departmental Representative.
- .2 Fully completed forms, excluding testing and verification results data, shall be completed and submitted to the Departmental Representative for review and comment. Submit forms within two (2) weeks of shop drawing submission review.
- .3 Forms supplied by the Departmental Representative shall be completed by the Contractor (hand written) to include the following:
  - .1 Shop drawing information.
  - .2 Information from nameplates on installed equipment.
  - .3 Provide the required shop drawing information and verify the correct installations and operation of each item on these forms. Include information such as equipment/component code, location and nameplate data.
  - .4 Submit shop drawing information with related shop drawings.
- .4 Perform all component testing and verification prior to systems commissioning verification.
- .5 Complete all systems testing and verification prior to performing integrated systems testing and verification.
- .6 At completion of all testing and verification make final submission of complete signed forms.

## **1.9 MANUFACTURER'S REPORTS**

- .1 Arrange for manufacturer to submit copies of all production test records for production tests required by these specifications prior to shipping.
- .2 These production test records will be certified by the manufacturer that the item meets the testing performance criteria specified.

- .3 Arrange for manufacturer to submit a brief step-by-step description of the entire set-up and starting procedure to allow Departmental Representative to repeat starting at any time.

#### **1.10 FINAL REPORTS**

- .1 Organization having managerial responsibility shall make reports.
- .2 Ensure each form bears signature of recorder, and that of the supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

#### **1.11 CONTRACTOR RESPONSIBILITIES**

- .1 The Departmental Representative is the authority responsible for the technical review of overall commissioning including the commissioning of this contract. The Contractor is responsible to ensure that commissioned components, systems, and integrated systems work correctly as per approved design criteria and design intent and will certify their operation. The Commissioning Agent may participate in some or all of the testing and verification of building components, systems, and integrated systems. The Contractor is responsible for organizing and implementing all aspects of the Commissioning Process outlined herein. The Contractor will arrange with his suppliers and subcontractors free access for the Departmental Representative to the plants where equipment is being manufactured.
- .2 Prepare each system for testing and balancing.
- .3 Cooperate with testing organization and provide access to equipment and systems.
- .4 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .5 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

#### **1.12 PREPARATION**

- .1 Provide instruments required for testing, adjusting, and balancing operations.
- .2 Make instruments available to Departmental Representative to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify system installation is complete and in continuous operation.
- .5 Verify lighting and circuit breakers.
- .6 Verify controllers are in full operation.

**1.13 MECHANICAL SCOPE**

- .1 Test equipment, balance distribution systems, and adjust devices for all mechanical systems provided by Division 14, 21 & 26 including controls.
- .2 Schedule performance verification and commissioning of all systems affected by the elevator systems upgrade as determined by the Departmental Representative.

**1.14 ELECTRICAL SCOPE**

- .1 Schedule performance verification and commissioning of all the systems affected by the elevator systems upgrade as determined by the Departmental Representative.

**1.15 WITNESSING OF COMMISSIONING**

- .1 Prior to starting and testing of components or systems, prepare a schedule for the required testing. Review schedule and seek approval of the Departmental Representative. Also refer to the scheduling section of this commissioning specification.
- .2 Provide sufficient notice (minimum ten working days) prior to commencing tests.
- .3 Departmental Representative may witness all or any portion of testing and starting procedures performed by the Contractor.
- .4 Contractor to be present for all tests. Contractor shall coordinate and ensure that Certified representative of Elevator manufacturer, control contractor and all other trades are present during the entire commissioning process and testing.

**1.16 AUTHORITIES HAVING JURISDICTION**

- .1 Starting procedures defined in this section may duplicate verification conducted by presiding authorities. To facilitate turnover of building, call and arrange for authorities to witness procedures in a manner that avoids unnecessary duplication of tests. It shall be the responsibility of the Contractor to confirm which tests the presiding authorities may be required to attend. Confirm to Departmental Representative that the presiding authorities will be present for each test, as required.
- .2 Any costs associated with the presiding authorities attending testing during the normal business hours or during off-hours shall be the responsibility of the Contractor.
- .3 Obtain certificates of approval, acceptance and comply with rules and regulations of authorities having jurisdiction. Provide originals of all certificates to the Departmental Representative.

**1.17 CORRECTION OF DEFICIENCIES**

- .1 Correct all contract deficiencies found during commissioning.

