

Public Works and Government Services Canada
Architectural and Engineering Services
Ontario Region

**Toronto, Ontario
1 Front Street West**

ELEVATOR MODERNIZATION PROJECT

PWGSC Project No. R.049549.001

SPECIFICATIONS

Issued for Tender
2013-08-29

| | | |
|---------------------|---------------|------------------|
| PWGSC Ontario | SPECIFICATION | Section 00 00 00 |
| Region Project | TITLE SHEET | Page 1 |
| Number R.049549.001 | | 2013-08-29 |

Project Title Elevator Modernization Project

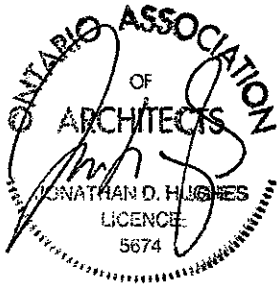
Project Number R.049549.001

Project Date 2013-08-29

PWGSC Ontario
Region Project
Number R.049549.001

PROFESSIONAL SEALS PAGE

Section 00 01 07
Page 1
2013-08-29



NORR Limited
Jonathan Hughes
Architect



Mazen AbuOmar
Mechanical Engineer



Ron Weir
Electrical Engineer

| <u>Section</u> | <u>Title</u> | <u>Pages</u> |
|--|---|--------------|
| <u>Division 01 - General Requirements</u> | | |
| 00 00 00 | TITLE SHEET | 1 |
| 00 01 07 | PROFESSIONAL SEALS PAGE | 1 |
| 00 01 11 | LIST OF CONTENTS | 2 |
| 01 11 00 | SUMMARY OF WORK | 2 |
| 01 14 00 | WORK RESTRICTIONS | 4 |
| 01 21 00 | ALLOWANCES | 2 |
| 01 29 83 | PAYMENT PROCEDURES FOR TESTING LABORATORY SERVICES | 2 |
| 01 31 16 | PROJECT MANAGEMENT AND COORDINATION | 5 |
| 01 31 19 | PROJECT MEETINGS | 3 |
| 01 32 16 | CONSTRUCTION PROGRESS SCHEDULE - BAR (GANTT) CHART | 3 |
| 01 33 00 | SUBMITTAL PROCEDURES | 6 |
| 01 35 29 | HEALTH AND SAFETY REQUIREMENTS | 6 |
| 01 35 35 | FIRE SAFETY REQUIREMENTS | 5 |
| 01 41 00 | REGULATORY REQUIREMENTS | 2 |
| 01 45 00 | QUALITY CONTROL | 4 |
| 01 51 00 | TEMPORARY UTILITIES | 3 |
| 01 52 00 | CONSTRUCTION FACILITIES | 4 |
| 01 56 00 | TEMPORARY BARRIERS AND ENCLOSURES | 3 |
| 01 61 00 | COMMON PRODUCT REQUIREMENTS | 6 |
| 01 71 00 | EXAMINATION AND PREPARATION | 2 |
| 01 73 00 | EXECUTION | 3 |
| 01 74 11 | CLEANING | 3 |
| 01 74 20 | CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL | 2 |
| 01 77 00 | CLOSEOUT PROCEDURES | 2 |
| 01 78 00 | CLOSEOUT SUBMITTALS | 7 |
| 01 79 00 | DEMONSTRATION AND TRAINING | 2 |
| 01 91 13 | GENERAL COMMISSIONING (CX) REQUIREMENTS | 11 |
| 01 91 31 | COMMISSIONING (CX) PLAN | 12 |
| 01 91 33 | COMMISSIONING FORMS | 3 |
| 01 91 41 | COMMISSIONING TRAINING | 4 |
| 01 91 51 | BUILDING MANAGEMENT MANUAL (BMM) | 5 |
| <u>Division 02 - Existing Conditions</u> | | |
| 02 82 00.01 | ASBESTOS ABATEMENT - MINIMUM PRECAUTIONS | 9 |
| 02 83 12 | LEAD - BASE PAINT ABATEMENT - MAXIMUM PRECAUTIONS | 13 |
| <u>Division 07 - Thermal and Moisture Protection</u> | | |
| 07 81 00 | APPLIED FIREPROOFING | 6 |
| 07 84 00 | FIRE STOPPING | 6 |
| 07 90 00 | JOINT SEALING | 4 |
| <u>Division 09 - Finishes</u> | | |
| 09 22 14 | FURRING AND LATHING | 4 |
| 09 23 00 | GYPSUM PLASTERING | 6 |
| 09 91 23.01 | INTERIOR RE-PAINTING | 15 |

| | | |
|---------------------|------------------|------------------|
| PWGSC Ontario | List of Contents | Section 00 01 11 |
| Region Project | | Page 2 |
| Number R.049549.001 | | 2013-08-29 |

Division 14 - Conveying Equipment

| | | |
|----------|---|----|
| 14 05 00 | ELEVATOR GENERAL PROVISIONS | 41 |
| 14 21 13 | ELECTRIC TRACTION FREIGHT ELEVATOR | 15 |
| 14 21 23 | ELECTRIC TRACTION PASSENGER ELEVATORS | 19 |
| ----- | ANNEX A - SPECIFICATIONS FOR ELEVATING DEVICES MAINTENANCE | 9 |

Division 23 - Heating, Ventilating and Air-Conditioning (HVAC)

| | | |
|-------------|--|---|
| 23 05 00 | COMMON WORK RESULTS - MECHANICAL | 5 |
| 23 05 05 | INSTALLATION OF PIPEWORK | 4 |
| 23 05 29 | HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT | 6 |
| 23 05 93 | TESTING, ADJUSTING AND BALANCING FOR HVAC | 5 |
| 23 07 15 | THERMAL INSULATION FOR PIPING | 6 |
| 23 23 00 | COPPER TUBING AND FITTINGS REFRIGERANT | 4 |
| 23 81 11 | DUCTLESS SPLIT SYSTEM A/C UNITS | 9 |
| 23 82 39.01 | UNIT HEATERS - ELECTRIC | 3 |

Division 26 - Electrical

| | | |
|-------------|---|---|
| 26 05 00 | COMMON WORK RESULTS - FOR ELECTRICAL | 5 |
| 26 05 20 | WIRE AND BOX CONNECTORS (0-1000 V) | 1 |
| 26 05 21 | WIRES AND CABLES (0-1000 V) | 1 |
| 26 05 22 | CONNECTORS AND TERMINATIONS | 1 |
| 26 05 28 | GROUNDING - SECONDARY | 2 |
| 26 05 29 | HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS | 2 |
| 26 05 31 | SPLITTERS, JUNCTION, PULL BOXES AND CABINETS | 1 |
| 26 05 34 | CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS | 3 |
| 26 12 16.01 | DRY TYPE TRANSFORMERS UP TO 600 V PRIMARY | 3 |
| 26 24 16.01 | PANELBOARDS BREAKER TYPE | 4 |
| 26 27 26 | WIRING DEVICES | 2 |
| 26 28 13.01 | FUSES - LOW VOLTAGE | 1 |
| 26 28 16.02 | MOULDED CASE CIRCUIT BREAKERS | 2 |
| 26 28 20 | GROUND FAULT CIRCUIT INTERRUPTERS - CLASS "A" | 3 |
| 26 28 23 | DISCONNECT SWITCHES - FUSED AND NON-FUSED | 1 |
| 26 50 00 | LIGHTING | 3 |

Division 27 - Communications

| | | |
|----------|---|---|
| 27 05 13 | COMMUNICATIONS SERVICES | 1 |
| 27 51 23 | INTERCOMMUNICATIONS AND PROGRAM SYSTEMS | 1 |

Division 28 - Electronic Safety and Security

| | | |
|----------|---|----|
| 28 31 00 | FIRE DETECTION AND ALARM | 5 |
| ----- | "Elevator Modernization Project - Hazardous Materials" dated July 29, 2013, prepared by exp Services Inc. | 6 |
| ----- | "Limited Asbestos & Designated Substances Survey" dated 29.06.12, prepared by exp Services Inc. | 42 |

PART 1 - GENERAL

- | | | |
|---|----|--|
| <u>1.1 PRECEDENCE</u> | .1 | For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual. |
| <u>1.2 WORK COVERED BY CONTRACT DOCUMENTS</u> | .1 | Work of this Contract comprises general renovation of elevators and elevator machinery, located at 1 Front St. Toronto, Ontario; and further identified as "Elevator Modernization Project". |
| <u>1.3 CONTRACT METHOD</u> | .1 | Construct Work under lump sum contract. |
| | .2 | Relations and responsibilities between Contractor and subcontractors are as defined in Conditions of Contract. |
| <u>1.4 COST BREAKDOWN</u> | .1 | Within 5 days of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract amount. |
| | .2 | Within 48 hours of acceptance of bid submit a list of subcontractors. |
| <u>1.5 WORK SEQUENCE</u> | .1 | Construct Work in stages to accommodate Owner's continued use of premises during construction. |
| | .2 | Coordinate Progress Schedule and coordinate 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 | For the sequence of work refer to Section 14 05 00. |
| | .5 | Maintain fire access/control. |

- | | | |
|---|----|---|
| <u>1.6 CONTRACTOR USE OF PREMISES</u> | .1 | Contractor shall limit use of premises for Work, for storage, and for access, to allow; .1 Owner occupancy. .2 Work by other contractors. .3 Public usage. |
| | .2 | Coordinate use of premises under direction of Departmental Representative. |
| | .3 | Obtain and pay for use of additional storage or work areas needed for operations under this Contract. |
| | .4 | Obtain and pay for security services required by the Contractor. |

- | | | |
|----------------------------|----|---|
| <u>1.7 OWNER OCCUPANCY</u> | .1 | Owner will occupy premises during entire construction period for execution of normal operations. |
| | .2 | Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage. |

- | | | |
|---|----|---|
| <u>1.8 ALTERATIONS TO EXISTING BUILDING</u> | .1 | Remove and recycle, compost, anaerobic digest, for reuse, or dispose of demolition materials. |
|---|----|---|

PART 2 - PRODUCTS

- | | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

- | | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .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 and scaffolding, 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.
- .5 Use only elevators, existing in building for moving workers and material.
 - .1 Protect walls of passenger elevators, to approval of Departmental Representative prior to use.
 - .2 Accept liability for damage, safety of equipment and overloading of existing equipment.
- .6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 PARKING

- .1 Parking is not available on site.
- .2 Should the Contractor require parking after normal working hours (07:00 - 18:00) the Contractor will be required to pay parking fees.

1.4 ALTERATIONS,
ADDITIONS OR
REPAIRS TO EXISTING
BUILDING

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Execute work so as not more than two elevators are down at the same time.

1.5 EXISTING SERVICES

- .1 Notify, Departmental Representative 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 7 days of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for personnel pedestrian and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00.

1.6 SPECIAL REQUIREMENTS

- .1 Regular work hours are Monday to Friday 07:00 hours to 18:00 hours.
- .2 Work will only be permitted during weekends and statutory holidays with the permission of the Departmental Representative. A minimum of 3 days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Departmental Representative.
- .3 Paint public or Departmental Representative occupied areas Monday to Friday from 18:00 to 07:00 hours only and on Saturdays, Sundays, and statutory holidays.
- .4 Carry out noise generating Work Monday to Friday from 18:00 to 07:00 hours and on Saturdays, Sundays, and statutory holidays.
- .5 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANTT) Chart.
- .6 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .7 Keep within limits of work and avenues of ingress and egress.
- .8 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.
- .9 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate, determine location of

reinforcing, service lines, pipes, conduits or other items by x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.

1.7 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.
- .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 Calculation 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 8 hours for late cancellations.

1.8 BUILDING SMOKING ENVIRONMENT

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

| | | |
|---------------------|-------------------|------------------|
| PWGSC Ontario | WORK RESTRICTIONS | Section 01 14 00 |
| Region Project | | Page 4 |
| Number R.049549.001 | | 2013-08-29 |

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 APPOINTMENT AND
PAYMENT

- .1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

1.2 CONTRACTOR'S
RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 1 - GENERAL

| | | |
|---|----|--|
| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 11 00 - Summary of Work. |
| | .2 | Section 01 91 13 - General Commissioning (CX) Requirements. |
| <u>1.2 DESCRIPTION</u> | .1 | Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other contractors, under instructions of Departmental Representative. |
| <u>1.3 PROJECT MEETINGS</u> | .1 | Schedule and administer weekly project meetings throughout progress of Work as determined by Departmental Representative. |
| | .2 | Prepare agenda for meetings. |
| | .3 | Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative. |
| | .4 | Provide physical space and make arrangements for meetings. |
| | .5 | Preside at meetings. |
| | .6 | Record minutes. Include significant proceedings and decisions. Identify action by parties. |
| | .7 | Reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants, affected parties not in attendance, Departmental Representative. |
| <u>1.4 CONSTRUCTION ORGANIZATION AND START-UP</u> | .1 | Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities. |
| | .2 | Senior representatives of Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance. |

- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 16.
 - .3 Schedule of submission of shop drawings, samples, colour chips in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00.
 - .5 Delivery schedule of specified equipment in accordance with Section 01 32 16.
 - .6 Site security in accordance with Section 01 52 00.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements (GC).
 - .8 Departmental Representative provided Products.
 - .9 Record drawings in accordance with Section 01 78 00.
 - .10 Maintenance in accordance with Section 01 78 00.
 - .11 Commissioning in accordance with Section 01 91 13.
 - .12 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 and 01 78 00.
 - .13 Monthly progress claims, administrative procedures, photographs, and holdbacks (GC).
 - .14 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00.
 - .15 Insurances and transcript of policies (GC).
- .6 Comply with Departmental Representative's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- .7 During construction coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .8 Comply with instructions of Departmental Representative for use of temporary utilities and construction facilities.
- .9 Coordinate field engineering and layout work with Departmental Representative.

1.5 ON-SITE
DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Amendments.
 - .4 Reviewed shop drawings.
 - .5 Change orders.
 - .6 Other modifications to Contract.
 - .7 Field test reports.
 - .8 Copy of approved Work schedule.
 - .9 Manufacturers' installation and application instructions.
 - .10 Labour conditions and wage schedules.
 - .11 Material Safety Data Sheets.
 - .12 Labour and Material Bonds.
 - .13 All applicable Municipal Permits.

1.6 SCHEDULES

- .1 Submit preliminary construction progress schedule in accordance with Section 01 32 16 and Commissioning Schedule in accordance with Section 01 91 13 to Departmental Representative coordinated with Departmental Representative's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by Departmental Representative.

1.7 CONSTRUCTION
PROGRESS MEETINGS

- .1 During course of Work and 2 weeks prior to project completion, schedule progress meetings bi-weekly.
- .2 Schedule separate commissioning meetings in accordance with Section 01 91 13.
- .3 Contractor, major subcontractors involved in Work and Departmental Representative are to be in attendance.
- .4 Notify parties minimum 5 days prior to meetings.
- .5 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .6 Agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.

- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

1.8 SUBMITTALS

- .1 Make submittal to Departmental Representative for review.
- .2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 and 01 91 13 for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Departmental Representative.
- .3 Submit requests for payment for review, and for transmittal to Departmental Representative.
- .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
- .5 Process substitutions through Departmental Representative.
- .6 Process change orders through Departmental Representative.
- .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative.

1.9 COORDINATION DRAWINGS

- .1 Provide information required by Departmental Representative for preparation of coordination drawings.
- .2 Review and approve revised drawings for submittal to Departmental Representative.

1.10 CLOSEOUT PROCEDURES

- .1 Notify Departmental Representative when Work is considered ready for Substantial Performance.
- .2 Accompany Departmental Representative on preliminary

inspection to determine items listed for completion or correction.

- .3 Comply with Departmental Representative's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to occupied areas.
- .4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

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

1.2 PRECONSTRUCTION MEETING

- .1 Within 10 days after award of Contract, request meeting of parties in contract to discuss and resolve administrative procedures and to discuss and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section

- 01 32 16.
- .3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.
- .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
- .6 Site security in accordance with Section 01 56 00.
- .7 Health and safety in accordance with Section 01 35 29.
- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .8 Record drawings and specifications in accordance with Section 01 33 00.
- .9 Maintenance manuals in accordance with Section 01 78 00.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and 2 weeks prior to project completion, schedule progress meetings every two weeks.
- .2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.
- .3 Notify parties minimum 5 days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.

- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

| | | |
|---------------------|------------------------|------------------|
| PWGSC Ontario | CONSTRUCTION PROGRESS | Section 01 32 16 |
| Region Project | SCHEDULE - BAR (GANTT) | Page 1 |
| Number R.049549.001 | CHART | 2013-08-29 |

PART 1 - GENERAL

1.1 DEFINITIONS

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

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit to Departmental Representative within 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 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 10 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.

1.5 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.

| | | |
|---------------------|------------------------|------------------|
| PWGSC Ontario | CONSTRUCTION PROGRESS | Section 01 32 16 |
| Region Project | SCHEDULE - BAR (GANTT) | Page 3 |
| Number R.049549.001 | CHART | 2013-08-29 |

- .6 Interior Architecture (Walls, Floors and Ceiling).
- .7 Electrical.
- .8 Controls.
- .9 Testing and Commissioning.
- .10 Supplied equipment long delivery items.
- .11 Departmental Representative supplied equipment required dates.

1.6 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.

1.7 PROJECT MEETINGS

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

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

1.2 SHOP DRAWINGS
AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario of Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 10 working days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Amount. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as

applicable:

- .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit three hard copies and one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit three hard copies and one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit three hard copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit three hard copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit three hard copies and one electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices

and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

- .15 Submit three hard copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .17 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

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

1.4 MOCK-UPS

- .1 Erect mock-ups in accordance with Section 01 45 00.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic and hard copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints:
 - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly and as directed by Departmental Representative.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Safety and Insurance Board Experience Report.

1.7 FEES, PERMITS AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.

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

PART 2 - PRODUCTS

- | | |
|---------------------|--------------|
| <u>2.1 NOT USED</u> | .1 Not Used. |
|---------------------|--------------|

PART 3 - EXECUTION

- | | |
|---------------------|--------------|
| <u>3.1 NOT USED</u> | .1 Not Used. |
|---------------------|--------------|

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA): Canada
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code 2010 (NBC):
 - .1 NBC 2010, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .3 National Fire Code 2010 (NFC):
 - .1 NFC 2010, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- .4 Province of Ontario:
 - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
 - .2 O. Reg. 490/09, Designated Substances.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal statutes and authorities.
- .5 Treasury Board of Canada Secretariat (TBS):
 - .1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=17316§ion=text.
- .6 Fire Commissioner of Canada (FCC):
 - .1 FC-301 Standard for Construction Operations, June 1982.
 - .2 FC-302 Standard for Welding and Cutting, June 1982.

Labour Program
 Fire Protection Engineering Services
 4900 Yonge Street 8th Floor
 North York, Ontario M2N 6A8

and copies may be obtained from:

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

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .2 Submit site-specific Health and Safety Plan: Within

7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

- .1 Results of site specific safety hazard assessment.
- .2 Results of safety and health risk or hazard analysis for site tasks and operations.
- .3 Measures and controls to be implemented to address identified safety hazards and risks.
- .4 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Building Emergency Procedures and Evacuation Plan in place at the site. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.
- .5 Contractor's and Sub-contractors' Safety Communication Plan.
- .6 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Facility Emergency Response requirements and procedures provided by Departmental Representative.

- .3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 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.
- .4 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .5 Submit names of personnel and alternates responsible for site safety and health.
- .6 Submit records of Contractor's Health and Safety meetings when requested.
- .7 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .8 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .9 Submit copies of incident and accident reports.

| | | |
|------------------------------------|-----|--|
| | .10 | Submit Material Safety Data Sheets (MSDS). |
| | .11 | Submit Workplace Safety and Insurance Board (WSIB)-Experience Rating Report. |
| <u>1.3 FILING OF NOTICE</u> | .1 | File Notice of Project with Provincial authorities prior to commencement of Work. |
| <u>1.4 WORK PERMIT</u> | .1 | Obtain building permits related to project prior to commencement of Work. |
| | .2 | Obtain Hot Work Permit from Building Manager. |
| <u>1.5 SAFETY ASSESSMENT</u> | .1 | Perform site specific safety hazard assessment related to project. |
| <u>1.6 MEETINGS</u> | .1 | Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. |
| <u>1.7 REGULATORY REQUIREMENTS</u> | .1 | Comply with the Acts and regulations of the Province of Ontario. |
| | .2 | Comply with specified standards and regulations to ensure safe operations at site. |
| <u>1.8 PROJECT/SITE CONDITIONS</u> | .1 | Work at site will involve contact with: <ul style="list-style-type: none"> .1 Silica in concrete, concrete block, concrete brick, stucco. .2 Mercury in switches, fluorescent light tubes, thermostats. .3 Asbestos in pipe covering, vinyl composition tiles. .4 Lead in paint. .5 PCBs in ballasts. |
| | .2 | Confined spaces in elevator shafts. |
| <u>1.9 GENERAL REQUIREMENTS</u> | .1 | Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan |

until final demobilization from site. Health and Safety Plan must address project specifications.

- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.
- .3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.10 COMPLIANCE REQUIREMENTS

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

1.11 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act for the Province of Ontario.

1.12 UNFORSEEN HAZARDS

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

1.13 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have site-related working experience specific to activities associated with abatement of lead and

asbestos containing materials.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.14 POSTING OF DOCUMENTS

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

.1 Contractor's Safety Policy.

.2 Constructor's Name.

.3 Notice of Project.

.4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).

.5 Ministry of Labour Orders and reports.

.6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.

.7 Address and phone number of nearest Ministry of Labour office.

.8 Material Safety Data Sheets.

.9 Written Emergency Response Plan.

.10 Site Specific Safety Plan.

.11 Valid certificate of first aider on duty.

.12 WSIB "In Case of Injury At Work" poster.

.13 Location of toilet and cleanup facilities.

1.15 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

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

| | | |
|----------------------|----|---|
| <u>1.16 BLASTING</u> | .1 | Blasting or other use of explosives is not permitted. |
|----------------------|----|---|

| | | |
|---|----|---|
| <u>1.17 POWDER ACTUATED DEVICES</u> | .1 | Use powder actuated devices is not permitted. |
|---|----|---|

| | | |
|---------------------------|----|--|
| <u>1.18 WORK STOPPAGE</u> | .1 | Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work. |
| | .2 | Assign responsibility and obligation to Health and Safety Coordinator and Competent Supervisor to stop or start Work when, at Health and Safety Coordinator's or Competent Supervisor's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations. |

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not used. |
|---------------------|----|-----------|

PART 1 - GENERAL

- | | | |
|-----------------------------|----|---|
| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 35 29 - Health and Safety Requirements; Fire safety plan. |
| <u>1.2 GENERAL</u> | .1 | This section specifies general requirements and procedures for fire safety. Additional requirements may be specified in individual sections elsewhere in specifications. |
| <u>1.3 REPORTING FIRES</u> | .1 | The Departmental Representative will co-ordinate arrangements for the Contractor to be briefed at the pre-construction meeting concerning Building's fire safety protocol. |
| | .2 | Building Manager will supply a copy of "Fire Safety Emergency Evacuation Plan" in effect for this building. Contractor shall comply with outlined fire safety requirements. |
| | .3 | Know location of nearest fire alarm box and telephone, including emergency phone number. |
| | .4 | Report immediately all fire incidents to Fire Department as follows: .1 activate nearest fire alarm box; or .2 telephone. |
| | .5 | Person activating fire alarm box will remain at box to direct Fire Department to scene of fire. |
| | .6 | When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify the location. |
| <u>1.4 FIRE WATCH</u> | .1 | Appoint a Fire Watch at locations where welding and soldering, torching or roofing is to take place. |
| | .2 | A dedicated Fire Watch is not required. A competent person from the workforce on site may be assigned as Fire Watch for duration of work. |
| | .3 | Assign a person who is knowledgeable in the correct use of fire extinguishers on the project. |

- .4 Have work inspected by the Fire Watch up to 1.0 hours after work stoppage for each work period.

1.5 INTERIOR AND EXTERIOR FIRE PROTECTION AND ALARM SYSTEMS

- .1 Fire protection and alarm system will not be:
 - .1 obstructed
 - .2 shut-off
 - .3 left inactive at end of working day or shift.
- .2 Fire hydrants, standpipes and hose systems will not be used for other than fire-fighting purposes unless authorized by Departmental Representative.
- .3 Provide and maintain free access to fire extinguishing equipment. Maintain exit facilities. Keep means of egress free from materials, equipment and obstructing.

1.6 FIRE EXTINGUISHERS

- .1 Supply fire extinguishers, as necessary to protect work in progress and contractor's physical plant on site.

1.7 BLOCKAGE OF ROADWAYS

- .1 Advise Departmental Representative of any work that would impede fire apparatus response. This includes violation of minimum required overhead clearance.

1.8 SMOKING PRECAUTIONS

- .1 Smoking is not permitted within areas of work or site storage.

1.9 RUBBISH AND WASTE MATERIALS

- .1 Rubbish and waste materials are to be kept to minimum.
- .2 Burning of rubbish is prohibited.
- .3 Remove all rubbish from work site at end of work day or shift or as directed.
- .4 Storage:
 - .1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.
 - .2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove from site daily or at the end of each shift.

1.10 FLAMMABLE AND COMBUSTIBLE LIQUIDS

- .1 Handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.

- .2 Flammable and combustible liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires permission of local Building Manager.
- .3 Transfer of flammable and combustible liquids is prohibited within buildings or jetties.
- .4 Transfer of flammable and combustible liquids will not be carried out in vicinity of open flames or any type of heat-producing devices.
- .5 Flammable liquids having a flash point below 38 C such as naphtha or gasoline will not be used as solvents or cleaning agents.
- .6 Flammable and combustible waste liquids, for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and Fire Department is to be notified when disposal is required.

1.11 HAZARDOUS SUBSTANCES

- .1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, will be in accordance with National Fire Code of Canada.
- .2 Obtain from local Building Manager a "Hot Work" permit for work involving welding, burning or use of blow torches and salamanders, in building or facility.
- .3 When Work is carried out in dangerous or hazardous areas involving use of heat, provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of the local Building Manager. Contractors are responsible for providing fire watch service for work on a scale established and in conjunction with Building Manager at pre-construction meeting.
- .4 Where flammable liquids, such as lacquers or urethanes are to be used, proper ventilation will be assured and all sources of ignition are to be eliminated. Building Manager is to be informed prior to and at cessation of such work.

- | | | |
|--|----|--|
| <u>1.12 WELDING, BURNING AND CUTTING</u> | .1 | Contractor performing work of this section must notify Departmental Representative in advance of commencing work. |
| | .2 | Use non-combustible shields for electric and gas welding or cutting executed within 3 m of combustible material or in occupied spaces. |
| | .3 | Place cylinders supplying gases as close to work as possible. Secure cylinders in upright position, free from exposure to sun or high temperature. |
| | .4 | Locate fire extinguishing equipment near all welding, cutting and soldering operations. |
| | .5 | Contractor's mechanics shall be properly equipped with required protective clothing, including goggles or welding hood or face mask, gloves, etc. |
| | .6 | Contractor is responsible for the protection of his work and the Departmental Representative's property. |
| | .7 | Provide Fire Watch on standby with approved fire extinguisher while burning or welding is in progress. |

- | | | |
|---|----|---|
| <u>1.13 QUESTIONS AND/OR CLARIFICATIONS</u> | .1 | Direct any questions or clarification on Fire Safety in addition to above requirements to local Building Manager. |
|---|----|---|

- | | | |
|---------------------------------|----|---|
| <u>1.14 FIRE INSPECTION</u> | .1 | Site inspections by Building Manager will be coordinated through Departmental Representative. |
| | .2 | Allow local Building Manager unrestricted access to work site. |
| | .3 | Co-operate with Building Manager during routine fire safety inspection of work site. |
| | .4 | Immediately remedy all unsafe fire situations observed by Building Manager. |

PART 2 - PRODUCTS

- | | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2010, National Fire Code of Canada (NFC) 2010 and Ontario Building Code (OBC) 2006, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

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

1.3 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.

1.4 IAQ - INDOOR AIR QUALITY

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

1.5 ACCESSIBLE DESIGN

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

1.6 TAXES

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

1.7 EXAMINATION

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

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .2 Section 01 91 13 - General Commissioning (CX)-
Requirements.

1.2 INSPECTION

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

1.3 INDEPENDENT
INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be
engaged by Departmental Representative for purpose of
inspecting and/or testing portions of Work, above and
beyond those required of the Contractor. Cost of such
services will be borne by Departmental Representative.
- .2 Provide equipment required for executing inspection
and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not
relax responsibility to perform Work in accordance with
Contract Documents.
- .4 If defects are revealed during inspection and/or
testing, appointed agency will request additional
inspection and/or testing to ascertain full degree of

defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

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

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

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

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

inspected or tested.

1.8 TESTS AND MIX
DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative and may be authorized as recoverable.

1.9 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in all locations acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.
- .6 Accepted mock-ups may remain as part of Work.
- .7 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.10 MILL TESTS

- .1 Submit mill test certificates as requested and as required of specification Sections.

1.11 EQUIPMENT AND
SYSTEMS

- .1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.
- .2 Submit Commissioning Documentation in accordance with Section 01 91 13.

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

- | | | |
|--|----|--|
| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 52 00 - Construction Facilities. |
| | .2 | Section 01 56 00 - Temporary Barriers and Enclosures. |
| <u>1.2 REFERENCES</u> | .1 | U.S. Environmental Protection Agency (EPA)/ Office of Water .1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites. |
| <u>1.3 SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00. |
| <u>1.4 INSTALLATION AND REMOVAL</u> | .1 | Provide temporary utilities controls in order to execute work expeditiously. |
| | .2 | Remove from site all such work after use. |
| <u>1.5 DEWATERING</u> | .1 | Provide temporary drainage and pumping facilities to keep excavations and site free from standing water. |
| <u>1.6 WATER SUPPLY</u> | .1 | Departmental Representative will provide continuous supply of potable water for construction use. |
| | .2 | Departmental Representative will pay for utility charges at prevailing rates. |
| <u>1.7 TEMPORARY HEATING AND VENTILATION</u> | .1 | Provide temporary heating required during construction period, including attendance, maintenance and fuel. |
| | .2 | Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted. |
| | .3 | Provide temporary heat and ventilation in enclosed |

areas as required to:

- .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10°C in areas where construction is in progress.
- .5 Ventilating:
- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, may be used. Be responsible for damage to heating system if use is permitted.
- .7 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.
- .8 Departmental Representative will pay utility charges when temporary heat source is existing building equipment.
- .9 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
- .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .10 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.8 TEMPORARY POWER
AND LIGHT

- .1 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .2 Maximum power supply of 347/600 volts, 3 phase, 60 Hz is available and will be provided for construction use at no cost. Connect to existing power supply in accordance with Canadian Electrical Code.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.9 FIRE
PROTECTION

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

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 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O121-08, Douglas Fir Plywood.
 - .3 CSA Z797-09, Code of practice for Access Scaffold.
 - .4 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.
- .3 U.S. Environmental Protection Agency (EPA)/ Office of Water
 - .1 EPA 833-R-06-004, May 2007, Developing Your Stormwater Pollution Prevention Plan - A Guide for Construction Sites.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

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

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CSA Z797.

- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platform, temporary stairs.

1.5 HOISTING

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

1.6 ELEVATORS

- .1 Designated existing elevators may be used by construction personnel and transporting of materials. Co-ordinate use with Departmental Representative.
- .2 Provide protective coverings for finish surfaces of cars and entrances.

1.7 SITE STORAGE/LOADING

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

1.8 CONSTRUCTION PARKING

- .1 Parking is not available on site.

1.9 OFFICES

- .1 Storage room can be provided on the ground floor west to be used as an office for the Contractor.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

| | | |
|---|----|---|
| <u>1.11 SANITARY FACILITIES</u> | .1 | Provide sanitary facilities for work force in accordance with governing regulations and ordinances. |
| | .2 | Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition. |
| <u>1.12 CONSTRUCTION SIGNAGE</u> | .1 | No other signs or advertisements, other than warning signs, are permitted on site. |
| | .2 | Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform 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. |
| <u>1.13 PROTECTION AND MAINTENANCE OF TRAFFIC</u> | .1 | Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative. |
| | .2 | Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs |
| | .3 | Protect travelling public from damage to person and property. |
| | .4 | Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic. |
| | .5 | Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations. |
| | .6 | Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic. |
| | .7 | Dust control: adequate to ensure safe operation at all times. |
| <u>1.14 CLEAN-UP</u> | .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.

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

| | | |
|---------------------------------------|----|---|
| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 51 00 - Temporary Utilities. |
| | .2 | Section 01 52 00 - Construction Facilities. |
| <u>1.2 INSTALLATION AND REMOVAL</u> | .1 | Provide temporary controls in order to execute Work expeditiously. |
| | .2 | Remove from site all such work after use. |
| <u>1.3 HOARDING</u> | .1 | Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures. |
| | .2 | Erect temporary site enclosure using modular freestanding fencing: galvanized, minimum 1.8 m high, chain link or welded steel mesh, pipe rail. Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys. Maintain fence in good repair. |
| <u>1.4 GUARD RAILS AND BARRICADES</u> | .1 | Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs. |
| | .2 | Provide as required by governing authorities and as indicated. |
| <u>1.5 WEATHER ENCLOSURES</u> | .1 | Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat. |
| | .2 | Design enclosures to withstand rain, wind pressure and snow loading. |

- | | | |
|---|----|---|
| <u>1.6 DUST TIGHT SCREENS</u> | .1 | Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public. |
| | .2 | Provide dust tight enclosure of fire alarm system components during dust generating work. |
| | .3 | Coordinate with building manager on by-passing fire alarm system. |
| | .4 | Maintain and relocate protection until such work is complete. |
| <u>1.7 ACCESS TO SITE</u> | .1 | Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. |
| <u>1.8 PUBLIC TRAFFIC FLOW</u> | .1 | Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public. |
| <u>1.9 FIRE ROUTES</u> | .1 | Maintain access to property including overhead clearances for use by emergency response vehicles. |
| <u>1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY</u> | .1 | Protect surrounding private and public property from damage during performance of Work. |
| | .2 | Be responsible for damage incurred. |
| <u>1.11 PROTECTION OF BUILDING FINISHES</u> | .1 | Provide protection for finished and partially finished building finishes and equipment during performance of Work. |
| | .2 | Provide necessary screens, covers, and hoardings. |
| | .3 | Confirm with Departmental Representative locations and installation schedule 10 days prior to installation. |
| | .4 | Be responsible for damage incurred due to lack of or improper protection. |

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.

1.2 REFERENCES

- .1 Within text of specifications, reference may be made to reference standards.
- .2 Conform to these standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 The cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.
- .6 OPSS Ontario Provincial Standard Specifications and OPSD Ontario Provincial Standard Drawings quoted in these specifications are available online at <http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>.