**1.18 SYSTEMS DEMONSTRATION AND TRAINING**

- .1 Provide system demonstration and training in accordance with requirements in the contract documents. Proper operation of the elevator system including, elevator

sequencing/staging/start/stop, demand limiting of elevator, elevator operation based on least energy consumption and all aspects of the entire elevator system upgrade shall be included as part of the scope.

- .2 Training shall be conducted weekdays between 8:30 - 11:30 and 13:00 - 16:00, or as required to meet operational requirements.
- .3 Prior to issuance of the Interim Certificate of Completion, hold instructional seminars or training sessions on all equipment and systems to demonstrate the complete operation, function, care and maintenance of equipment and materials to the Departmental Representative.
- .4 Training shall be conducted in English and French. Should either French or English training not be used, provide additional training in the preferred training language of equivalent value.

#### **1.19 INSTRUCTIONAL SEMINARS**

- .1 Provide instructional seminars and training sessions including the following:
- .2 Design Philosophy: Contractor with participation of the Departmental Representative shall describe and outline the functional and design philosophy of each system. Include the following information:
  - .1 An overview of how the system is intended to operate.
  - .2 Description of the design parameters, constraints, and operational requirements.
  - .3 Description of the system operation strategies.
  - .4 Information to help in identifying and troubleshooting system problems.
- .3 Equipment:
  - .1 Contractor and equipment manufacturer representative shall present information dealing with equipment. Include the following in presentations:
    - .1 Explanation of how equipment should operate in the proposed application.
    - .2 Recommended preventative and routine maintenance.

#### **1.20 SEMINAR AND DEMONSTRATION QUESTIONS**

- .1 During demonstrations and seminars be prepared to answer all questions raised by the Departmental Representative's personnel.
- .2 If unable to provide satisfactory response to questions, provide written response to the Departmental Representative within three (3) working days.

#### **1.21 FOLLOW-UP SEMINARS**

- .1 Follow-up seminar, or seminars as required will be conducted prior to Final Certificate of Completion. Seminars shall deal with any clarifications required as a result of initial system operating experiences.

**1.22 COMMISSIONING MANUAL**

- .1 Compile test reports, verification forms, and certificates, by Division and specification section, into one Commissioning Manual.
- .2 Submit to the Departmental Representative for review, three (3) copies of draft manual two (2) weeks prior to application of Interim Certificate of Completion for the project.
- .3 Submit six (6) copies of the approved manual prior to issue of Interim Certificate of Completion.

**1.23 MAINTENANCE OF EQUIPMENT AND SERVICE CALL-BACKS**

- .1 Maintain equipment and provide equipment service call-backs. All service call-backs shall be recorded and reported to the Departmental Representative.

**1.24 MAINTENANCE MANAGEMENT SYSTEM (MMS)**

- .1 Prior to removal or modification of existing equipment from the on-site location, submit to Departmental Representative all information related to each component being removed or modified under this contract.
- .2 Submit to Departmental Representative fully completed Product Information Report Forms for all new equipment two (2) weeks prior to seeking approval for proposed component identification as specified in the Tender Documents. Departmental Representative will assign numerical numbering sequence to components and return sheets to the Contractor.
- .3 Fabricate and install new identification tags and include MMS numerical numbering sequence for all components (i.e. elevators, fans, pumps, splitters, disconnects, starters, etc.) Being installed or modified under this contract.
- .4 Complete labelling of system components prior to issuing Interim Certificate of Completion of Project.

**1.25 SCHEDULES AND THE COMPLETION OF SYSTEM INSTALLATION**

- .1 Submit to the Departmental Representative, prior to the scheduled Interim Certificate a detailed and comprehensive installation completion/start-up/testing schedule including all Contractors and Suppliers involved. The schedule shall be updated and resubmitted for review, on a bi-weekly basis, during the course of commissioning. If found to be unacceptable, the Contractor shall revise the schedule and the construction effort to suit the revised schedule. This schedule shall include but is not limited to the following items:
  - .1 Mechanical Contractor – installation and testing of elevator systems and other equipment.
  - .2 Controls Contractor - control systems, inter-wiring, building automation system.
  - .3 Air/Water Balancing Contractor and Maintenance Manual Agency.
  - .4 Electrical Contractor - connection of electrical services to equipment specified under this Mechanical Specification.
  - .5 Equipment Suppliers for start-up of equipment.