1.3 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.4 AVAILABILITY

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

1.5 METRIC SIZED MATERIALS

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

1.6 STORAGE, HANDLING AND PROTECTION

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

1.7 TRANSPORTATION

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

1.8 MANUFACTURER'S INSTRUCTIONS

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

1.9 QUALITY OF WORK

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

1.10 CO-ORDINATION

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

1.11 CONCEALMENT

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

1.12 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace

parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13 LOCATION OF FIXTURES

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

1.14 FASTENINGS

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

1.15 FASTENINGS - EQUIPMENT

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

Use resilient washers with stainless steel.

| | | |
|--|----|---|
| <u>1.16 PROTECTION OF WORK IN PROGRESS</u> | .1 | Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Departmental Representative. |
|--|----|---|

| | | |
|------------------------------------|----|---|
| <u>1.17 EXISTING UTILITIES</u> | .1 | When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic. |
| | .2 | Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service. |

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

- | | | |
|---|----|--|
| <u>1.1 EXISTING SERVICES</u> | .1 | Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings. |
| <u>1.2 LOCATION OF EQUIPMENT AND FIXTURES</u> | .1 | Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate. |
| | .2 | Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance. |
| | .3 | Inform Departmental Representative of impending installation and obtain approval for actual location. |
| | .4 | Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative. |
| <u>1.3 RECORDS</u> | .1 | Maintain a complete, accurate log of control and survey work as it progresses. |
| <u>1.4 SUBMITTALS</u> | .1 | On request of Departmental Representative, submit documentation to verify accuracy of field engineering work. |
| | .2 | Submit certificate noting those elevations and locations of completed Work that conform and do not conform with Contract Documents. |

PART 2 - PRODUCTS

- | | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

| | | |
|---------------------|-----------------|------------------|
| PWGSC Ontario | EXAMINATION AND | Section 01 71 00 |
| Region Project | PREPARATION | Page 2 |
| Number R.049549.001 | | 2013-08-29 |

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

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

1.2 MATERIALS

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

1.3 PREPARATION

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

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

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Fit Work airtight to pipes, ducts, sleeves, conduits, and other penetrations through surfaces.
- .14 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00, full thickness of the construction element.
- .15 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

| | | |
|--|----|--|
| <u>1.5 WASTE MANAGEMENT AND DISPOSAL</u> | .1 | Separate waste materials for reuse, recycling, composting and anaerobic digestion in accordance with Section 01 74 20. |
|--|----|--|

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 PROJECT
CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Provide on-site containers for collection of waste materials and debris.
- .5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.
- .6 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

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

- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .8 Clean lighting reflectors, lenses, and other lighting surfaces.
- .9 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .10 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .11 Remove dirt and other disfiguration from exterior surfaces.
- .12 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .13 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

PART 2 - PRODUCTS

- | | |
|---------------------|--------------|
| <u>2.1 NOT USED</u> | .1 Not Used. |
|---------------------|--------------|

| | | |
|---------------------|----------|------------------|
| PWGSC Ontario | CLEANING | Section 01 74 11 |
| Region Project | | Page 3 |
| Number R.049549.001 | | 2013-08-29 |

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Steel.
 - .2 Mech. demolition waste: existing fan coil units, ductwork, ductwork insulation, flex ductwork, piping, piping insulation, thermostat wiring, condensate piping, equipment hangers, and grilles.
 - .3 Electrical demolition waste: wiring, conduit, luminaires, lamps, and breakers.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
 - .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING SITES

- .1 Province of: Ontario.
 - .1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
 - .2 Telephone: 800-565-4923 or 416-323-4321.
 - .3 Fax: 416-323-4682.

- .2 Recycling Council of Ontario: 215 Spadina Avenue, #225,
Toronto, ON, M5T 2C7.
- .1 Telephone: 416-657-2797
- .2 Fax: 416-960-8053
- .3 Email: rco@rco.on.ca.
- .4 Internet: <http://www.rco.on.ca/>.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

- .1 Government Chief Responsibility for the Environment.
- | Province | Address | General
<u>Inquiries</u> | Fax |
|----------|---------|-----------------------------|-----|
|----------|---------|-----------------------------|-----|

| | | | |
|---------|---|---|-------------------|
| Ontario | Ministry of Environment and Energy 135 St Clair Avenue West Toronto, ON M4V 1P5 Environment Canada Toronto, ON | (416) 323-4321 (800) 565-4923 (416) 734-4494 | (416) 323-4682 |
|---------|---|---|-------------------|

PART 1 - GENERAL

1.1 INSPECTION AND
DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by Fire Commissioner, utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to the building's personnel.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

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

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 91 13 - General Commissioning (CX)- Requirements.
- .2 Section 01 79 00 - Demonstration and Training.

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.3 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and

identify subject matter of contents.

- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide CAD files in dwg format on USB drive.

1.4 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 addresses, and telephone numbers of Contractor with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .6 Training: Refer to Section 01 79 00.

1.5 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Amendments.

- .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
 - .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
 - .5 Keep record documents and samples available for inspection by Departmental Representative.
 - .6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work.
 - .7 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

1.6 RECORDING
ACTUAL SITE
CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible

features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Amendments and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.8 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and

maintenance instructions.

- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination 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 45 00 and 01 91 13.
- .15 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items

in Work.

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

1.11 MAINTENANCE MATERIALS

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

1.12 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.14 WARRANTIES AND
BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 91 13 - General Commissioning (CX) Requirements.
- .2 Section 01 91 31 - Commissioning Plan.

1.2 DESCRIPTION

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

1.3 QUALITY CONTROL

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

1.4 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with Section 01 91 13.
- .2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance

manuals for use in demonstrations and instructions.

1.5 PREPARATION

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

1.6 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled agreed upon times, at the designated location.
- .2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .3 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

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 PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Sections:
 - .1 Section 01 91 31 - Commissioning (CX) Plan.
 - .2 Section 01 91 33 - Commissioning Forms.
 - .3 Section 01 91 41 - Commissioning Training.
 - .4 Section 01 91 51 - Building Management Manual (BMM).
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to

enhance performance to meet environmental or user requirements.

- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.
- .4 AFD managed projects the term Departmental Representative in Cx specifications to be interpreted as AFD Service Provider.

1.3 COMMISSIONING OVERVIEW

- .1 Section 01 91 31.
- .2 For Cx responsibilities refer to Section 01 91 31.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .6 Departmental Representative will issue Certificate of Substantial Performance when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the un-functional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions

or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
 - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental

Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33.
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 16 and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days' notice prior to commencement.
- .2 Departmental Representative to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel

where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

- .4 Qualifications of manufacturer's personnel:
- .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
- .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
- .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be removed from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP
DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND
MAINTENANCE OF
EQUIPMENT AND
SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF
COMMISSIONING

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS/
EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.20 COMMISSIONING
PERFORMANCE
VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING
COMMISSIONING

- .1 Departmental Representative to witness activities and verify results.

1.22 AUTHORITIES
HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.23 COMMISSIONING
CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before

issuance of the Certificate of Substantial Performance, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION
OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF
VERIFICATION

- .1 Laboratory areas:
 - .1 Provide manpower and instrumentation to verify up to 100% of reported results.
- .2 Elsewhere:
 - .1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.
- .3 Number and location to be at discretion of Departmental Representative.
- .4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .5 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .6 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT
VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS
AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.

- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 TRAINING

- .1 In accordance with Section 01 91 41.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited

with Departmental Representative.

- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE
VERIFICATION
TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/-10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/-2% of recorded values.

1.36 OWNER'S
PERFORMANCE TESTING

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

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 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 33 - Commissioning Forms.
 - .3 Section 01 91 41 - Commissioning Training.
 - .4 Section 01 91 51 - Building Management Manual (BMM).

1.2 REFERENCES

- .1 American Water Works Association (AWWA).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2010, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2010, Standard for the Installation of Standpipe and Systems.
 - .3 NFPA 20-2010, Standard for the Installation of Stationary Fire Pumps for Fire Protection.
- .3 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.
- .4 Underwriters' Laboratories of Canada (ULC).

1.3 GENERAL

- .1 Provide a fully functional facility:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to

implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O&M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements.

.5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

.6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.

.2 BMM - Building Management Manual.

.3 EMCS - Energy Monitoring and Control Systems.

.4 MSDS - Material Safety Data Sheets.

.5 PI - Product Information.

.6 PV - Performance Verification.

.7 TAB - Testing, Adjusting and Balancing.

.8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 95% completed before added into Project Specifications.

.2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:

.1 Approved shop drawings and product data.

.2 Approved changes to contract.

.3 Contractor's project schedule.

.4 Cx schedule.

.5 Contractor's, sub-contractors', suppliers' requirements.

.6 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.5 REFINEMENT OF
CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 6 weeks during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION,
ROLES AND
RESPONSIBILITIES OF
CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.
- .3 Departmental Representative is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.
 - .4 Witnessing and certifying TAB and other tests.
 - .5 Developing BMM.
 - .6 Ensuring implementation of final Cx Plan.
 - .7 Performing verification of performance of installed systems and equipment.
 - .8 Implementation of Training Plan.
- .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for

construction/installation in accordance with contract documents, including:

- .1 Testing.
- .2 TAB.
- .3 Performance of Cx activities.
- .4 Delivery of training and Cx documentation.
- .5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.
- .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
- .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-to-day operation and maintenance of facility.

1.7 CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
- .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
- .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
- .4 Specialist Cx agency:
 - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
- .5 Client: responsible for intrusion and access security systems.
- .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
 - .1 Modify ventilation rates to meet changes in off-gassing.
 - .2 Changes to heating or cooling loads beyond scope of EMCS.
 - .3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.

- .4 Redistribution of electrical services.
- .5 Modifications of fire alarm systems.
- .6 Modifications to voice communications systems.
- .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

- .1 Cx Structural and Architectural Systems:
 - .1 Architectural and structural:
 - .1 Beam and slab deflection.
 - .4 Accessibility and operational safety.
 - .3 Vertical transportation systems:
 - .1 Passenger elevators.
 - .2 Freight elevators.
 - .4 Doors, related hardware:
 - .1 New door hardware.
- .2 Commission electrical systems and equipment:
 - .1 Low voltage below 750 V:
 - .1 Low voltage equipment.
 - .2 Low voltage distribution systems.
 - .2 Lighting systems:
 - .1 Lighting equipment.
 - .2 Emergency lighting systems, including battery packs.
 - .3 Fire alarm systems, equipment:
 - .1 Annunciators.
 - .2 Control panels.
 - .3 Fire alarm battery banks.

1.9 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets.
 - .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 DELIVERABLES
RELATING TO THE CX
PROCESS

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Tests performed by Owner/User.
 - .10 Training Plans.
 - .11 Cx Reports.
 - .12 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

1.11 PRE-CX
ACTIVITIES AND
RELATED
DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor all of these pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
 - .6 Departmental Representative will monitor some

of these inspections and tests.

.7 Include completed documentation in Cx report.

- .2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:
 - .1 Slab and beam deflection test: test after removal of temporary supports and concrete has cured to ensure adequacy for raised floors.
 - .2 Vertical transportation:
 - .1 Passenger and freight elevators.
 - .3 Doors, related hardware:
 - .1 Door hardware.
- .3 Pre-Cx activities - ELECTRICAL:
 - .1 Lighting systems:
 - .1 Emergency lighting systems:
 - .1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
 - .2 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Departmental Representative has witnessed and certified report, demonstrate devices and zones to Departmental Representative.

1.12 START-UP

- .1 Startup components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, equipment and systems.
- .3 Departmental Representative to monitor all of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
 - .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
 - .5 Departmental Representative reserves right to verify up to 30% of reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup

and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

- .1 Cx to be performed by specified Cx specialist, using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Tests to be witnessed by Departmental Representative and documented on approved report forms.
- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental Representative for review.
- .4 Departmental Representative reserves right to verify percentage of reported results.
- .5 Integrated systems to include:
 - .1 Fire alarm systems.
- .6 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, Property Manager and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.15 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33.

1.16 PRODUCT INFORMATION (PI) REPORT FORMS .1 Refer to Section 01 91 33.

1.17 PERFORMANCE VERIFICATION (PV) REPORT .1 Refer to Section 01 91 33.

1.18 DELIVERABLES RELATING TO ADMINISTRATION OF CX .1 General:
.1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.19 CX SCHEDULES .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
.1 Design criteria, design intents.
.2 Pre-TAB review: 28 days after contract award, and before construction starts.
.3 Cx agents' credentials: 60 days before start of Cx.
.4 Cx procedures: 3 months after award of contract.
.5 Cx Report format: 3 months after contract award.
.6 Discussion of heating/cooling loads for Cx: 3 months before start-up.
.7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
.8 Notification of intention to start TAB: 21 days before start of TAB.
.9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
.10 Notification of intention to start Cx: 14 days before start of Cx.
.11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
.12 Identification of deferred Cx.
.13 Implementation of training plans.
.14 Cx of smoke management/control systems: after Cx of related systems is completed and 7

1.20 CX SCHEDULE
FOR ELECTRICAL
SYSTEMS

- days before proposed date of Cx these systems.
- .15 Cx stair shaft pressurization systems:
at same time as emergency evacuation exercises.
- .16 Cx reports: immediately upon successful
completion of Cx.
- .17 Emergency evacuation exercises: after at
same time as Cx of stair shaft pressurization
systems.
- .2 Detailed training schedule to demonstrate no
conflicts with testing, completion of project and
hand-over to Property Manager.
- .3 6 months in Cx schedule for verification of
performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into
Construction Schedule.
- .3 Contractor, Contractor's Cx agent, and Departmental
Representative will monitor progress of Cx against this
schedule.
- .1 Systems to be tested as required by codes:
 - .1 Where testing is required as part of a regulatory
process and where Cx procedures are developed and are
appropriate to project, perform tests as required by
such codes.
 - .2 Departmental Representative to witness these
tests as part of Quality Assurance role.
- .2 Produce a schedule of Cx activities in a bar chart
format to a scale that will ensure legibility. Bar chart
to indicate:
 - .1 Sequences of testing equipment and systems,
interrelationship between tests, duration of tests and
training periods.
 - .2 Cx resources which will be committed to this
project to ensure completion by prescribed dates.
 - .3 Training plan.
 - .4 Cx documentation plan.
- .3 Distribution system:
 - .1 Testing and Cx to be defined in construction
specifications.
- .4 Emergency lighting systems:
 - .1 Perform tests by interrupting normal power.
 - .2 Thereafter verify adequacy of coverage.
- .5 Fire alarm systems:
 - .1 Verify operation of these systems after aspects
of life safety and security systems are complete.
 - .2 Testing to be monitored by Departmental
Representative and include complete verification in
accordance with ULC requirements.

.3 After receipt by Departmental Representative of Cx Report, Cx specialist to demonstrate devices and zones to Cx Manager, Project Manager and Property Manager.

.6 Cx requirements to be included in construction specifications.

1.21 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.22 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
 - .3 Full-scale emergency evacuation exercises.

1.23 TESTS TO BE PERFORMED BY OWNER/USER

- .1 None is anticipated on this project.

1.24 TRAINING PLANS

- .1 Refer to Section 01 91 41.

1.25 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 31 - Commissioning (CX) Plan.
 - .3 Section 01 91 41 - Commissioning Training.
 - .4 Section 01 91 51 - Building Management Manual (BMM).

1.2
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.

1.3 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.

1.4 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.

1.5 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.

1.6 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.

1.7 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 in accordance with Section 01 91 51.

1.8 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 Section Includes:
 - .1 This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 31 - Commissioning (CX) Plan.
 - .2 Section 01 91 33 - Commissioning Forms.
 - .4 Section 01 91 51 - Building Management Manual (BMM) .

1.2 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

- .1 Departmental Representative will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis and trouble-shooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.
 - .5 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.

- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.
 - .8 Trouble-shooting diagnosis.
 - .9 Inter-action among systems during integrated operation.
 - .10 Review of O&M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.9 VIDEO-BASED TRAINING

- .1 Manufacturer's videotapes/DVDs/Blu-ray to be used as training tool with Departmental Representative's review and written approval 3 months prior to commencement of scheduled training.
- .2 On-Site training videos:
 - .1 Videotape or record training sessions for use during future training.
 - .2 To be performed after systems are fully commissioned.
 - .3 Organize into several short modules to permit incorporation of changes.
- .3 Production methods to be professional and high quality.

PART 2 - PRODUCTS

| | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

| | | |
|---------------------|----|-----------|
| <u>3.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.
- .2 Related Sections:
 - .1 Section 01 91 13 - General Commissioning (CX) Requirements.
 - .2 Section 01 91 31 - Commissioning (CX) Plan.
 - .3 Section 01 91 33 - Commissioning Forms.
 - .4 Section 01 91 41 - Commissioning Training.
- .3 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 HVAC - Heating, Ventilation and Air Conditioning.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.
 - .7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

- .1 Standard letter size paper 216 mm x 279 mm.
- .2 Methodology used to facilitate updating.
- .3 Drawings, diagrams and schematics to be professionally developed.
- .4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.3 APPROVALS

- .1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.4 GENERAL INFORMATION

- .1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:
 - .1 Complete list of names, addresses, telephone and fax numbers of Contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.

.2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.

.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.

.3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.

.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.

.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.

.6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.

.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.

.8 Operating and maintenance manual - Section 3.2 of BMM.

.9 Final commissioning plan as actually implemented.

.10 Completed commissioning checklists.

.11 Commissioning test procedures employed.

.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

- .1 For detailed requirements refer to Section 01 78 00.
- .2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.
- .3 Include original manufactures brochures and written information on products and equipment installed on this project.
- .4 Record and organize for easy access and retrieval of information contained in BMM.
- .5 Include completed PI report forms, data and information from other sources as required.
- .6 Inventory directory relating to information on installed systems, equipment and components.
- .7 Approved project shop-drawings, product and maintenance data.

- .8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.
- .9 Inventory and location of spare parts, special tools and maintenance materials.
- .10 Warranty information.
- .11 Inspection certificates with expiration dates, which require on-going re-certification inspections.
- .12 Maintenance program supporting information including:
 - .1 Recommended maintenance procedures and schedule.
 - .2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

- .1 Samples of LSC Manual will be available from Departmental Representative.
- .2 Content of Manual:
 - .1 All possible Emergency situations modes including: presence of fire and smoke, power failure, loss of water or pressure, chemical spills and refrigerant release.
 - .2 Failure of elevators and escalators.
 - .3 HVAC emergencies and fuel supply failures.
 - .4 Intrusion and security breach.
 - .5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.
 - .6 Dedicated emergency generators for high security projects, medical facilities and computer systems.
 - .7 Emergency control procedures for fire, power and major equipment failure.
 - .8 Emergency contacts and numbers.
 - .9 Manual to be readily available and comprehensible to non-technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

- .1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:
 - .1 General:
 - .1 Finalized commissioning plan.
 - .2 WHMIS information manual.
 - .3 Approved "as-built" drawings and specifications.
 - .4 Procedures used during commissioning.
 - .5 Cross-Reference to specification sections.
 - .2 Architectural and structural:

- .1 Inspection certificates, construction permits.
 - .2 Roof anchor log books.
 - .3 PV reports.
 - .3 Fire prevention, suppression and protection:
 - .1 Test reports.
 - .2 Smoke test reports.
 - .3 PV reports.
 - .4 Mechanical:
 - .1 Installation permits, inspection certificates.
 - .2 Piping pressure test certificates.
 - .3 Ducting leakage test reports.
 - .4 TAB and PV reports.
 - .5 Charts of valves and steam traps.
 - .6 Copies of posted instructions.
 - .5 Electrical:
 - .1 Installation permits, inspection certificates.
 - .2 TAB and PV reports.
 - .3 Electrical work log book.
 - .4 Charts and schedules.
 - .5 Locations of cables and components.
 - .6 Copies of posted instructions.
- .2 Assist Departmental Representative with preparation of BMM.

1.8 IDENTIFICATION OF FACILITY

- .1 When submitting information to Departmental Representative for incorporation into BMM, use following system for identification of documentation:
 - .1 (1) Building; (2) Integrated systems; (3) Systems; (4) Sub-systems; (5) Components; (6) Control points for components.

1.9 USE OF CURRENT TECHNOLOGY

- .1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.
- .2 Obtain Departmental Representative's approval before starting 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 SUMMARY

- .1 Comply with requirements of this Section when performing following work:
 - .1 Removing non-friable asbestos-containing materials, other than ceiling tiles, if the material is installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated at locations indicated in "Limited Asbestos & Designated Substances Survey".
 - .2 Break, cut, grind, sand, drill, scrape, vibrate or abrade non-friable asbestos containing materials using non-powered hand-held tools, and the material is wetted to control the spread of dust or fibres.
 - .3 Removing less than one square metre of drywall in which joint-filling compounds that are asbestos containing materials have been used.

1.2 SECTION INCLUDES

- .1 Requirements and procedures for asbestos abatement of non-friable asbestos-containing materials, ceiling tile removal of less than 7.5 square metres, and less than one square metre of drywall with asbestos containing joint compound.

1.3 REFERENCES

- .1 Department of Justice Canada (JUS)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .3 O. Reg. 278/05, Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.
- .4 O. Reg. 490/09, Designated Substances.
- .5 A Guide to the Regulations respecting Asbestos on Construction Projects and in Buildings and Repair Operations released in November 2007, <http://www.labour.gov.on.ca/english/hs/asbestos/index.html>.
- .6 "Limited Asbestos & Designated Substances Survey", dated 29.06.12 and prepared by exp

Services Inc. Survey report is attached at the end of specifications.

1.4 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Amended Water: water with nonionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.
- .3 Asbestos-Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.
- .4 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.
- .5 Authorized Visitors: Engineers, Consultants or designated representatives, and representatives of regulatory agencies.
- .6 Competent worker person: in relation to specific work, means a worker who:
 - .1 Is qualified because of knowledge, training and experience to perform the work.
 - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
 - .3 Has knowledge of all potential or actual danger to health or safety in the work.
- .7 Friable material: means material that:
 - .1 When dry, can be crumbled, pulverized or powdered by hand pressure, or
 - .2 is crumbled, pulverized or powdered.
- .8 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .9 Occupied Area: any area of the building or work site that is outside Asbestos Work Area.
- .10 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

- .11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial and/or local requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.
- .6 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.
- .7 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial, and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications, more stringent requirement applies. Comply with regulations in effect at time Work is performed.
- .2 Health and Safety:
 - .1 Perform construction occupational health and safety in accordance with Section 01 35 29.
 - .2 Safety Requirements: worker protection.
 - .1 Protective equipment and clothing to

be worn by workers while in Asbestos Work Area include:

.1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.3 Before leaving Asbestos Work Area, the

worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.4 Facilities for washing hands and face shall be provided within or close to the Asbestos Work Area.

.5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are located as indicated on drawings.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .4 Separate for reuse and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
 - .7 Fold up metal banding, flatten and place in designated area for recycling.
 - .8 Disposal of asbestos waste generated by removal
-

activities must comply with Federal, Provincial, and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick (6 mil) bags or leak proof drums. Label containers with appropriate warning labels.

- .9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.8 EXISTING CONDITIONS

- .1 Refer to "Limited Asbestos & Designated Substances Survey".
- .2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

1.9 SCHEDULING

- .1 Hours of Work: perform work involving asbestos abatement outside of normal working hours. Include in Contract Sum additional costs due to this requirement.

1.10 OWNER'S INSTRUCTIONS

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, following minimum requirements:
 - .1 Fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by a competent, qualified person.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Drop Sheets:
 - .1 Polyethylene: 0.15 mm thick.
 - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.
- .3 Waste Containers: contain waste in two separate containers.
 - .1 Inner container: 0.15 mm thick sealable polyethylene waste bag.
 - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
 - .3 Labelling requirements: affix pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .5 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

PART 3 - EXECUTION

3.1 PROCEDURES

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.
 - .2 Before beginning Work, isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.
 - .1 Remove visible dust from surfaces in the
-

- work area where dust is likely to be disturbed during course of work.
- .2 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.
 - .3 Do not use compressed air to clean up or remove dust from any surface.
- .3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
- .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.
- .4 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.
- .1 Use garden reservoir type low - velocity fine - mist sprayer.
 - .2 Perform Work to reduce dust creation to lowest levels practicable.
 - .3 Work will be subject to visual inspection and air monitoring.
 - .4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .5 Frequently and at regular intervals during Work and immediately on completion of work:
- .1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and
 - .2 Drop sheets to be wetted and placed in a waste container as soon as practicable.
- .6 Cleanup:
- .1 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.
 - .2 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.
 - .3 Seal waste bags and remove from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal Authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous
-

nature of material to be dumped and that the appropriate guidelines and regulations for asbestos disposal are followed.

.4 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
 - .1 Removal of lead based paint from walls ceilings, as indicated on drawings and in "Limited Asbestos & Designated Substances Survey", using power tools with an effective dust collection system equipped with HEPA filter.
 - .2 Abrasive blasting of lead based paint on walls, ceilings, and as indicated.
 - .3 Removal of lead-containing dust using air mist extraction system.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Z180.1-00(R2005), Compressed Breathing Air and Systems.
- .2 Department of Justice Canada
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .3 Health Canada
 - .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- .4 Human Resources and Social Development Canada (HRSDC)
 - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
- .5 Ontario Ministry of Labour
 - .1 O. Reg 490/09, Designated Substances as amended by O. Reg. 148/12 and O. Reg. 149/12.
- .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .7 U.S. Environmental Protection Agency (EPA)
 - .1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.
- .8 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational

Safety and Health (NIOSH)

.1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).

.9 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances

.1 Lead in Construction Regulation - 29 CFR 1926.62-1993.

.10 Underwriters' Laboratories of Canada (ULC)

.11 "Limited Asbestos & Designated Substances Survey", dated 29.06.12 and prepared by exp Services Inc. Survey report is attached at the end of specifications.

1.3 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.2 Authorized Visitors: Departmental Representative or designated representatives of regulatory agencies.

.3 Occupied Area: area of building or work site outside Work Area.

.4 Dioctyl Phthalate (DOP) Test: testing method used to evaluate particle penetration and air flow resistance properties of filtration materials - HEPA filter leak test.

.5 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Appropriate capacity for scope of work.

.6 Airlock: ingress or egress system without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.

.7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other

sheet along opposite vertical side of doorway.
.2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.
.3 Overlap each polyethylene sheet at openings 1.5 m on each side.

- .8 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre of air calculated as an 8-hour time-weighted average (TWA). Maximum precautions for lead abatement are based on airborne lead concentrations greater than 1.25 milligrams per cubic meter of air within Work Area.
- .9 Competent person: individuals capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.
- .10 Lead in Dust: wipe sampling on the vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.
- .11 Negative Air Pressure Machine: extracts air directly from work area and filters extracted air through a HEPA filter, discharge air to exterior of building.
 - .1 Maintain pressure differential of 5 to 7 Pa relative to adjacent areas outside of work areas. Machine to be equipped with alarm to warn of system breakdown, and equipped with instrument to continuously monitor and automatically record pressure differences.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.
- .3 Provide: Provincial and local requirements for Notice of Project Form.
- .4 Provide proof of Contractor's General and Environmental Liability Insurance.

- .5 Quality Control:
 - .1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof it has been received and properly disposed.
 - .2 Provide proof satisfactory to Departmental Representative that employees had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.
 - .3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.
- .6 Product data:
 - .1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
 - .1 Encapsulants.
 - .2 Amended water.
 - .3 Slow drying sealer.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead, in case of conflict among those requirements or with these specifications the more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
 - .1 Require construction work to be in compliance with the occupational health and safety regulations in 01 35 29.
 - .2 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Lead Work Area includes:
 - .1 Leads removal using power tool: respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering

contaminated areas.

.2 Abrasive blasting of lead paint: NIOSH approved and equipped with filter cartridges with assigned protection factor of 1000, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Respirator to be equivalent Type CE abrasive blast supplied air respirator operated in a pressure demand or positive pressure mode with a tight-fitting full-face-piece. Compressed air used to supply supplied air respirators to meet breathing air purity requirements of CAN/CSA-Z180.1. Where an oil-lubricated compressor is used to supply breathing air, a continuous carbon monoxide monitor/alarm to be provided.

.3 Disposable protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.

.2 Requirements for workers:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment

from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not use this system as means to leave or enter Work Area.

- .3 Eating, drinking, chewing, and smoking are not permitted in Work Area.
- .4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.
- .5 Ensure workers wash hands and face when leaving Lead Work Area. Facilities for washing are located as indicated on drawings.
- .6 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
- .7 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.
- .8 Visitor Protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
 - .2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm thick bags or leak proof drums. Label containers with appropriate warning labels.
- .4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.7 EXISTING CONDITIONS

- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are available for inspection at Departmental Representative's offices.
- .2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.8 SCHEDULING

- .1 Not later than 10 days before beginning Work on this Project notify the following in writing; where appropriate.
 - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
 - .2 Provincial Ministry of Labour.
 - .3 Disposal Authority.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide Departmental Representative copy of notifications prior to start of Work.
- .4 Hours of Work: perform work involving lead abatement outside of normal working hours. Include in Contract Sum additional costs due to this requirement.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Polyethylene 0.15 mm unless otherwise specified; in sheet size minimize joints.
- .2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

- .5 Lead waste containers: metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.
 - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

PART 3 - EXECUTION

3.1 SUPERVISION

- .1 Approved Supervisor must remain within Work Area during disturbance, removal, or handling of lead based paints.

3.2 PREPARATION

- .1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Departmental Representative.
- .2 Work Area:
 - .1 Shut off and isolate HVAC system to prevent lead dust and particulate dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
 - .2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
 - .3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.
 - .4 Install negative pressure machine system and operate continuously from installation of polyethylene sheeting until completion of final cleanup. Provide automatic continuous monitoring and recording instrument of pressure difference.
 - .5 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
 - .6 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.
 - .7 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.
 - .8 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as

follows where number in parentheses indicates font size to be used:

- .1 CAUTION LEAD HAZARD AREA (25 mm).
 - .2 NO UNAUTHORIZED ENTRY (19 mm)
 - .3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
 - .4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).
 - .9 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.
 - .10 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.
 - .11 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.
- .3 Worker Decontamination Enclosure System:
- .1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:
 - .1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of the suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.
 - .2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.
- .4 Construction of Decontamination Enclosures:
- .1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.
 - .2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through

doorway, one of two closure comprising doorway always remains closed.

.3 Shower room in decontamination facility to be provided with the following:

.1 Hot and cold water or water of constant temperature not less than 40 degrees Celsius or more than 50 degrees Celsius.

.2 Individual controls inside to regulate water flow and temperature.

.4 Prior to each shift in which a decontamination facility is being used, a competent person should inspect the facility to ensure that there are no defects that would allow lead-containing dust to escape. Defects should be repaired before the facility is used. The decontamination facility should be maintained in a clean and sanitary condition.

.5 Separation of Work Areas from Occupied Areas:

.1 Barriers between Work Area and occupied area to be constructed as follows:

.1 Construct floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting and seal with duct tape. Apply 9 mm plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.

.2 Cover plywood with polyethylene sheeting and sealed with duct tape.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in tidy condition.

.2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.

.3 Visually inspect enclosures at beginning of each working day.

.4 Use smoke test method to test effectiveness of barriers as directed by Departmental Representative.

3.3 LEAD - BASE PAINT ABATEMENT

.1 Removal of lead based paint to be performed using power tools that are attached to dust-collecting vacuums with HEPA filters.

.2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.

.3 Wet method to be used to reduce dust generation. Examples of wet methods include wetting surfaces,

wet scraping, and wet shovelling. Wet method not be used if it creates a hazard or cause damage to equipment or to project. Power tools to be equipped with a shroud, and to be kept flush with surface.

- .4 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove immediate from working area to staging area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .5 After completion of stripping work, wire brush and wet sponge surface to remove visible material. During this work keep surfaces wet. After wire brushing and wet sponging, wet clean and HEPA vacuum entire work area including Equipment and Access Room. Compressed air or dry sweeping not be used to clean up lead-containing dust or waste. After inspection and approval by Departmental Representative apply continuous coat of slow drying sealer to surfaces. Do not disturb work area for 8 hours, no entry, activity, or ventilation other than operation negative air machine during this period.
- .6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

3.4 INSPECTION

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from requirements not been approved in writing by Departmental Representative will result in Work shutdown, at no cost to Owner.
- .2 Departmental Representative will inspect work for:
 - .1 Adherence to specific procedures and materials.
 - .2 Final cleanliness and completion.
 - .3 No additional costs will be allowed for additional labour or materials required to provide specified performance level.

- .3 When lead dust leakage from Work Area occurs Departmental Representative will order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 LEAD SURFACE SAMPLING - WORK AREAS

- .1 Final lead surface sampling conducted as follows:
 - .1 After Work Area has passed a visual inspection for cleanliness approved by Departmental Representative and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Departmental Representative will perform lead wipe sampling in Work Area.
 - .1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.
 - .2 If wipe sampling results show levels of lead dust in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
 - .3 Repeat as necessary until lead dust levels are less than 40 micrograms per square foot.

3.6 FINAL CLEANUP

- .1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.
- .3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Clean-up Work areas, Equipment and Access Room, and other contaminated enclosures.
- .5 Remove sealed waste containers and equipment used in Work and remove from work areas at appropriate

time in cleaning sequence.

- .6 Conduct final check to ensure no dust or debris remain on surfaces as result of dismantling operations.

3.7
RE-ESTABLISHMENT OF
OBJECTS AND SYSTEMS

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

PART 1 - GENERAL

1.1 REFERENCES

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

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Samples: submit duplicate 300 x 300 mm size sample of exposed fireproofing for approval of texture and colour.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00.
 - .1 Test Reports:
 - .1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
 - .2 Submit test results in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
 - .3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit

manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company, person specializing in sprayed-on fireproofing with 5 years documented experience and approved by manufacturer.
- .2 Mock-ups:
 - .1 Construct mock-up in accordance with Section 01 45 00.
 - .2 Apply fireproofing to approximately 10 m2 area of surface to be treated.
 - .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
 - .4 Locate where directed.
 - .5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with fireproofing work.
 - .6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.
- .3 Site Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations, with Contractor's representative and Departmental Representative in accordance with Section 01 31 19 and 01 32 16 to:
 - .1 Verify Project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Prior to start of Work arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work.
 - .3 Hold project meetings every week.
 - .4 Ensure key personnel, site supervisor, project manager, subcontractor representatives attend.
 - .5 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.4 DELIVERY,
STORAGE AND
HANDLING

- .4 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver packaged materials in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
 - .3 Damaged or opened containers will be rejected.
 - .4 Packaging to indicate shelf-life and materials to be applied prior to expiration of shelf-life.
 - .5 Provide temporary enclosures to prevent spray from contaminating air beyond application area.
 - .6 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 AMBIENT
CONDITIONS

- .1 At temperatures less than 5°C, ensure that 5°C air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.
- .2 Maintain relative humidity within limits recommended fireproofing manufacturer.
- .3 Ensure that natural ventilation to properly dry fireproofing during and subsequent to its application

is provided.

- .4 In enclosed areas lacking openings for natural ventilation, provide minimum of 4 air exchanges per hour by forced air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Sprayed fireproofing: ULC certified cementitious or asbestos-free mineral fibre fireproofing qualified for use in ULC Designs specified and fungus resistant for 28 days.
- .2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.
- .3 Sealer: type recommended by fireproofing manufacturer, qualified for use in ULC Design specified.
 - .1 Colour: as selected by Departmental Representative from manufacturer's standard range.
- .4 Fireproofing: minimum dry density and cohesion/adhesion properties as follows:
 - .1 Fireproofing for structural components concealed above ceiling, or within wall, chase, or furred space: minimum applied dry density of 240 kg per cubic meter and cohesion/adhesion strength of 9.57 kPa.
 - .2 Fireproofing for exposed structural components, except where otherwise specified or indicated: minimum applied dry density of 350 kg per cubic meter and cohesion/adhesion strength of 20.83 kPa.
 - .3 Fireproofing for structural components located in mechanical rooms and storage areas: minimum applied dry density of 640 kg per cubic meter and cohesion/adhesion strength of 350 kPa.
 - .4 Ensure spray-applied fireproofing: does not crack, spall or delaminate under downward deflection conditions over 3 m clear span.
 - .5 Minimum compressive strength: 48 kPa.
 - .6 Spray-Applied fireproofing material: not contribute to corrosion of test panels.
 - .7 Dust removal: not exceed 0.25 gram per square meter.

PART 3 - EXECUTION

3.1 MANUFACTURER'S
INSTRUCTIONS

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

3.2 PREPARATION

- .1 Substrate: free of material, which would impair bond.
- .2 Verify that painted substrates are compatible and have suitable bonding characteristics to receive fireproofing.
- .3 Remove incompatible materials.
- .4 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.
- .5 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

3.3 APPLICATION

- .1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.
- .2 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide fire resistance ratings as indicated.
- .3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.
- .4 Apply fireproofing directly to open web joists without use of expanded lath.
- .5 Tamp smooth, surfaces visible in finished work as indicated.
- .6 Apply curing compound to surface of cementitious fireproofing as required by manufacturer.
- .7 Apply sealer to surface of mineral fibre fireproofing as required by manufacturer in ventilation plenums, where fireproofing is to be painted, and as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .2 Inspection and Site Tests:
 - .1 Inspection and testing of fireproofing will be carried out by Testing Laboratory designated by Departmental Representative.
 - .2 Departmental Representative will pay costs for testing, as specified in Section 01 29 83.