- .6 Start-up for the various pieces of equipment & systems.
- .7 Testing of the operation of the components.
- .8 Trouble shooting.
- .9 Calibration of controls.
- .10 Prove out control software.
- .11 System and equipment check out sheet completion.
- .12 Demonstration of systems and equipment.
- .13 Electrical systems as required
- .14 Any other systems necessary
- .2 At the time of the schedule submittal, also submit proposed testing recording sheets and procedures for review.
- .3 Hold regular meetings during the commissioning process. Minutes of the meeting shall be issued to all contractors involved and to the Departmental Representative.

#### **1.26 DESIGN INTENT**

- .1 Review with the Departmental Representative the design intent of the project and the intended operation.
- .2 Commission a fully automated and integrated variable speed elevator.
- .3 Full involvement and coordination by the main contractor with various manufacturer's and sub-contractors is required. In addition to the regular start-up and commissioning, a final commissioning and operation should be demonstrated during the peak cooling design day as determined by the Departmental Representative.

#### **1.27 START-UP**

- .1 Co-ordinate and supervise the start-up of the various pieces of equipment and systems. Utilize the start-up services of the manufacturer's representative. Ensure that the equipment is operating in a satisfactory manner. Check the following items:
  - .1 Direction of rotation.
  - .2 Grease and lubricants.
  - .3 Noise.
  - .4 Seals.
  - .5 Piping connections and safeties.

#### **1.28 TROUBLESHOOTING**

- .1 Resolve inter-contractor co-ordination problems. Where problems become apparent during the commissioning process, work toward the identification and resolution of these problems. The basic functions in troubleshooting are:
  - .1 What - Identification and definition of the problem.
  - .2 Why - Determination and evaluation of the causes.
  - .3 When - Determine the time available to resolve the problem.

- .4 Involve the designing authority in the review of the problem and proposed resolution.
- .5 Co-ordinate remedial action with the appropriate parties.
- .6 Evaluate the effectiveness of the remedial action.

#### **1.29 OPERATION AND TESTING**

- .1 Test the operation of the individual components and systems. Go through each step of the sequence of operation and verify that each component operates correctly. Direct and ensure that all trades involved make the required changes and adjustments to affect the proper operation of all components and systems. Document the operations and sequences. See Commissioning tests.
- .2 In conjunction with the Balancing Contractor document the performance of each component. Verify the operating point of equipment with respect to certified performance data. Review the results with suppliers.
- .3 Test record sheets shall be reviewed by the Departmental Representative prior to commencement of testing. The record sheets shall include a list of all specialist personnel, and specialized equipment required for the test to ensure that these are available on the testing date.
- .4 Carry out operational tests.

#### **1.30 DOCUMENTATION**

- .1 Provide documentation of the commissioning process for inclusion into the maintenance manuals. These are to include check out sheets, report forms, start-up certificates from Suppliers involved in start-up, documentation concerning demonstration to the Departmental Representative. Include all record and result sheets from tests specified herein.
- .2 Maintain a daily log of key operating parameters, problems encountered, solutions employed and verification of effectiveness of solutions.
- .3 Prepare detailed progress reports to coincide with regular commissioning meetings.

#### **1.31 TESTING INSTRUMENTS**

- .1 Provide two-way radios, ladders and other equipment as required to complete system and component commissioning.
- .2 Provide all safety equipment required for personnel involved in the starting, testing, adjusting, and balancing program.

#### **1.32 TESTING PERSONNEL**

Provide sufficient 'qualified' personnel to successfully test and commission components, systems, and integrated systems.



**Part 2            Products**

**2.1                NOT USED**

- .1        Not Used.

**Part 3            Execution**

**3.1                PHASE 1**

- .1        Before starting any of the separate systems provide a certificate stating that the specific system is ready for start-up and the following conditions have been met.
  - .1        All safety controls installed and fully operational (dry run test).
  - .2        Qualified personnel available to operate the plant.
  - .3        Permanent electrical connections made to all equipment.
- .2        System readings shall include, but not necessarily be limited to, the following:
  - .1        Checking system physical completion, including all instrumentation.
  - .2        Flushing, chemical cleaning (as required), charging, fluid treating (as required).
  - .3        Equipment lubrication and pre-start checks.
  - .4        Rotational checks.
  - .5        Elevator system installation approved by manufacturer. All DX systems checked for pressure and leakage.
  - .6        Control function checks, including all alarms.
  - .7        Self-diagnostic packaged control items checked.
  - .8        All deficiencies to be recorded, reviewed by the commissioning team and, subsequently corrected before proceeding to the next phase, Phase 2.