3.5 PATCHING

- .1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
- .2 Clean surfaces not indicated to receive fire- proofing of sprayed material within 24 hours period after application.
- .3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

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

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product

literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00.

.1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.2 All fire stopping material shall be from one manufacturer.

.3 All fire stopping installation work for entire project shall be by a single contractor experienced in fire stopping. Individual disciplines shall NOT fire stop their own work.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 and 01 32 16 to:

.1 Verify project requirements.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building subtrades.
- .4 Review manufacturer's installation instructions and warranty requirements.
- .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
 - .2 Fire stop system rating: F.
- .2 Service penetration assemblies: systems tested to CAN/ULC-S115.

- .3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating

onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

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

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

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

accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

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

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separation.
 - .9 Rigid ducts: greater than 129 cm², when specifically permitted by the fire damper manufacturer's detailed installation instructions, fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C920-14, Standard Specification for Elastomeric Joint Sealants.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

1.2 ENVIRONMENTAL CHOICE PROGRAM

- .1 Provide sealant products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-45-92 for Sealants and Caulking Compounds, except maximum VOC 60 g/L during application and curing.
- .2 For primers and sealants, indicate VOC in g/L during application and curing.

1.3 PRODUCT DATA

- .1 Submit manufacturer's literature indicating recommended surface preparation, sealant selection and primer for each substrate in accordance with Sections 01 33 00 and 01 78 00.

PART 2 - PRODUCTS

2.1 SEALANTS

- .1 Provide sealant products bearing Ecologo to ECP/PCE-45-92 with maximum VOC 60 g/L.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Silicones One Part '3'.
 - .1 To ASTM C920, primerless, Type S, Grade NS, Class 50, SWRI validated.
- .2 Acrylic Latex One Part '5'.
 - .1 To CAN/CGSB-19.17-M90.

- .3 Acoustical Sealant '6'.
 - .1 One part silicone to ASTM C920, primerless, Type S, Grade NS, Class 25, SWRI validated.
- .4 Preformed compressible and non-compressible back-up materials '10', CFC free.
 - .1 Polyethylene, urethane, neoprene or vinyl foam. Extruded open or closed cell foam backer rod. Size: oversize 30 to 50%.
 - .2 Neoprene or butyl rubber. Round solid rod, Shore A hardness 70.
 - .3 High density foam. Extruded closed cell polyvinyl chloride (PVC) or extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m3 density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond breaker tape. Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

- .1 Control and expansion joints on the interior of exterior poured-in place concrete walls: Designation 3.
- .2 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: Designation 3.
- .3 Interior control and expansion joints in floor surfaces: Designation 10.
- .4 Perimeters of interior frames, as detailed: Designation 3.
- .5 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Designation 3.
- .6 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Designations 5, 6.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: to manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION OF JOINT SURFACES

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.2 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.3 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape with approximately 30% compression.

3.4 MIXING

- .1 Mix materials in accordance with sealant manufacturer's instructions.

3.5 APPLICATION

- .1 Ventilate interior spaces during application and curing of sealants to maintain VOCs less than 50 g/l. Coordinate with building manager to ensure existing ventilation system or temporary ventilation supplies sufficient outside air.

- .2 Sealant.
 - .1 Protect installed work of other trades from staining or contamination.
 - .2 Apply sealant in accordance with manufacturer's application manual and written instructions.
 - .3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint. remove tape after sealant applied.
 - .4 Apply sealant in continuous beads.
 - .5 Apply sealant using gun with proper size nozzle.
 - .6 Use sufficient pressure to fill voids and joints solid.
 - .7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .8 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .3 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .4 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 09 23 00: Gypsum plaster.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C841-03(2013), Standard Specification for Installation of Interior Lathing and Furring.
 - .2 ASTM C847-12, Standard Specification for Metal Lath.
 - .3 ASTM C933-13, Standard Specification for Welded Wire Lath.
 - .4 ASTM C1032-06(2011), Standard Specification for Woven Wire Plaster Base.
 - .5 ASTM C1047-10a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .6 ASTM C1063-13, Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA)
 - .1 CSA 123.3-05(R2010), Asphalt Saturated Organic Roofing Felt.
- .4 Environmental Choice Program (ECP)
 - .1 ECP-69-94, Polyethylene Plastic Film Products.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert furring and lathing accessories scraps and cut-offs made from metal, plastic and PVC from landfill by disposal at nearest appropriate recycling facility.
- .2 Divert metal cut-offs from landfill by disposal at nearest metal recycling facility.
- .3 Divert reusable materials for reuse at nearest used building materials facility or similar type facility.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Metal furring (channels, hangers, tie wire, inserts, anchors): to ASTM C841.
 - .1 Steel: minimum 25% recycled content.
- .2 Metal lath: to ASTM C933, of type and weight to suit plaster system and support spacing. Steel: minimum 25% recycled content.
- .3 Polyethylene film: to CAN/CGSB-51.34, Type 2, 0.15 mm thick.
- .4 Metal accessories (corner beads, base screeds, cornerite, casing beads): to ASTM C1047.
 - .1 Steel: minimum 25% recycled content.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Use galvanized supports, members, angles and metal lathing in wet areas, exterior walls and exterior soffits.
- .2 Do not lath over bucks, anchors, blocking, electrical and mechanical work until they are inspected and approved by Departmental Representative.
- .3 Leave finished work rigid, secure, square, level, plumb, and erected to maintain finish plaster line dimensions and contours. Make allowance for thermal movement.
- .4 Provide clearance under beams and structural slabs to prevent transmission of structural loads to vertical furring.

3.2 INSTALLATION

- .1 Furring and lathing work: in accordance with ASTM C841 except as specified otherwise.
- .2 Wall Furring.
 - .1 Install steel furring for walls.
 - .2 Frame openings and around built-in equipment, access panels, on four sides, with channels. Extend furring into reveals. Check clearances with equipment suppliers.

.3 Construct bulkheads and boxed-in duct shafts, for beams, columns, pipes and around exposed services where indicated. Install 19 mm channels at corners and at 300 mm o.c.

.4 Build in hollow metal frames in plastered furred walls.

.3 Metal Lathing.

.1 Apply metal lath taut. Locate end joints over framing members; stagger end joints on alternate courses; on vertical surfaces lap lower sheet over upper sheet.

.2 Install ribbed lath over chases and openings. Extend 450 mm each side of opening.

3.3 CONSTRUCTION

.1 Install 150 x 450 mm metal lath strips diagonally at each corner of openings exceeding 0.1 m², in masonry, gypsum lath and rigid insulation substrates.

.2 Apply cornerite to internal angles to be plastered except at suspended ceilings. Fasten to retain position during plastering. Do not secure to framing members.

.3 Lath across junctures of dissimilar materials to be plastered with strip of metal lath at least 200 mm wide.

.4 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 220 mm o.c.

.5 Install corner beads on external angles.

.6 Install casing beads at perimeter of suspended plaster ceilings; wherever plaster abuts or joins a dissimilar exposed surface such as masonry, concrete, wood, metal; where edges of plaster are exposed; where plaster on a non-structural member butts plaster on a structural member; and elsewhere as indicated.

.7 Install metal screeds at top of bases and dados.

.8 Construct control joints of two back-to-back casing beads set in plaster or accordion pleated metal accessory supported independently on both sides of joint.

.9 Provide continuous polyethylene air seal behind and across expansion/contraction joints.

.10 Locate control joints at butting structural elements, at dissimilar walls and ceilings, at wall juncture with suspended ceilings, at changes in substrate

| | | |
|---------------------|---------------------|------------------|
| PWGSC Ontario | FURRING AND LATHING | Section 09 22 14 |
| Region Project | | Page 4 |
| Number R.049549.001 | | 2013-08-29 |

construction, over control joints in block walls, at line of door jambs from top of door frame to ceiling, at approximate 9 m spacing on long corridor runs, at maximum 7.5 m spacing in each direction on ceilings, at building expansion and construction joints.

- .11 Install control joints straight and true.
- .12 Install rings and frames for electrical and mechanical fixtures.
- .13 Rigidly secure rings and frames to furring and lathing systems.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C28/C28M-10, Standard Specification for Gypsum Plasters.
 - .2 ASTM C35-01(2009), Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.
 - .3 ASTM C206-03(2009), Standard Specification for Finishing Hydrated Lime.
 - .6 ASTM C631-09, Standard Specification for Bonding Compounds for Interior Gypsum Plastering.
 - .7 ASTM C841-03(2013), Standard Specification for Installation of Interior Lathing and Furring.
 - .8 ASTM C842-05(2010)e1, Standard Specification for Application of Interior Gypsum Plaster.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Environmental Choice Program (ECP)
 - .1 CCD-126-95, Polyethylene Plastic Film Products.
- .4 Health Canada/ Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Underwriters' Laboratories of Canada (ULC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum plaster materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit duplicate 300 x 300 mm samples of plaster finishes.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

1.3 QUALITY ASSURANCE

- .1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Ensure materials remain in original wrapping and containers until used.
 - .2 Deliver lath and plaster products to job site just prior to application.
 - .3 Deliver fresh plaster as needed to job site.
- .3 Storage and Handling Requirements:
 - .1 Store gypsum plastering materials off ground, indoors, in dry location away from heavy traffic areas and in accordance with manufacturer's recommendations.
 - .2 Store and protect bagged goods from direct contact with rain, snow, splashing water, wet or damp surfaces, condensation and absorption from the atmosphere.
 - .3 Stack plaster bags on planks or platforms away from damp floors and walls.
 - .4 Store gypsum plaster bases flat on clean dry floor.
 - .5 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.5 SITE CONDITIONS

- .1 Site Requirements:
 - .1 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of materials.
- .2 Ambient Conditions:
 - .1 Ventilation:

- .1 Provide free circulation of air to carry off excess moisture.
- .2 Mechanically remove moisture laden air in areas lacking normal ventilation.
- .3 Protect plaster from vent drafts, heaters or windows, to avoid uneven drying.
- .4 Avoid excessive ventilation or air movement to allow plaster to properly set.
- .5 Screen exterior openings in building.
- .2 Temperature:
 - .1 Do not apply plaster to surfaces containing frost.
 - .2 Maintain temperature above 13 degrees C for 48 hours prior to erection of gypsum plaster base, prior to and during application of plaster, and for 48 hours following installation of plaster or until plaster is dry.
 - .3 Distribute heat well to areas.
 - .4 Prevent irregular heat on plaster near source by providing deflection or protective screens.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Basecoat plasters:
 - .1 Gypsum mill aggregated plaster: to ASTM C35.
 - .2 Gypsum bonding plaster: to ASTM C28/C28M.
- .2 Finishing plaster:
 - .1 Hydrated finishing lime:
 - .1 Type S: to ASTM C206.
 - .2 Soaked overnight in water above 10 degrees C.
 - .2 Gypsum gauging plaster:
 - .1 To ASTM C28/C28M.
 - .2 Add to lime putty in proportion of 1 part dry gauging plaster by volume to 3 parts lime putty by volume.
 - .3 Grounds:
 - .1 Wooden strips, corner beads, metal casing beads applied at perimeter of all openings.
 - .2 Set over metal lath to obtain minimum 15.9 mm plaster thickness from face of lath.
 - .4 Screeds: install plumb and level to allow for 2.4 mm finish coat.
- .3 Sand, Perlite, or Vermiculite aggregate for use in basecoat plasters: to ASTM C35.
- .4 Water:
 - .1 Clean, fresh, potable.

.2 Free from mineral and organic substances which affect plaster set.

.3 Minimum required for plaster of workable consistency.

.4 20 degrees C.

.5 Polyethylene film:

.1 CAN/CGSB-51.34, Type 2.

.2 EcoLogo certified to CCD-126.

.6 Bonding agent: to ASTM C631.

2.2 MIXES

.1 Mix plasters to ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum plastering installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Prepare surfaces to receive plaster to ASTM C841.

.2 Ensure grounds, screeds, beads and accessories are in place and conduits, pipes, cables and outlets are properly plugged, capped or covered before starting work.

.3 Where plaster butts exposed masonry walls, insert 1 m wide strip of polyethylene before applying plaster to protect masonry. Cut polyethylene neatly at junction with plaster when plastering is completed.

.4 Do not plaster adjacent to aluminum or finished work until such work is masked.

.5 Apply bonding agent to concrete and bonding plaster to masonry surfaces in accordance with manufacturer's written instructions.

3.3 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Do plastering work to ASTM C842.
- .3 Apply plaster finish level and plumb to variation of 3 mm maximum in 2.5 m in any plane.
- .4 Use 3 coats plaster.
- .5 Form small vee groove where plaster finish is flush with bases, window frames, glazed wall tiles or similar construction.
- .6 Basecoat Plaster:
 - .1 12.7 mm thick.
 - .2 Mix by hand or with mechanical mixer, following manufacturer's directions.
 - .3 Wet unit masonry surfaces.
 - .4 Treat monolithic concrete with application of plaster bonder before plastering.
 - .5 Fur and lath interior surface of exterior masonry or monolithic concrete walls prior to plastering.
 - .6 Apply scratch (first) coat with sufficient materials and pressure to form good full keys on metal lath, and good bond on other bases.
 - .7 Cross rake.
 - .8 Apply brown (second) coat after first coat has set firm and hard.
 - .9 Bring out to grounds and straighten to a true surface with rod and darby without use of additional water.
 - .10 Leave surface rough to receive finish (third) coat.
 - .11 Cut base coats free of bucks, frames and grounds to allow for movement. Cut plaster free of electrical outlet boxes and other opening.
 - .12 Mix fireproofing plaster basecoats using perlite or vermiculite aggregate.
- .7 Finishing Plaster:
 - .1 Mix in accordance with applicable bag mixing instructions.
 - .2 Add 0.014 m3 of perlite fines per 45.4 kg of gauging plaster, or use mill-aggregated "quality" gauging plaster.
 - .3 Trowel Finish Coats:
 - .1 Scratch plaster in thoroughly and immediately double back to fill out to smooth, dense surface for decoration, free of surface blemishes and irregularities.
 - .2 Apply 2.4 mm (maximum) finish coat.

- .3 Trowel plaster after set to achieve dense, hard, smooth surface.
- .4 Float Finish Coats:
 - .1 Scratch plaster in thoroughly and immediately double back to a true, even surface.
 - .2 Float using a wood, sponge, or rubber float to bring aggregate to surface to produce finish of uniform texture free of slick spots, cat faces, and other blemishes.
 - .3 Use water sparingly on natural colour and no water on coloured finishes.
- .5 Machine-Applied Spray Finishes:
 - .1 Apply initial coat of finish by hand.
 - .2 Float to uniform texture surface to provide background.
 - .3 Apply plaster in uniform spray pattern to produce texture approved by Departmental Representative.
- .6 Finish Coat: leave brown coat properly roughened and open as well as partially dry (green state) to receive finish coat.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 SCHEDULES

- .1 Carry basecoat on fire rated columns and partitions to underside of structure.
- .2 Apply finish coat plaster to exposed plaster surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 The Master Painters Institute (MPI)
 - .1 Maintenance Repainting Manual 2004, Master Painters Institute (MPI), including Identifiers, Evaluation, Systems, Preparation and Approved Product List.
- .2 Environmental Protection Agency (EPA)
 - .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.

1.2 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Qualified journeypersons as defined by local jurisdiction to be engaged in repainting work.
 - .2 Apprentices: may be employed provided they work under the direct supervision of qualified journeyperson in accordance with applicable trade regulations.
- .2 Conform to latest MPI requirements for interior repainting work including cleaning, preparation and priming.
- .3 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners and solvents) shall be in accordance with the latest edition of the MPI Approved Product List and shall be from a single manufacturer for each system used.
- .4 Paint materials such as linseed oil, shellac, reducers and turpentine shall be the highest quality product of an approved manufacturer listed in MPI Maintenance Repainting Manual and shall be compatible with other coating materials as required.
- .5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
- .6 Standard of Acceptance: when viewed using final

lighting source surfaces shall indicate the following:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface.

.3 Final coat to exhibit uniformity of colour and sheen across full surface area.

.7 Mock-ups: construct mock-ups in accordance with Section 01 45 00.

.1 Provide a mock-up in accordance with requirements of Section 01 45 00 to Departmental Representative and Paint Inspection Agency.

.2 Prepare and repaint mock-up designated interior room, surface or item to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Maintenance Repainting Manual standards for review and approval.

.3 When approved, repainted room, surface and/or item shall become acceptable standard of finish quality and workmanship for similar on-site interior repainting work.

1.3 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:

.1 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 rating.

1.4 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule a minimum of 48 hours in advance of proposed operations.

.2 Paint occupied facilities in accordance with approved schedule. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

.3 Obtain written authorization from Departmental Representative for changes in work schedule.

.4 Schedule repainting operations to prevent disruption by other trades if applicable and by occupants in and about building.

1.5 SUBMITTALS

- .1 Provide product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with the requirements of Section 01 33 00.
- .2 Provide samples in accordance with Section 01 33 00.
 - .1 Submit full range colour sample chips for review and selection. Indicate where colour availability is restricted.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets for paint and coating materials.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.
 - .1 Submit records of products used. List products in relation to finish system and include following:
 - .1 Product name, type and use (i.e. materials and location).
 - .2 Manufacturer's product number.
 - .3 Colour code numbers.
 - .4 MPI Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.6 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00, supplemented as follows:
 - .1 Deliver and store materials in original containers, sealed, with labels intact.
 - .2 Labels to indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
 - .3 Remove damaged, opened and rejected materials from site.
 - .4 Store and handle in accordance with manufacturer's recommendations.
 - .5 Store materials and equipment in secure, dry, well-ventilated area with temperature range between 7 degrees C to 30 degrees C. Store materials and supplies away from heat generating devices and sensitive products above minimum temperature as recommended by manufacturer.
 - .6 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.
 - .7 Remove paint materials from storage in

quantities required for same day use.

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

.9 Fire Safety Requirements:

.1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site daily.

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

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

.2 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.3 Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.6 Where paint recycling is available, collect waste materials by type and provide for delivery to recycling or collection facility.

.7 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by individuals or organizations for verifiable re-use or re-manufacturing.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Do not perform repainting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application and until paint has cured sufficiently.

.2 Ventilate enclosed spaces in accordance with Section 01 51 00. Where required, provide continuous ventilation for seven days after completion of application of paint.