**3.2                PHASE 2**

- .1        System commissioning shall include, but not necessarily be limited to:
  - .1        Sub-system activation of all sub-systems.
  - .2        Sub-system testing and adjustment of all sub-systems.
  - .3        Major of composite system activation.
  - .4        Major or sub-system testing and adjustment.
- .2        As in the case of the System Readiness Phase, all deficiencies are to be recorded, reviewed by the commissioning team and, subsequently, corrected. The process at the point of the deficiency shall be repeated before proceeding forward.
- .3        Phase 2 is concluded when the installation is in full working order and acceptable for use. The work will include the following:
  - .1        Adjust all controls for proper operations of all elevators.

- .4 Fine Tuning
  - .1 Setting up automatic controls for accurate response and precise sequencing.
- .5 Testing
  - .1 A detailed check by a person having direct overall charge of commissioning. This check must include all items and functions to be later demonstrated to the Corporation's representatives.

### **3.3 PHASE 3**

- .1 Verification of Commissioning by the Departmental Representative shall not commence until the commissioning process Phase 2, has been totally completed. Submit test procedure completion test certificates at the time of requesting the commencement of the verification procedure. The verification process will include the demonstration of the following:
  - .1 Operation of all automatic control valves and temperature/ pressure control devices.
  - .2 Operation of all equipment and systems, under each mode of operation.
- .2 At the completion of Phase 3 the Contractor shall submit the following to the Departmental Representative:
  - .1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specifications and drawings.
  - .2 A copy of Phase 2 verification certificates provided by the specialist trades.
  - .3 Record drawings as specified.
  - .4 A letter from the testing and balancing agency certifying that all necessary data for inclusion in operating and maintenance manuals has been received.
- .3 Upon receipt of all documents and a satisfactory outcome to the verification procedure, the Departmental Representative will provide a certificate of verification for Phase 3.
- .4 Interim Certificate may, thereupon, be declared.

### **3.4 PHASE 4**

- .1 Demonstration and acceptance shall not commence until the commissioning process Phase 3 has been successfully completed - verification certificate issued and substantial performance declared. The demonstration process is a planned process requiring a pre-plan approval before commencement and a signed statement of satisfaction from the Corporation upon completion. Total performance will not be accomplished without this achievement.

### **3.5 COMMISSIONING TESTS**

- .1 Comprising of all M&E systems associated with the elevator systems upgrade as determined by Departmental Representative.

### **3.6 POST-SUBSTANTIAL PERFORMANCE VISITS**

- .1 Visit the site with the Departmental Representative at 2 weeks, 4 weeks and 8 weeks after interim certificate for a minimum period of 2 hours per site visit. Provide two additional site visits during peak cooling conditions as determined by Departmental Representative and/or weather conditions.
- .2 Review the operation of the systems.
- .3 Correct any operating problems.
- .4 Prepare a report for the Departmental Representative and owner for inclusion in the operating manuals of the problems and issues that have arisen and the corrective action.

### **3.7 TESTING OVERVIEW**

- .1 Ensure integrated system operations conform with design documents providing required and performance with proper interaction between related systems. Integrated building life safety system testing shall include both the new systems installed or modified as part of this project and existing building systems. Ensure that the elevator system operates properly.
- .2 Verify performance of components and systems operating in conjunction with one another under all conditions and modes of operation. Each system is to be operated for as long as required to complete commissioning.
- .3 Reported results of testing and procedures are checked and verified to be correct within stated tolerances. If inconsistencies appear between reported results and demonstrated values, the relevant testing procedures are repeated and adjustments made until satisfactory results are obtained. Adjustments shall be made to both systems which form part of this project and existing systems.
- .4 Reported results of testing shall clearly indicate where the existing systems require adjustments and cannot be adjusted to acceptable level of performance due to system limits.
- .5 Failure or partial failure of testing for any one system shall result in the retesting of all systems as directed by the Departmental Representative. The Contractor shall bare all costs for retesting to successfully complete the requirements of this specification.

### **3.8 GENERAL**

- .1 Restore to new condition all equipment which has been operated during the construction phase.
- .2 Permanently mark all final settings in such a manner that they cannot be eradicated or obliterated in any way.
- .3 Record all final settings and record drawings. Include 'As-Commissioned' Performance data within Operations and Maintenance Manuals.