.3 Co-ordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements. Use of gas-fired appliances is not permitted.

.5 Do not perform painting work unless minimum lighting level of 323 Lux is provided on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, do not perform repainting work when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Relative humidity within area to be repainted is above 85%.

.2 Conduct moisture tests using properly calibrated electronic Moisture Meter, except use simple "cover patch test" on concrete floors to be repainted.

.3 Do not perform repainting work when maximum moisture content of substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 12% for plaster and gypsum board.

.4 Test painted concrete, masonry and plaster

surfaces for alkalinity as required.

- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint when previous coat of paint is dry or adequately cured, unless otherwise pre-approved by specific coating manufacturer.
 - .4 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of the Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.8 MAINTENANCE

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

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in latest edition of MPI Approved Product List (APL) are acceptable for use on this project.
- .2 Where required by authorities having jurisdiction, paints and coatings to provide a fire resistant rating.
- .3 Paint materials for repaint systems to be products of single manufacturer.
- .4 Only qualified products with MPI "Environmentally Friendly" E2 rating are acceptable for use on this project.
- .5 Paints, coatings, thinners, solvents, cleaners and other fluids used in repainting, to be as follows:
 - .1 Not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
 - .2 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.
 - .3 Be manufactured without compounds which contribute to smog in lower atmosphere.
 - .4 Be manufactured where matter generating 'Biochemical Oxygen Demand' (BOD) in undiluted production plant effluent discharged to natural

watercourse or a sewage treatment facility lacking secondary treatment does not exceed 15 mg/L.
.5 Be manufactured where total suspended solids (TSS) content in undiluted production plant effluent discharged to natural watercourse or sewage treatment facility lacking secondary treatment does not exceed 15 mg/L.

- .6 Paints and coatings must not be formulated or manufactured with formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

2.2 COLOURS

- .1 Departmental Representative will provide Colour Schedule after Contract award.
- .2 Selection of colours will be from manufacturers full range of colours.
- .3 Where specific products are available in restricted range of colours, selection will be based on limited range.
- .4 First coat in two coat (Premium) repaint system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed with Departmental Representative's written permission.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition not to exceed paint manufacturer's recommendations. Do not use kerosene or such organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss defined as sheen rating of applied paint, in accordance with following MPI gloss/ sheen standard values:

| Gloss Level Category | Units @ 60 Degrees | Units @ 85 Degrees |
|------------------------|--------------------|--------------------|
| G1 - matte finish | 0 to 5 | maximum 10 |
| G2 - velvet finish | 0 to 10 | 10 to 35 |
| G3 - eggshell finish | 10 to 25 | 10 to 35 |
| G4 - satin finish | 20 to 35 | minimum 35 |
| G5 - semi-gloss finish | 35 to 70 | |
| G6 - gloss finish | 70 to 85 | |
| G7 - high gloss finish | > 85 | |

- .2 Gloss level ratings of repainted surfaces shall be as specified herein and as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

- .1 RIN 3.1 - Concrete Vertical Surfaces: (including soffits).
- .1 RIN 3.1A - Latex G5 finish.
- .2 RIN 3.2 - Concrete Horizontal Surfaces: (floors and stairs).
- .1 RIN 3.2B - Alkyd Floor Enamel.
- .2 RIN 3.2F - Concrete Floor Sealer Waterborne.
- .3 RIN 4.1 - Clay Masonry Units: (pressed and extruded brick).
- .1 RIN 4.1A - Latex G5 finish.
- .4 RIN 4.2 - Concrete Masonry Units: (Concrete Block and Concrete Brick).
- .1 RIN 4.2A - Latex G5 finish.
- .4 RIN 5.1 - Structural Steel and Metal Fabrications.
- .1 RIN 5.1J - 2 Component Epoxy (Waterborne) G5 finish.
- .2 Maximum VOC limit 250 g/L.
- .5 RIN 5.3 - Galvanized Metal: (High Contact/High Traffic Areas (Doors, Frames, Railings, Pipes, and Handrails). Low Contact/Low traffic areas (Overhead Decking, Pipes, and Ducts)).
- .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1113.
- .2 RIN 5.3A - Latex (Low Contact/Traffic) G5 finish.

- .6 RIN 9.1 - Spray Textured Surfaces: (Ceilings).
 - .1 RIN 9.1A - Latex Flat.
- .7 RIN 9.2 - Plaster and Gypsum Board: (gypsum wallboard, drywall, and "sheet rock type material".
 - .1 RIN 9.2A - Latex G3 finish.
- .8 RIN 10.2 - Bituminous Coated Surfaces: Cast Iron Pipe, and Concrete.
 - .1 RIN 10.2A - Latex G5 finish.

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 EXAMINATION

- .1 Interior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting contractor to notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project repainting specification and Finish Schedule (as well as plans and elevation drawings).
- .2 Interior surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.
- .3 Where an assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.
- .4 Where "special" repainting or recoating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer to provide as part of work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no

additional cost to Departmental Representative.

3.3 PREPARATION

- .1 Perform preparation and operations for interior painting in accordance with MPI Maintenance Repainting Manual requirements except where otherwise specified.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.
- .3 Clean and prepare interior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using stiff bristle brush to remove dirt, oil and surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and to dry thoroughly. Allow sufficient drying time and test surfaces using an electronic moisture meter before commencing work.
 - .5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
 - .6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.
- .4 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminants from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- .6 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from distance up to 1000 mm.

3.4 EXISTING CONDITIONS

- .1 Prior to commencing work, examine site conditions and existing interior substrates to be repainted. Report in writing to Departmental Representative damages, defects, or unsatisfactory or unfavourable conditions or surfaces that will adversely affect this work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test" and report findings to Departmental Representative. Maximum moisture content not to exceed specified limits.
- .3 Do not commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to Painting Subcontractor and Inspection Agency.
- .4 Degree of surface deterioration (DSD) to be assessed using MPI Identifiers and Assessment criteria indicated in MPI Maintenance Repainting Manual. MPI DSD ratings and descriptions are as follows:

| Conditio n | Description |
|---------------|--|
| DSD-0 | Sound Surface (includes visual (aesthetic) defects that do not affect film's protective properties). |
| DSD-1 | Slightly Deteriorated Surface (indicating fading; gloss reduction, slight surface contamination, minor pin holes scratches). |
| DSD-2 | Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, and staining). |
| DSD-3 | Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges). |
| DSD-4 | Substrate Damage (repair or replacement of surface required). |

3.5 PROTECTION

- .1 Protect existing surfaces and adjacent fixtures and furnishings from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Departmental Representative.

- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect general public and building occupants in and about building.
- .5 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and surface mounted equipment, fittings and fastenings prior to undertaking re-painting operations. Store items and re-install after painting is completed.
- .6 Move and cover furniture and portable equipment as necessary to carry out repainting operations. Replace as painting operations progress.
- .7 As repainting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.6 APPLICATION

- .1 Apply paint by method that is best suited for substrate being repainted using brush, roller, air sprayer and/or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise. Methods of application as pre-approved by Departmental Representative before commencing work.
- .2 Brush and Roller Application:
 - .1 Apply paint in uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple unless approved by Departmental Representative.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray Application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application by intermittent agitation as frequently as necessary.
 - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern.

- .4 Back roll spray applications and brush out runs and sags immediately.
- .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Departmental Representative.
- .5 Apply paint coats in continuous manner and allow surfaces to dry and properly cure between coats for minimum time period as recommended by manufacturer. Minimum dry film thickness of coats not less than that recommended by manufacturer. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Sand and dust between coats to remove visible defects.
- .7 Repaint surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .8 Repaint top, bottom, and vertical edges of doors to be repainted.
- .9 Repaint inside of cupboards and cabinets as specified for outside surfaces.
- .10 Repaint closets and alcoves to match existing, unless otherwise scheduled or noted.

3.7
MECHANICAL/ELECTRIC
AL EQUIPMENT

- .1 Unless otherwise noted, repainting to include exposed to view / previously painted mechanical and electrical equipment and components (panels, conduits, piping, hangers, and ductwork.).
- .2 Touch up scratches and marks and repaint such mechanical and electrical equipment and components with colour, and sheen finish to match existing unless otherwise noted or scheduled.
- .3 Do not paint over name plates or instruction labels.
- .4 Leave unfinished exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish.
- .5 Keep sprinkler heads free of paint.
- .6 Do not paint interior transformers and substation equipment.
- .7 Standard of Acceptance: when viewed using natural

prevailing sunlight at peak period of day (mid-day) on surface viewed, surfaces to indicate following:

- .1 Walls: no defects visible from distance of 1000 mm at 90 degrees to surface.
- .2 Soffits: no defects visible from grade at 45 degrees to surface.
- .3 Final coat to exhibit uniformity of colour and sheen across full surface area.

3.8 FIELD QUALITY CONTROL

- .1 Inspection:
 - .1 Advise Departmental Representative and Paint Inspection Agency when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
 - .2 Co-operate with Paint Inspection Agency and provide access to areas of work.

3.9 CLEANING

- .1 Proceed in accordance with Section 01 74 11, supplemented as follows:
 - .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
 - .2 Keep work area free from unnecessary accumulation of tools, equipment, surplus materials and debris.
 - .3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
 - .4 Clean equipment and dispose of wash water used for water borne materials, solvents used for oil based materials as well as other cleaning and protective materials (e.g. rags, drop cloths, and masking papers), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction and as noted herein.
 - .5 Clean painting equipment in leak-proof containers that will permit particulate matter to settle out and be collected. Sediment remaining from cleaning operations to be recycled or disposed of in manner acceptable to authorities having jurisdiction.
 - .6 Recycle paint and coatings in excess of repainting requirements as specified.

3.10 RESTORATION

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.

- .3 Remove paint splashings on affected exposed surfaces. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

PART 1 - GENERAL

1.1 GENERAL
REQUIREMENTS

- .1 Comply with Division 01, General Requirements and documents referred to therein.
- .2 Read and conform to all sections of Division 14.
- .3 Where a device or piece of equipment is referred to in singular number, it is intended that such references shall apply to as many devices or pieces of equipment as are required.

1.2 SUMMARY

- .1 This Section applies to:
 - .1 The major alteration of seven passenger elevators. Passenger elevators consist of three separate groups of elevators, with two groups containing 2 elevators (Cars 1, 2 and 8, 9), with a third group containing 3 elevators (Cars 4, 5, 6).
 - .2 The major alteration of one freight elevator (Car 3).
 - .2 Elevator work specified herein shall be done by one company, including the provision of machine room guarding and car top rails to suit current standards and regulations, even in cases where a portion of the work is sub-contracted by this Division.
 - .3 Unit identification numbers are as follows:
 - .1 East Court Passenger Elevators: 1, 2.
 - .2 Building Freight Elevator: 3
 - .3 Central Court Passenger Elevators: 4, 5, 6.
 - .4 West Court Passenger Elevators: 8, 9.
 - .4 Confirm with bid submission key project milestones associated with elevator installation including but not limited to:
 - .1 Submission of shop drawings from Contract Award date;
 - .2 Delivery of equipment from Contract Award date and start of elevator alteration;
 - .3 Completion and turnover of each elevator from time that on-site installation work commences, including review and licensing of elevator by Technical Standards and Safety Authority (TSSA).
 - .4 Schedule is to reflect work being performed on two elevators simultaneously in order to expedite
-

overall completion of work, acknowledging that at no time can more than one elevator be taken out of service from any respective group.

1.3 DEFINITIONS

- .1 Term "provide", where used, shall be understood to include labour, materials and services necessary to supply and install item of work referred to.
- .2 Term "refurbish", where used, shall include the supply, inspection, testing, equipment design, equipment fabrication, equipment modification, equipment replacement, material(s) and labour to ensure retained equipment components will provide reliable, long term operation, in compliance with Contract performance requirements, and will be compatible with new or replaced devices, as added to existing installation under this Contract.
- .3 Wherever words "indicated", "designated", "shown", "noted", "listed", or similar words or phrases are used in the Specifications, they shall be understood, unless context otherwise indicates, to mean that material or item referred to is "indicated", "designated", "shown", "listed", or "noted" in the Contract Documents.
- .4 Wherever words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected", or similar words or phrases are used in the Specification, they shall be understood, unless context otherwise provides, to mean that material or item referred to shall be "approved by", "Satisfactory to", "as directed by", "submitted to", "permitted by", or "inspected by", the Departmental Representative.

1.4 RELATED WORK (NOT BY THIS DIVISION)

- .1 Work and services by other Divisions, in conjunction with the work specified herein, is as follows:
 - .1 Division 23: Heating, Ventilating and Air Conditioning.
 - .2 Division 26: Electrical.
 - .3 Division 28: Electronic Safety and Security.
- .2 This Division shall be responsible for reviewing Contract Documents to establish services to be provided by other disciplines for the completion of this Project, carrying costs for remaining services required as part of this major alteration work.

1.5 EXISTING SITE
CONDITIONS

- .1 Supply equipment that can be accommodated by existing Building infrastructure, including but not limited to:
 - .1 Clear elevator hoistway dimensions;
 - .2 Clear pit depth,
 - .3 Clear overhead,
 - .4 Clear height of the elevator secondary level (where applicable),
 - .5 Clear machine room height,
 - .6 Building support pockets.

1.6 WORK IN OCCUPIED
BUILDING

- .1 Normal building routine must be accommodated throughout the course of this work. Avoid unnecessary noise, obstruction of corridors, litter and blockage of passageways.
- .2 Where excessive noise or obstructions are unavoidable, advise Departmental Representative prior to undertaking or commencing work such that work can be scheduled accordingly and signage (where required) can be posted.
- .3 For intrusive work (noise, dusty, smelly etc.) in the Building, arrange with Departmental Representative to do such work during off-hours. Allow for extra labour cost in the Contract prize for off-hour work.
- .4 On site personnel shall be readily identifiable in uniforms, and Elevator Contractor shall supervise their personnel, at all times, so that they present a neat appearance and their movement in the building is within requirements of their work.

1.7 BARRICADES AND
HOARDING

- .1 To limit noise associated with the Work and to mitigate building occupants from exposure to Work related risks, when working on landing doors or within elevator lobbies, erect a substantial barrier to enclose work area. Extent of barrier shall be reviewed with Departmental Representative in advance of Work commencing. Erect and dismantle barrier as required, removing same from Site at completion of Work.
- .2 In cases where elevators operate in common hoistways, and where the operation of the adjacent elevator may be hazardous to the persons performing the work, this Division must provide a separation between hoistways in accordance with current standards and regulations in advance of commencing

the alteration work. This separation must serve to ensure that a maximum of one elevator per group is taken out of service when alterations on the respective group are being performed.

- .3 Where a counterweight is located between elevators, the counterweight runway shall be guarded on the side next to the adjacent elevator. Provide such guarding in accordance with requirements of Codes, standards and regulations.

1.8 STORAGE OF MATERIALS

- .1 Store materials in specified locations, as directed by Departmental Representative. Efforts will be made to assign space which is convenient, and as such it is recommended that Elevator Contractor identify the extent of storage space which is required.
- .2 Elevator Contractor shall be responsible for equipment insurances and protection, as required to protect equipment stored on site. Departmental Representative will not assume responsibility for elevator equipment stored on site.

1.9 PROTECTION OF FINISHES

- .1 Obtain approval from Departmental Representative on the routes and schedules of moving materials within the Building and ensure that such routes are protected and safe for occupants and users of the Building. Clean up the routes immediately after use.
- .2 Provide protection of existing property against damage arising from the execution of this Contract.
- .3 Make good such losses and damage except such as are directly attributed to the actions of others or are beyond the reasonable control of Elevator Contractor.
- .4 In cases where building elevators are used for material hoisting Elevator Contractor shall be responsible for protecting cab finishes. In cases where cab finishes are damaged, Elevator Contractor shall be responsible for repairing same.

1.10 EQUIPMENT DELIVERY AND RUBBISH REMOVAL

- .1 Equipment delivery must be coordinated with the Departmental Representative and only be scheduled following the approval of Departmental Representative.

- .2 Where use of an elevator is required for material movement this must be coordinated in advance with the Departmental Representative and only scheduled following Departmental Representative's approval.
- .3 Remove rubbish from work areas as quickly as it accumulates and maintain work areas clean.
- .4 At the termination of this Contract ensure that all areas in which work were performed are left in a clean and perfect condition.

1.11 SCHEDULE

- .1 Elevator modernization schedule shall be coordinated with Departmental Representative with the intention of having all Work completed as soon as possible.
- .2 Sufficient manpower shall be provided to ensure that Work on two elevators can proceed simultaneously throughout the course of this Work, with a dedicated crew (consisting of a mechanic and helper as a minimum) being assigned to both cars.
- .3 The initial schedule is to reflect elevators being modernized in the following order, appreciating that amendments to this schedule may be required following site reviews and discussion with the Departmental Representative:
 - .1 Elevators 1 and 4;
 - .2 Elevators 2 and 5;
 - .3 Elevators 6 and 8;
 - .4 Elevators 3 and 9.

1.12 QUALITY ASSURANCE

- .1 All Work specified in these contract documents shall be undertaken by Elevator Contractor.
- .2 Work shall be performed in strict accordance with current requirements of all local, provincial and federal codes, ordinances and by-laws. Work shall conform to the latest version of the following standards:
 - .1 ASME A17.1-2010/CSA B44-10, Safety Code for Elevators and Escalators (hereafter referred to as "Elevator Code").
 - .2 Elevating Devices Act, Revised Statutes of Ontario, 1990, Regulation 316
 - .3 Active Director's Orders as released by the Technical Standards and Safety Authority including the respective Code Adoption Document.
 - .4 CSA B651-12 Accessible Design for the Built Environment.
 - .5 National Building Code of Canada 2010
 - .6 Ontario Building Code 2006

- .7 Ontario Electrical Safety Code 2012, and all bulletins (Ontario)
- .8 CSA and Ontario Hydro Certification for electrical components
- .9 Occupational Health and Safety Act for Industrial Establishments (O.Reg. #280/05).
- .3 Use only components which can be shown to have performed satisfactorily and proven reliable for a minimum period of at least two (2) years in a similar environment. Use of prototype or first time installation equipment, component combinations or equipment mixes are not acceptable.
- .4 Elevator work shall be performed by properly trained and skilled mechanics in the direct employ of unit's manufacturer or authorized installation company.
- .5 In addition to such tests required by the regulatory authorities, carry out the following tests prior to handing the elevator over for public use. Tests to be witnessed by the Departmental Representative (where they are not witnessed by the jurisdictional authorities) include:
 - .1 Full load, overspeed, safety test.
 - .2 Full load, contract speed, car buffer test.
 - .3 Empty car, contract speed, counterweight buffer test.
- .6 Per TSSA Elevating Devices Code Adoption Document - Amendment 261-13, Rev. No. 1, where category 5 (CAT5) tests require the use of load for testing purposes, alternative no load methods shall be permitted where the alternative method is acceptable to the Director, with an understanding that alternative CAT5 tests may be performed without load if the elevating device (at some point in time) was tested with load and directly afterwards was tested using alternative testing methods (and no load). The documentation of the load test followed by the no load test forms the "baseline" documents to be used going forward (i.e. at the next 5 year anniversary). As part of this elevator alteration establish a procedure for these tests and submit same for approval from TSSA. Once approved, provide a copy of same in the Maintenance Control Program on site and a second copy to the Departmental Representative for their records. For each elevating device perform required full load CAT5 tests at the time of the TSSA acceptance reviews, followed immediately by the no load tests in order to establish the "baseline" identified above, and mitigate the need to carry out full load CAT5 tests in the future. Document all tests maintaining permanent records of same on site.

1.13 PERMITS

- .1 Obtain and pay for provincial design submission registration, inspection and permit, as required, except operation and ownership permits.
- .2 Perform such tests as called for by regulations of such authorities. Tests shall be performed in presence of authorized representatives of such authorities, and Departmental Representative.
- .3 Obtain governmental approval and register design submission before commencing any site work, in compliance with local requirements.

1.14 WARRANTY

- .1 Provide one (1) year warranty for all the work and equipment provided.
- .2 Warranty period shall cover defects in equipment and workmanship provided and commence on the same date for all units.
- .3 Warranty shall include prompt remedy of all defects upon written notification from Departmental Representative that defects exist. Remedy shall include labour, materials, equipment and services required to make good defective areas of Work. Warranty shall cover for the replacement of components, at no cost to Departmental Representative.
- .4 Warranty work shall be undertaken at times convenient to Departmental Representative.
- .5 Warranty shall include making good building parts, finishes and building property, damaged or disturbed in the course of remedying defects, at no additional cost to Departmental Representative.
- .6 In the event that equipment does not meet all requirements of Specification, Elevator Contractor shall promptly remove and replace work failing to comply, without expense to Departmental Representative. Bear expense of making good all work damaged by such removal or replacement.

1.15 SUBMITTALS

- .1 Shop drawings shall be of the same standard size.
 - .2 Drawings shall use Metric System of weights and measures with Imperial equivalents noted.
-

- .3 Submittal drawings must include a minimum of six (6) sets or copies and an electronic set in dwg format.
- .4 Submit scaled shop drawings detailing arrangements for the retained and new equipment including:
 - .1 Machine room equipment layouts including location of new controllers cabinets and associated equipment;
 - .2 Hall and car operating fixtures including mounting locations;
 - .3 Modified elevator panel at the main floor Commissionaires Desk;
 - .4 Elevator voice communication system including details of master station at Security Office, Commissionaire's Desk and machine room sub-stations;
 - .5 Remote monitoring system;
 - .6 Vertical section of elevator shafts showing travel distance between stops, total travel, headrooms available and bottom runbys.
- .5 Review of submittal data or shop drawings for material, equipment, apparatus, devices, arrangements and/or layouts shall not relieve this Division from the responsibility of furnishing all equipment required to meet all relevant codes and regulations and efficiently perform the requirements and intent of these Contract Documents.

1.16 MANUALS

- .1 Provide three (3) sets of Manufacturer's Maintenance and Operating Manuals for each elevator group.
- .2 Manuals shall contain, as a minimum, the following information:
 - .1 Description of system's method of operation and control including, but not restricted to, control system and special or non-standard features provided.
 - .2 Detailed Maintenance Control Program in accordance with current standards and requirements enforced by the jurisdictional authority.
 - .3 Replacement parts list.
 - .4 Lubrication chart.
 - .5 Information on each piece of equipment shall be assembled in following order:
 - .1 Equipment details such as:
 - .1 Approved shop drawings
 - .2 Model, part and serial number
 - .2 Maintenance details such as:
 - .1 Lubrication
 - .2 Trouble-shooting procedures
 - .3 Complete list of diagnostic codes associated with the troubleshooting and

fault-finding equipment associated with equipment.
.4 Adjustment techniques
.5 Operation checks
.6 List of recommended spares to be kept on site
.7 List of all special tools and appropriate unique application
.8 Detail manufacturer and supplier names and addresses
.9 All equipment is to be listed as to types.

- .3 Documents, other than circuit diagrams, larger than standard imperial size paper shall be neatly folded and inserted in labelled envelope. Photocopies must be totally legible. Only pertinent details shall be acceptable.
- .4 Maintenance and operating manuals / binders shall be approved by Departmental Representative before certification of Substantial Performance of work is issued. Full release of hold back monies will not be processed until manual / binder submissions, complete with a digital copy / electronic version of the submission, have been received.

1.17 WIRING DIAGRAMS

- .1 Upon completion of work, provide one digital copy / electronic version and two sets of "As Built" wiring diagrams for each elevator group including field wiring changes.
- .2 Plasticize wiring diagrams and mount one complete set in respective Machine Room, complete with wood frame and plywood back board.
- .3 Remaining set shall be neatly folded and turned over to Departmental Representative in a labelled envelope identifying the contents.

1.18 MODERNIZATION CONTRACT MAINTENANCE

- .1 State Separate Price to provide modernization contract maintenance services for in-service elevators under this Contract throughout the duration of this Renovation. See also 1.11 above. The cost for ongoing maintenance must be invoiced on a monthly basis until completion of the modernization and independent of progress draws (invoices) for the modernization work.
- .2 Modernization contract maintenance services shall start on a date after the start of this Contract and

selected by the Departmental Representative and continue through to the completion of the modernization work and acceptance of the installation.

- .3 Pre-modernization maintenance and adjustment services shall be undertaken by this Division to ensure that group operations are functioning and that elevators are travelling at rated speed, levelling within 6 mm of respective floor and that slowdowns are smooth and consistent.
- .4 Maintenance Work shall be undertaken during regular working hours but overtime call-backs shall be included (on a 24-hour basis, 7 days per week) without additional premium for release of trapped passengers.
- .5 Maintenance Work shall be performed on a regular basis by qualified maintenance personnel, independent of modernization crew(s).
- .6 Maintenance services shall include those listed in Article 14 05 00 1.19.
- .7 Maintenance services and callbacks shall be registered in the site log book (provided by this Division), identifying the work done, unit worked on and verifying and recording that the unit was left in proper operating condition. Existing log books shall remain on the premises.
- .8 Callbacks shall be answered promptly by personnel independent of the modernization crew. In the interest of response time, entrapments shall be responded to by the modernization crew.
- .9 Personnel responsible for scheduled maintenance visits or responding to call-backs shall sign for machine room keys, when they arrive on site, and return keys prior to leaving site.

1.19 FULL SERVICE MAINTENANCE

- .1 At the Departmental Representative's option, Maintenance Contract shall commence at the end of the "Modernization Contract Maintenance" coverage and include the renovated elevators under this Contract.
- .2 Cost for this Maintenance Contract, shall not be included in the Bid Price. State, in Bid Form, Separate Price for the first year of a ten year on-going maintenance contract, reflecting that this first year is concurrent with the twelve month

Warranty Period specified in Article 14 05 00 1.14. The I.U.E.C agreement (labour and fringe benefits) and Statistics Canada material index on which the first year maintenance pricing is based shall be identified on the Bid Form with the appropriate value for each. In addition to the initial ten year term, this Division must be prepared (at the option of the Departmental Representative) to enter into three additional five year terms.

- .3 Where conflict between documents exist, Maintenance Contract shall include the more stringent of services detailed here-in and as found in PWGSC's Elevating Devices Maintenance Specifications as appears in Annex-A (Note: A copy of the PWGSC's maintenance agreement will be made available to Bidders upon request).
- .4 Maintenance contract shall include for all new, refurbished and retained equipment. Pre-maintenance and/or prorating of existing equipment is not acceptable.
- .5 Monthly maintenance shall be performed on all equipment, although this Division must ensure that the site is visited by qualified maintenance personnel to perform such maintenance on a bi-weekly basis. Maintenance service shall include 24-hour emergency call-backs, 7 days per week, without additional costs or premiums associated with overtime call-back service for the release of trapped passengers, or other emergency call-back services. Maintenance service shall include for any and all travelling time charges.
- .6 Personnel responsible for scheduled maintenance visits shall be required to sign for the Machine Room keys when they arrive at the premises and return the keys prior to leaving the site. Procedures for obtaining these keys for visits occurring after-hours shall be confirmed with Departmental Representative.
- .7 Maintenance proposal shall include following clauses:
 - .1 Maintenance contract shall be subject to termination by either party with 90 days written notice to the other party, 90 days prior to end of initial or any renewal period.
 - .2 Maintenance Company shall submit, to Departmental Representative, a minimum of 120 days prior to Contract expiry date, an invitation to extend contract, notifying Departmental Representative of any adjustments used in determining monthly maintenance costs.

- .3 Renewals or extensions of the Contract, including the three five-year optional terms, are not permitted to occur automatically. Such renewals or extensions must be authorized by the Departmental Representative.
- .8 Maintenance Contract shall include, but not be limited to, the following termination provisions:
- .1 Should alteration work be undertaken on a portion or all of the equipment covered in this Contract, which subsequently changes scope of work or type of equipment listed in this Contract, then this Contract shall become null and void, at the option of, and no additional cost to Departmental Representative once modernization or alteration work has been awarded. Examples of such work include any major alteration.
- .2 Departmental Representative may terminate the Contract:
- .1 If a professionally qualified third party, retained by Departmental Representative, whose decision shall be final, judges the maintenance performed on any unit as not according to the terms of the Contract and 30 days written notice is given to the Contractor to correct the problem, and the problem has not been corrected within 30 days.
- .2 In the event Elevator Contractor becomes insolvent or goes into bankruptcy;
- .3 In the event Elevator Contractor is sold to another firm, organization, corporation or enterprise.
- .3 In the event of such cancellation, Departmental Representative may at its option, elect to use another company to restore the equipment to the specification standard and to charge the cost of this to the maintenance contractor.
- .4 Elevator Contractor may terminate Contract, by written notice to Departmental Representative, if:
- .1 Unsafe conditions, for which Departmental Representative is responsible, persist (as judged by a government inspector), after written notice has been given to Departmental Representative to correct problem, and 90 days has been allowed for problem to be solved.
- .2 Submitted invoices are not paid within a 90 day period, unless invoices are in dispute for non-performance as judged by Departmental Representative's representative.
- .9 Should Departmental Representative have an audit of the elevator equipment performed by an independent third party, deficiencies noted as part of this audit, for which the Contractor is responsible, shall be addressed as part of this agreement within 30 days. Departmental Representative reserves the

right to correct any noted deficiencies which remain outstanding after 30 days written notice is given to the Contractor to correct the problem, and the problem has not been corrected within 30 days. The cost associated with such repairs shall be deducted from monies owing to the Contractor.

- .10 Departmental Representative reserves the right to obtain competitive quotes for work which is not covered under the terms of this maintenance contract and award the said work to a registered elevator contractor other than the maintaining contractor. On completion of the work, maintaining contractor shall have the opportunity to review the work which was performed, and provided that no corrective work was identified, maintaining contractor would assume maintenance of same as part of Contract.
- .11 The following maintenance services shall be included:
 - .1 Systematic examination, adjustment and lubrication of elevator equipment and apparatus, and repair or replacement of electrical and mechanical parts of equipment and apparatus. Replacement of damaged and worn parts shall be with parts of equivalent or better material and strength to the original manufacturer's design.
 - .2 Replace wire ropes as often as required to maintain adequate factor of safety. Wire rope inspections shall be based on CEMA standards.
 - .3 Following installation, new hoist ropes must be monitored bi-weekly (in the first 6 months (minimum)) for stretch such that adjustments can be made as required.
 - .4 Examining and equalizing tensions of all hoist ropes shall be included and performed on a regular basis.
 - .5 Renewals or repairs, necessitated by reason of misuse, accidents or negligence beyond the reasonable control of Contractor shall not be included. Renewals or repairs, necessitated by ordinary wear and tear or component defect, shall be included.
 - .6 Maintain control equipment in good operating condition.
 - .7 Supply required lubricants, cleaning materials and repair parts required to keep installation in good working order.
 - .8 Guide rails shall be kept clean and properly aligned. When required, guides and guide rails, shall be renewed, readjusted, or realigned as required to insure smooth and quiet operation.
 - .9 Specified equipment performance figures shall be maintained, unless subsequently modified in writing by Departmental Representative.

- .10 Safety devices including rope grippers and governors shall be periodically examined and tested.
- .11 Adjustment, cleaning, repair and replacement of the cab ventilation fan shall be included in this maintenance agreement.
- .12 Elevator pits and car tops shall be thoroughly cleaned.
- .13 Replacement bulbs or tubes shall be maintained on site to ensure burnt out fixtures in the pits, top of shafts and car tops are replaced as soon as they burn out.
- .14 Machines and motor static drive units shall be kept in good working condition with particular attention being given to machine brake operation.
- .15 Bearings shall be checked periodically for vibration, heat, wear, and kept lubricated.
- .16 Safety circuits shall always be kept in proper adjustment.
- .17 Machine room equipment shall be kept clean and painted. Machine room floors shall be painted a minimum of once every two years and washed as required.
- .18 Car and hoistway door equipment, including interlocks, gate switches, relating cables, door relating arms, closing devices and clutch assemblies shall be checked regularly and maintained in proper adjustment to ensure safe, smooth and quiet operation.
- .19 Door tracks and sills shall be kept clean of debris. Rollers and gibs shall be replaced as required.
- .20 Door clutch assemblies shall be kept free of sharp edges and damaged or worn pickup rollers replaced.
- .21 This Division shall replace worn or damaged car and landing sills at no cost to Departmental Representative where the sill damage or wear resulted from worn or broken door gibs or lack of adjustment and maintenance by this Division. Replacement sills shall be of equivalent strength and finish to those being replaced.
- .22 Should Departmental Representative request additional work be performed on equipment not defined in the terms of this Maintenance Contract, then such work shall be based on preferred rates included in Contract for time and material.
- .23 Work on equipment shall be registered in the log books, including time of arrival, nature of work or problem, and action taken. Log books shall be provided by this Division and remain within the Machine Room or alternative location as directed by the Departmental Representative.
- .24 Maintenance program shall be designed to minimize shutdowns and set up and followed to meet or exceed minimum equipment maintenance standards

and frequencies currently enforced by local jurisdictional authorities.

.25 Program shall be designed to minimize shut-downs. No two elevators shall be shut down at the same time for maintenance purposes without Departmental Representative's prior approval.

.26 Shut-downs shall be scheduled only after prior notification to Departmental Representative and with Departmental Representative's consent.

.27 Should it become necessary to work on elevators with landing doors held open, proper safety barricades shall be erected to protect people.

.28 Maintenance program shall include semi-annual testing of Firefighter's Emergency Operation and Emergency Power operation to ensure proper operation of same. Maintenance Contractor shall submit a report to Departmental Representative confirming status of tests and date on which each test was performed, and take corrective measures, as required, where deficiencies (which they are responsible for) are found. These tests shall be scheduled and performed at times co-ordinated with Departmental Representative, to minimize disruption to facility operations, allowing for these services to be performed outside of normal working hours.

.29 Maintenance Contractor shall provide access to elevator hoistways (including but not limited to pits and car tops) for testing, verification and servicing of fire sensing devices by others.

Maintenance Contractor manpower must be present, supervising others' efforts while inside pit or hoistway. Initially, include for this service to occur semi-annually and outside of normal working hours.

.30 Average response time shall be the elapsed time recorded from time a request for call-back service is placed until Maintenance Contractor's field technicians arrive at unit, to commence required remedial actions. For emergency call-backs, average response time shall be under 30 minutes during normal working hours and under 60 minutes outside of normal working hours. For other call-backs, average response time shall be under 60 minutes during normal working hours and under 120 minutes outside of normal working hours. Emergency call-backs shall be understood as any call-back in response to evacuate a trapped passenger or cases where all elevators within a group are out of service.

.31 Prior to leaving the site, whether on a preventative maintenance visit or callback, Elevator Contractor shall immediately advise Departmental Representative of any condition with the elevator(s) that present potentially hazardous condition(s) to the user(s). These concerns shall be recorded in the log book including the specific unit(s) which the concerns apply to and the nature of the concern and

potential hazard which exists. An elevator(s) presenting a potentially hazardous condition shall not be left in service.

- .12 Provide lockable steel cabinets for the storage of tools, spare parts, materials, lubricants and document records required in the ongoing maintenance and care of the elevator installation.
- .13 Adequate stock of spare parts shall be maintained locally and personnel shall be available at such places to ensure fulfilment of service without unreasonable loss of time in reaching site. Contractor shall also maintain sufficient supply of spare parts for equipment nearing obsolescence.
- .14 Work under this maintenance provision shall be performed by personnel under supervision and in direct employ of the elevator maintenance Contractor.
- .15 Develop a detailed Maintenance Control Program conforming to requirements of the Elevator Code and local Code Adoption Document. In addition to maintaining a hard copy of this document in each machine room, provide the Departmental Representative with a digital and hard copy of same.

1.20 MAINTAINABILITY

- .1 Elevator equipment provided under this specification shall not contain proprietary features, which limit the Departmental Representative's ability to engage a qualified elevator maintenance contractor, other than the original manufacturer/installer, for the provision of maintenance services.
- .2 Where specialized tools are required to perform these services, such tools shall be provided with the equipment as part of the installation and become property of the Departmental Representative.
- .3 No devices, diagnostic or otherwise, shall lose any function over time or contain self-expiring software.
- .4 Provide fault codes, set-up parameters, detailed procedural, operating and troubleshooting instructions, plus all other materials required to permit an alternate contractor to undertake maintenance or service.
- .5 At completion of the Project, provide one set of "as built" e-proms, to be retained by the Departmental Representative for his sole use and storage.