- .4 Verify the implementation of all identification procedures as specified in the Contract Documents.
- .5 Identify systems which require testing after the facility has been handed over, accepted, and during the warranty period.
- .6 Co-ordinate commissioning activities to suit building occupants to avoid interference and disruption.

### **3.9 COORDINATION**

- .1 Integrated system testing shall not take place until the mechanical, electrical, and electronic control systems testing and commissioning has been completed and accepted by the Departmental Representative.
- .2 System testing shall not take place until operation and maintenance manuals have been reviewed and accepted by Departmental Representative.
- .3 Arrange for and confirm to Departmental Representative that the presiding authorities will be present for each test, as required. Provide a minimum of seventy-two 72 hours notice (weekend excluded).

### **3.10 RESPONSIBILITIES**

- .1 During Systems and Integrated System Testing and Fine Tuning the Departmental Representative's activities include:
  - .1 Witness integrated system performance tests under conditions simulating, to the extent possible, full and partial operating loads and emergency load conditions.
  - .2 Review recorded test results.
  - .3 Identify contract deficiencies.
  - .4 Identify repeat tests as required following correction of Contract Deficiencies.
  - .5 Provide direction during system fine tuning under test conditions to satisfy the operating requirements.
- .2 During Systems and Integrated Systems Testing and Fine Tuning the Contractor shall:
  - .1 Employ all coordination, resources, services, measures and responsibilities to execute the entire testing and commissioning program (process) without damage to building systems or components, with no disruption to the building occupant.
  - .2 Modify operating parameters of the systems to satisfy the fine tuning requirements outlined by the Departmental Representative so to ensure proper system operation. For example:
    - .1 Make adjustments which may become apparent as testing proceeds.
    - .2 Undertake modifications to suit changes as equipment settles down during the running in period.
    - .3 Documentation of results.
    - .4 Diagnosis of problems.

- .5 Correct contract deficiencies previously outstanding as well as any deficiencies identified during Systems and Integrated Systems Testing and Fine Tuning.
- .6 Fine Tuning will provide for the adjustment of the system where the integrated systems testing have shown a need, such as but not limited to:
  - .1 The upgraded elevator system.

### **3.11 COMPONENT, SYSTEM AND INTEGRATED SYSTEM TESTING**

- .1 Modify sample verification forms and checklists to suit requirements of project. Copy sample forms provided as required to complete and list the component inventory. Provide all required tools, materials, labour to complete verification forms and checklists for each new or modified existing system and for each existing system which forms part of the life safety systems within the facility.
- .2 Commission each component, system, and integrated system and complete the requirements for each test. Record all test data on verification forms, checklists and other reports. Submit reports to Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                INSTALLATION/START-UP CHECK LISTS**

- .1        Include the following data:
  - .1        Product manufacturer's installation instructions and recommended checks.
  - .2        Special procedures as specified in relevant technical sections.
  - .3        Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2        Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3        Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4        Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .5        Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

**1.2                PRODUCT INFORMATION (PI) REPORT FORMS**

- .1        Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2        Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

**1.3                PERFORMANCE VERIFICATION (PV) FORMS**

- .1        PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2        PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3        Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

#### **1.4 SAMPLES OF COMMISSIONING FORMS**

- .1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

#### **1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS**

- .1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
  - .1 Additional commissioning forms to be in same format as provided by Departmental Representative.

#### **1.6 COMMISSIONING FORMS**

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
  - .1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.
  - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
  - .3 Confirm operation as per design criteria and intent.
  - .4 Identify variances between design and operation and reasons for variances.
  - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
  - .6 Record analytical and substantiating data.
  - .7 Verify reported results.
  - .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
  - .9 Submit immediately after tests are performed.
  - .10 Reported results in true measured SI unit values.
  - .11 Provide Departmental Representative with originals of completed forms.
  - .12 Maintain copy on site during start-up, testing and commissioning period.
  - .13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual.

#### **1.7 LANGUAGE**

- .1 To suit the language profile of the awarded contract.

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**



**Part 1 General**

**1.1 SUMMARY**

- .1 Provide labour, materials, products, equipment and services necessary for the following items associated with four hydraulic elevators.:

1.1 The removal and replacement of four hydraulic elevator cylinders and plungers

1.2 The addition of sprinklers and GFCI receptacles and circuit breakers.

1.3 The removal and replacement of the pump/motor and oil tank system.

1.4 Upgrading the PLC in controllers #1, 3 & 4 and mounting all the controllers on independent supports. The PLC was recently replaced on #2 controller.

1.5 Remove and replace the hydraulic fluid.

1.6 Remove and replace all Victaulic coupling on all piping in the machine room.

1.7 Install a new automatic oil interceptor in each elevator pit.

1.8 Remove existing cathodic protection system.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA)
- .1 ASME A17.1/CSA B44 (latest edition), Safety Code for Elevators and Escalators.

**1.3 QUALITY ASSURANCE**

- .1 Permits, Inspections and Certificates: The Elevator Contractor shall obtain and pay for necessary permits as required by the elevator inspection authority, and make such tests as are called for by the regulations or such authorities are carried out. These tests shall be made in the presence of such authorities or their authorized representatives.

**1.4 SUBMITTALS**

- .1 Submit shop drawings for review.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Submit approved safety inspection report.

**1.6 REGULATORY REQUIREMENTS**

- .1 Supply equipment and do work in accordance with the latest editions of the National Building Code of Canada and ASME A17.1 /CSA B44 Safety Code for Elevators.

**Part 2 Products**

**2.1 MATERIALS AND EQUIPMENT**

- .1 Material and equipment to be CSA certified.

**2.2 PLUNGERS AND CYLINDERS**

- .1 Each hydraulic cylinder shall be replaced with a double bottom cylinder which comprises of a bottom plate and safety bulkhead with an orifice to limit the speed of a car's decent in the case of a cylinder bottom failure. The new cylinders shall be equipped with sealed PVC cylinder protection to reduce the risk of corrosion.
- .2 Each cylinder shall be constructed according to ASME 17.1 and of steel pipe of sufficient thickness and suitable for the operating pressure. The top of each cylinder shall be equipped with a cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. Each plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. Each plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder. Each plunger and cylinder shall be installed plumb and shall operate freely with minimum friction.
- .3 The new cylinders shall have the same I.D. and O.D. as the existing cylinders.
- .4 Once the new cylinder and plunger assembly is installed, the hydraulic system shall be filled with new hydraulic oil.

**2.3 CYLINDER WELLS**

- .1 The contractor shall modify the existing wells as required to ensure that the new cylinders with the PVC protective casings can be properly installed plumb.

**2.4 PUMP AND OIL TANK**

- .1 Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Oil tank shall match requirements of elevator system.

Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts

**2.5 CONTROLLER**

- .1 The PLC in controllers #1, #3, and #4 shall be replaced. The new PLC shall match the one in controller #2 which was replaced recently.

## **2.6 HYDRAULIC FLUID**

- .1 Hydraulic Fluid: Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

## **Part 3 Execution**

### **3.1 DEMOLITION**

- 1.1 Disassemble, remove, and dispose of the existing cylinder and plunger assemblies for the four hydraulic elevators.
- 1.2 Disassemble, remove, and dispose of the pump/motor and oil tank system.
- 1.3 Disassemble, remove, and dispose of the PLC in controllers #1, 3 &4.
- 1.4 Disassemble, remove, and dispose of existing hydraulic fluid.
- 1.5 Disassemble, remove, and dispose all Victaulic coupling on all piping in the machine room.
- 1.6 Disassemble, remove, and dispose existing oil interceptor in each elevator pit.
- 1.7 Disassemble, remove, and dispose existing cathodic protection system.
- 1.8 Contractor to carry on his bid a contingency of \$5,000.00 for unforeseen items during the removal of the cylinders.

### **3.2 INSTALLATION**

- .1 Perform all work as specified herein and in accordance with the latest edition of the ASME A17.1/CSA B44 Safety Code for Elevators.
  - .2 Excavate the elevator pit to accommodate installation of the new hydraulic cylinders.
  - .3 Install new hydraulic cylinders and associated plungers according to manufacturer's instructions and recommendations for hydraulic cylinder replacement.
- Install new sprinklers and GFCI receptacles and circuit breakers.
- Install new pump/motor and oil tank system.
- Install new PLC in controllers #1, 3 &4 and mounting all the controllers on independent supports.
- Install new hydraulic fluid.
- Install new Victaulic coupling on all piping in the machine room.

Install new automatic oil interceptor in each elevator pit.

### **3.3 TESTING**

- .1 After completion of the work and prior to substantial performance submit a completed test data form, signed by the person responsible for the performance of the work, certifying that the unit is complete and ready for inspection.
- .2 Provide testing as follows, as minimum, before passenger use of the elevator:
  - .1 Acceptance Testing: perform acceptance tests as required and recommended by ASME A17.1 and governing regulations and agencies.
  - .2 Operating Testing: Load elevators to rated capacity and operate continuously for a minimum of 30 minutes over full travel distance, stopping at each level and proceeding to the next.
    - .1 Perform operating tests specified above on each elevator, capacity, speed, and travel distance. Perform any additional operating tests as required by governing regulations and agencies.
- .3 Advise in advance of dates and times of elevator testing.
- .4 Should more than one inspection for a license or approval be required due to deficient work, assume the cost of the additional inspections.

### **3.4 DEMONSTRATION AND TRAINING**

- .1 Arrange with the Owner to provide training for the Owner's staff.
- .2 Include in the training, a complete review of the documentation, operation of the equipment, and demonstration of any special features.

### **3.5 ACCEPTANCE**

- .1 An Interim Certificate of Completion will not be issued until substantial performance, as defined by this Section, has been achieved.
- .2 A Final Certificate of Completion will not be issued until total performance, as defined by this Section, has been achieved.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 National Fire Prevention Association (NFPA)
  - .1 NFPA 13-2007, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 20-2007, Standard for the Installation of Stationary Pumps for Fire Protection.
  - .3 NFPA 24-2007, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
  - .4 NFPA 25-2008, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN4 S543-M984, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide shop drawings.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets, 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 Quebec, Canada.
  - .2 Indicate:
    - .1 Materials.
    - .2 Finishes.
    - .3 Method of anchorage
    - .4 Number of anchors.
    - .5 Supports.
    - .6 Reinforcement.
    - .7 Assembly details.
    - .8 Accessories.
- .4 Samples:
  - .1 Submit samples of following:
    - .1 Each type of sprinkler head.
    - .2 Signs.
- .5 Test reports:

- .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .7 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
- .8 Field Quality Control Submittals:
  - .1 Manufacturer's Field Reports: manufacturer's field reports specified.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Provide operation, maintenance and engineering data for incorporation into manual in accordance with ANSI/NFPA 20.
- .2 Manufacturer's Catalog Data, including specific model, type, and size for:
  - .1 Pipe and fittings.
  - .2 Alarm valves.
  - .3 Valves, including gate, check, and globe.
  - .4 Water motor alarms.
  - .5 Sprinkler heads.
  - .6 Pipe hangers and supports.
  - .7 Pressure or flow switch.
  - .8 Fire department connections.
  - .9 Excess pressure pump.
  - .10 Mechanical couplings.
- .3 Drawings:
  - .1 Sprinkler heads and piping system layout.
    - .1 Prepare working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
    - .2 Show data essential for proper installation of each system.
    - .3 Show details, plan view, elevations, and sections of systems supply and piping.
    - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
  - .2 Electrical wiring diagrams.
- .4 Design Data:
  - .1 Calculations of sprinkler system design.
  - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
- .5 Field Test Reports:

- .1 Preliminary tests on piping system.
- .6 Records:
  - .1 As-built drawings of each system.
    - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
    - .2 Submit drawings on reproducible Mylar film with title block similar to full size contract drawings.
- .7 Operation and Maintenance Manuals:
  - .1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for piping and other documentation for incorporation into manual in accordance with NFPA 13.

#### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: company or person specializing in wet sprinkler systems with documented experience
- .2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Provide spare sprinklers and tools in accordance with NFPA 13.

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Storage and Protection:
  - .1 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

### **Part 2 Products**

#### **2.1 DESIGN REQUIREMENTS**

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13.
- .2 Install a sprinkler at the bottom of the elevator pit in accordance with NFPA 13 (2013), Section 8.15.5.1-2.

- .3 Install a sprinkler at the top of the elevator shaft ceiling space (ceiling above ducts) in accordance with NFPA 13 (2013) 8.15.5.1.4-5.
- .4 Sprinkler design and installation shall be in accordance with ASME A17.1, Safety Code for Elevators and Escalators, paragraph 2.8.3.3.2, which includes the installation of a means to automatically disconnect the main line power supply and any other power supplies used to move the elevator upon or prior to the application of water from the sprinklers. Contractor is to provide a shop drawing of the sprinkler design following ASME A17.1 stamped by professional engineer from the province of Quebec prior to construction. Construction shall not start until review of the shop drawings.
- .5 The temperature of the sprinkler head to meet the requirements of NBC for severe intermediate temperatures.
- .6 Supply and install protection as per NBC for sprinklers in the machine room.

### **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, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

#### **3.3 ELECTRICAL CONNECTIONS**

- .1 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.

#### **3.4 FIELD QUALITY CONTROL**

- .1 Site Test, Inspection:
  - .1 Perform testing of installed sprinkler systems in accordance with local code and authorities having jurisdiction.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2.

**1.2 DEFINITIONS**

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

**1.3 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 and French.
- .4 Use one nameplate or label for both languages.

**1.4 SUBMITTALS.**

- .1 Product Data: submit WHMIS MSDS.
- .2 Shop drawings:
  - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
  - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
  - .3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .4 Submit 2 copies of drawings to the authority having jurisdiction.
  - .5 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Quality Control:
  - .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 or 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.
- .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

## **1.5 QUALITY ASSURANCE**

- .1 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.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

## **1.7 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.

## **1.8 OPERATING INSTRUCTIONS**

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

- .3 Post instructions where directed.
- .4 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction or inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .2 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.

### **2.3 WIRING TERMINATIONS**

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

### **2.4 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoid 1.5 mm thick plastic engraving sheet, colour to match existing, 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.

## **2.5 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, number and 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.

## **2.6 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 3.0 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour to match existing.

## **2.7 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 indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 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 conduits and cables as indicated on the drawings.

### **3.4 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 Panel boards: as required by Code or as indicated.

### **3.5 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as over current trips, relays and fuses are installed to required values and settings.

### **3.6 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panel boards 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 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct testing on the following systems
  - .1 Circuits originating from branch distribution panels.
  - .2 Lighting and its control.
- .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.

### **3.7 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                PRODUCT DATA**

- .1      Provide product data.

**1.2                DELIVERY, STORAGE AND HANDLING**

- .1      Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials.

**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 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted.

**2.2                ARMOURED CABLES**

- .1      Conductors: insulated, copper, size as indicated.
- .2      Type: AC90.
- .3      Armour: interlocking type fabricated from galvanized steel strip.
- .4      Connectors: anti short connectors.

**Part 3            Execution**

**3.1                FIELD QUALITY CONTROL**

- .1      Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .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      Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .2      Conductor length for parallel feeders to be identical.
- .3      Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

- .4 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.

### **3.3 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### **3.4 INSTALLATION OF ARMoured CABLES**

- .1 Group cables wherever possible on channels.
- .2 Maximum length for power connection to light fixture is 3.5 metres.

**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 CSA C22.2 No. 83-[M1985(R2003)], Electrical Metallic Tubing.

**1.2 SUBMITTALS**

- .1 Product data: submit manufacturer's printed product literature, specifications and datasheets.
  - .1 Submit cable manufacturing data.
- .2 Quality assurance submittals:
  - .1 Instructions: submit manufacturer's installation instructions.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
  - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 3 m on centre.
- .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 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.



- .1 Set-screws are not acceptable.

## **2.4 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.
- .3 Surface mounts conduits and directed by Department Representative.
- .4 Use electrical metallic tubing (EMT) except in cast concrete.
- .5 Use flexible metal conduit for connection to surface or recessed fluorescent fixtures and pot lights.
- .6 Minimum conduit size for lighting and power circuits: 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 surface/suspended 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 CLEANING**

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## 1.1 SUBMITTALS

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

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1        Equipment and installation for ground fault circuit interrupters (GFCI).

**1.2            RELATED SECTIONS**

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

**1.3            REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CAN/CSA-C22.2 No.144-M91(R2001), Ground Fault Circuit Interrupters.
- .2        National Electrical Manufacturers Association (NEMA)
  - .1        NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

**1.4            SUBMITTALS**

- .1        Submit product data and shop drawings.
- .2        Submit test report for field testing of ground fault equipment and a certificate that system as installed meets criteria specified herein.

**Part 2           Products**

**2.1            MATERIALS**

- .1        Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144 and 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 c/w test and reset facilities.

**2.3            GROUND FAULT PROTECTOR UNIT**

- .1        Self-contained with 15 A, 120 V circuit interrupter and duplex or single receptacle complete with:
  - .1        Solid state ground sensing device.
  - .2        Facility for testing and reset.
  - .3        CSA Enclosure

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Do not ground neutral on load side of ground fault relay.
- .2        Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

**3.2                FIELD QUALITY CONTROL**

- .1        Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2        Demonstrate simulated ground fault tests.

**END OF SECTION**