1.21 TRAINING OF
DESIGNATED BUILDING
STAFF

- .1 Prior to Departmental Representative's final acceptance of the elevators, arrange with Departmental Representative to provide competently trained personnel, thoroughly conversant with all operational and control aspects of elevator equipment installed, to instruct designated Departmental Representative's representative, in the operation of same.
- .2 Provide trained personnel, to carry out instructions regarding elevator usage and operation for designated Building employees. Training shall include, but not be limited to, the elevator two-way voice communication system, remote monitoring system, remote panel and features, firefighters' emergency operation and emergency power operation.
- .3 Training shall be carried out by competent forces, who are completely conversant with all facets of elevator operations including life safety controls.

1.22 BILINGUAL
SIGNAGE

- .1 Written instructions, designations and functions must be provided in both English and French. Bilingual signage is not required where internationally recognizable characters and symbols are utilized.
- .2 French language designations shall be located below the English language equivalents unless advised otherwise.

1.23 PROGRESS
PAYMENT CLAIMS

- .1 During modernization, submit monthly progress billing claims detailing the following information:
 - .1 Total contract amount for alteration of each elevator group.
 - .2 Percentage breakdown of materials plus labour used within total contract amount.
 - .3 Submit for each elevator group, a detailed billing, including respective material and labour component breakdowns for each of the following stages of installation:
 - .1 Preparation of Shop Drawings and Engineering
 - .2 Machine Room Equipment
 - .3 Hoistway Equipment
 - .4 Cab Enclosure Fixtures
 - .5 Signals and Wiring
 - .6 Installation and field labour

- .7 Adjustment
- .8 Inspections by TSSA and Departmental Representative.

PART 2 - PRODUCTS

2.1 ELECTRICAL REQUIREMENTS

- .1 Provide complete hoistway and machine room with new insulated wiring to connect all parts of equipment.
- .2 Provide conduit and all the required wires for single phase and 3-Phase circuits from the load side of the power disconnecting means in the machine room to the new elevator controller cabinets.
- .3 Extend ground wires from the wall mounted ground bar in each machine room to suit the new elevator controller cabinets. Refer to Electrical Drawing E-101 for proposed location of ground bar. Co-ordinate with Division 26 if change of ground bar location is required.
- .4 Supply new wiring for all elevator devices located remote from the machine room and hoistways including but not limited to remote panels, voice communication system master stations and remote monitoring system. Work by others is limited to the provision of conduit and installation of wires as detailed on Electrical Drawing E-100. Installation of wires will be a coordinated effort and require assistance of this Division to feed wires from within the hoistway. Termination of wires must be performed by this Division. This Division is to run wiring within the respective hoistways from machine room down to Level G, where conduit provided by others will be terminated. This Division must provide wires of adequate length to reach proposed destination appreciating that wires will first be run from the hoistways to the Security Office at Level G, and then to the Commissionaires Desk adjacent to elevators 4, 5 and 6 (Level E).
- .5 Insulated wiring shall have a flame retarding and moisture resisting outer cover and shall be run in metal conduit, metallic tubing or wire ducts as provided by this Division.
- .6 Remove existing travelling cables and provide new travelling cables between each car and its machine room.
- .7 Signals wiring for emergency power and fire alarm shall be brought to elevator controller by others,

as co-ordinated on site with this Division.
Termination of these items within elevator controller shall be the responsibility of this Division.

- .8 Travelling cables shall have flame retarding and moisture resisting outer cover, running without splices, cuts, breaks or intermediate junction boxes between elevator cab and controller. Travelling cables shall be flexible and suitably suspended to relieve strains in individual conductors. Provide travelling cables with minimum 10% spare conductors.
- .9 Insulated conductors and conduit or tubing, as well as fittings, including metal boxes, troughs and ducts, shall comply with governing Electrical Safety Code.
- .10 Existing power supply is 600 (575) volts, 3-phase, 60 Hz.
- .11 Lighting power supply is 110 volts, single phase, 60 Hz.
- .12 Provide interconnections at elevator controller for power feeds and control circuits.
- .13 Provide flexible conduit interconnections with proper anti-shorts. Properly anchor and support flexible and rigid conduit sections. Lengths of conduit shall be supported at intervals of not more than 1525 mm.
- .14 In addition to the wires for normal operating controls, elevator travelling cable shall be provided with the following wiring and cables:
 - .1 Six (6) pairs of shielded signal wires (no. 20 AWG), for Departmental Representative's use;
 - .2 Eight (8) pairs of shielded wires, #18 gauge, for Security card readers;
 - .3 Two (2) RG-6U stranded centre conductor coaxial cables, and two (2) pair of 20 gauge stranded conductor low voltage cable, within an overall braided shield, for CCTV Camera and Departmental Representative's use. Cables shall extend from terminal blocks in the elevator controller to the top of the elevator cab. An excess loop of 2000 mm of cable shall be provided at both ends of the cables.
 - .4 All wires and cables shall run between machine room and elevator cab without splices, cuts or breaks;
 - .5 Mount and label each wire on a terminal strip(s) within controller cabinet.

- .15 Coordinate with Security Contractor installation, testing and commissioning of security card readers and CCTV cameras as applicable.

2.2 EMERGENCY POWER OPERATION

- .1 Upon receipt of signal from emergency power transfer switch, indicating imminent transfer of power supplies, running elevators shall be brought to a safe stop, at the next available level served, after which the doors will open and the unit will shut down. An elevator parked at a floor, when the signal is received, shall remain at that floor and shut down (Note: If door open button is not operative, elevator shall fully open its doors before shutting down).
- .2 Sufficient emergency power is available to run three (3) elevators, at any one time. Under emergency power conditions, elevators shall operate as follows:
 - .1 Elevator 1 shall start up and automatically return non-stop to the emergency power recall level. Upon arrival at emergency power recall level, elevator shall fully open its doors and then shut down. After Elevator 1 shuts down, this same sequence of operation shall be followed for elevators 2, 4 and 5. Once the final car arrives at the recall level, one unit shall be automatically selected to commence normal operation under standby power, responding to hall and car call demands.
 - .2 Elevator 3 shall automatically start, return to the recall level and then commence normal operation in response to hall and car call demands.
 - .3 Elevator 6 shall start up and automatically return non-stop to the emergency power recall level. Upon arrival at emergency power recall level, elevator shall fully open its doors and then shut down. After Elevator 6 shuts down, this same sequence of operation shall be followed for elevators 8 and 9. Once the final car arrives at the recall level, one unit shall be automatically selected to commence normal operation under standby power, responding to hall and car call demands.
- .3 Under automatic emergency power recall operation, the following shall occur:
 - .1 In cases where the elevator is parked at the emergency power recall lobby with its doors closed, doors shall open and next elevator in sequenced return shall start up, although where this is the final car in the sequence, elevator will resume normal operation after opening its doors.

- .2 A car which is on independent service shall not be selected to operate as designated emergency power elevator. Instead, this elevator shall sound a buzzer, return to main recall lobby, open its doors, and then shut down. At that time, one of the remaining elevators shall be automatically selected to operate under standby power.
- .3 Flight times and other car operating performance times shall comply with specified settings.
- .4 A car with its doors blocked open shall sound continuous buzzer until obstruction is removed or car has been bypassed.
- .5 Should an elevator fail to start up and commence its return to emergency power recall lobby, after an adjustable period of time, initially set at 20 seconds, it shall be automatically by-passed and next car in sequence chain shall be signalled to start up.
- .4 Equipment shall be designed so that it can automatically re-start in the event of a power failure and maintain specified performances.
- .5 Provide battery backup and surge protection devices for all circuits which contain volatile memory.
- .6 For each elevator group, the lobby fixture at the recall level shall be provided with an emergency power LED indicator and required engraving (i.e. "Elevator Emergency Power"). Indicator shall illuminate whenever respective elevator group is operating under emergency power.
- .7 Provide within elevator remote panel at the street level Commissionaires Desk two (2) emergency power re-selection key-switches, with an FEO-K1 barrel, as follows:
- .1 One switch shall have five (5) positions designated as "AUTO", "1", "2", "4" and "5". In "AUTO" position, Elevator 5 shall be normally selected unless directed otherwise by the Departmental Representative.
- .2 Second switch shall have four (4) positions designated as "AUTO", "6", "8" and "9". In "AUTO" position, Elevator 9 shall be normally selected unless directed otherwise by the Departmental Representative.
- .8 For passenger elevators 4, 5 and 6, in cases where two cars in this group are operating on emergency power, controls shall be configured such that these units operate as a 2-car group with hall calls demands being dispatched to a single elevator, based on the car best suited to respond to the call.

2.3 FIREFIGHTERS'
EMERGENCY OPERATION
(FEO): PHASE I AND II

- .9 In advance of the TSSA inspection of this feature, this Division shall be responsible for testing of the emergency power sequenced operation to ensure that this feature works in accordance with the Contract Document and Elevator Code. This Division will make available sufficient manpower to perform such tests and include costs for other disciplines where required.
- .10 Given the need for inter-group sequenced operation, wires will be routed to the elevator remote panel at the Commissionaires desk where this Division shall terminate the wires on appropriate connections. As specified elsewhere wires are to be supplied by this Division.
- .1 Provide elevators with automatic Phase I (recall) and Phase II (in-car) controls. Elevators shall be arranged to operate in accordance with ASME A17.1-2010/CSA B44-10 rule 2.27, as well as local building codes.
- .2 For each elevator group, provide one Phase I recall switch, indicators and engraving in the main recall level hall station.
- .3 In cases where unit identification number is missing at the recall level provide same to match the same style as existing numbers, mounting same on the entrance jamb.
- .4 Primary and alternate recall levels shall be established as follows (unless directed otherwise by the Departmental Representative):
 - .1 Cars 1, 2, 3, 8 and 9: Level G is main recall; Level 1 is alternate level.
 - .2 Cars 4, 5 and 6: Level E (street side opening) is main recall; Level G is alternate level.
- .5 Fire detection signals, provided by other, will be wired directly to elevator controller. Termination of signal wires to controllers shall be completed by this Division.
- .6 This Division must identify specific fire signal requirements to be provided by others.
- .7 In advance of the TSSA inspection of the final elevator, this Division shall assist in the testing of the FEO recall and in-car operation to ensure that this feature works in accordance with the Contract Document and Elevator Code. This Division will make available sufficient manpower to assist in the testing.

- .8 Throughout the course of the elevator alteration this Division shall continue to provide instruction to the Departmental Representative on FEO operation to ensure that Departmental Representative is aware of procedures and protocols for initiating fire recall manually and resetting of the system.

2.4 CONTROLLER EQUIPMENT

- .1 Provide new self-supporting controller cabinets to suit available location in the respective machine rooms. Cabinets shall be completely enclosed and equipped with removable or hinged covers for service access.
- .2 Controller cabinets shall be mounted atop a metal frame provided by this Division, allowing the cabinets to be raised a minimum of 100 mm above the floor finish.
- .3 Controller wiring is to be installed in a neat workmanlike fashion. Mark relays, contactors, fuses, fuse ratings and printed circuit cards with clear and unique designation numbers, permanently affixed to the controller. Designation numbers shall match those used in schematic and wiring diagrams.
- .4 Locate isolation transformers, filters and reactors within the Machine Room space directly in front of the machines and provide electrical conduit and wiring between these devices and the elevator controllers.
- .5 Electrical windings for isolation transformers must utilize copper wires.
- .6 Where trip meters are provided in the controllers, meters shall be installed after the modernization of the final elevator is completed. All trip meters shall start at zero.
- .7 Provide each controller cabinet with one stop switch mounted on the outside of the controller clearly designated as "STOP". Stop switch shall be installed within the control circuit to prevent the elevator from starting when activated.

2.5 INDEPENDENT SERVICE

- .1 Provide all elevators with Independent Service operation in accordance with the following:
 - .1 Independent Service to be controlled by two-position key-switch mounted within service cabinet.

Key shall be removable with the switch in either position.

.2 Under Independent Service, hall lanterns and car door re-opening device shall be de-activated.

.3 Turning key-switch to "ON" position will cancel car calls registered while elevator was in normal group operation and allow car to be withdrawn from normal group operation, operating in response to car calls only.

.4 Under Independent Service, automatic door closing operation shall not be allowed. Doors shall close by constant pressure on either car call button or Door Close button.

.5 Car calls registered while on Independent Service shall be capable of cancellation by turning key-switch to "OFF" position.

2.6 EQUIPMENT HARMONIC DISTORTION

.1 Equipment manufacturer shall provide, in writing, a statement that total voltage harmonic distortion (THD) from equipment, as measured from 3rd to 21st harmonic at branch circuit connection, will not exceed 3%, and individual harmonic distortion will not exceed 5%, as defined by I.E.E.E. 519.

.2 This shall apply to all microprocessor based equipment, all equipment containing switch-mode power supplies and all non-linear loads.

.3 Where required, install harmonic filters to meet above requirements.

2.7 EQUIPMENT GUARDING

.1 Provide equipment guarding in accordance with the most stringent of current guidelines and regulations as enforced by regulating authorities such as the Ontario Ministry of Labour and TSSA. This includes equipment installed throughout elevator hoistway, pit, machine room and secondary level.

.2 In cases where equipment guarding consists of perimeter guarding, provide an auxiliary stop button within each fenced area, locating this button adjacent to the machine. Operation of this stop button shall interrupt the control circuit preventing operation of the respective elevator.

2.8 LEVELLING AND SLOWDOWN

.1 Provide new floor selection and levelling devices. Levelling devices shall be solid state electronic devices or equivalent levelling devices in hoistway. Electro-mechanical devices are not acceptable.

- .2 Self-levelling feature shall automatically bring car to floor landings, independent of operating devices. This device shall also correct for over travel, under travel and rope stretch.
- .3 Maintain car floor within 6 mm of the intended landing irrespective of load and direction of travel on the initial stop. Levelling feature shall automatically correct for over or under travel by returning car imperceptibly to floor level.
- .4 Provide new terminal landing slow down and final limit switches. After setting and adjustment of these switches is completed and tested, fasten by through bolting or dowelling final limit switches and final limit switch brackets.

2.9 ELEVATOR HANDICAPPED PROVISIONS

- .1 Passenger elevators shall comply with ASME A17.1-2010/CSA B44-10 Appendix "E" Elevator Requirements for Persons with Physical Disabilities and CSA B651-12 Accessible Design for the Built Environment.
- .2 Provide devices including, but not limited to, tactile plates, chimes, car position indicators, hall lanterns, audible car call registration, voice annunciators and handrails, as outlined in Appendix "E".
- .3 Provide each elevator, including the freight elevator, with a digitized voice annunciator. Annunciator shall utilize latest digital technology to reproduce real human speech, with announcements being made in English and French. As a minimum, annunciator shall be capable of announcing floor levels, direction of travel, along with a list of special announcements, as selected by Departmental Representative. Voice unit shall be capable of male voice, female voice, or a combination of both, as confirmed with Departmental Representative. Final selection of special announcements shall be reviewed with Departmental Representative, with this Division providing a complete list of special announcements, which are available (i.e. Elevator on Fire Recall Operation - When doors open please exit building in a safe and orderly manner; Please stand clear of closing doors; This elevator is on Independent Service; Elevator on Emergency Power Recall to Main Floor, etc.) Annunciator shall have multiple message volume controls, such that volume for specific messages can be adjusted to appeal to specific user within cab or in lobby. Install unit in accordance with manufacturer's instructions, and

be responsible for maintaining complete system as part of the preventive maintenance agreement. Include for four custom announcements, outside of the manufacturer's standard announcement selections, requiring programming from the equipment manufacturer.

- .4 Where they are missing, provide entrance tactile plates, mounted on both entrance jambs, at all levels served, with no visible fastening devices. Provide samples of tactile plate finishes for Departmental Representatives review, trying to match existing where possible.

2.10 MANUFACTURER'S NAME AND TRADEMARKS

- .1 Manufacturer's name shall not appear in elevator cab, entrances, elevator landing sills, remote panel or any other location visible to general public.

2.11 ALARM BELL

- .1 Provide electric signal bell, located on car top and connected to alarm button in car. Activating this button shall cause car top bell to ring.

2.12 ELEVATOR TWO- WAY VOICE COMMUNICATION

- .1 Provide elevators with a complete hands-free telephone communication system which satisfies requirements of Elevator Code item 2.27.1.1 "Emergency Communications", including a battery back-up capable of operating communication system for a minimum period of four (4) hours, in the event of a power loss.
- .2 Hands-free telephone unit shall be securely mounted behind car operating panel, while a circular pattern of perforations (75 mm in diameter) shall be made directly in front of the speaker and microphone.
- .3 In the general area of speaker perforations, surface engrave elevator number (25 mm high), and phrase "In case of emergency, press phone button, wait for answer" in letters at least 6 mm high. Engraving shall be filled in black.
- .4 Provide shielded wiring running between in-car telephone and controller. Assume responsibility for final installation and hook-up of two-way communication system and co-ordinate, with Departmental Representative, specific phone line requirements and where calls are to be automatically directed.

- .5 Provide one master communication station in the Level G Security Office, and a second master station at the Commissionaires Desk adjacent to elevators 4, 5 and 6. Options for finish of master stations shall be presented for selection by Departmental Representative. In the case of wall mounted stations, a stainless steel finish is to be provided where available.
- .6 System shall accommodate bilingual LCD displays, lettering, voice prompts and manuals, with manuals being provided in digital format and hard copy.
- .7 Supply wiring between elevator hoistways and remote communication stations, with installation of wires and provision of conduit by others per Electrical Drawing E-100.
- .8 Within each machine room provide a sub-station permitting two-way voice communication between this station and any elevator cab with equipment in the respective room (as a minimum). Two-way voice communication shall also be possible between the master stations and these sub-stations.
- .9 Communication system shall comply with requirements of Elevator Code including monitoring provisions in 2.27.1.1.6.
- .10 Others shall provide single phase power supply and telephone line associated with this voice communication system at the Level G Security Office per Electrical Drawing E-100.

2.13 CAR TOP OPERATION AND LIGHTING

- .1 Provide elevators with new car top operation controls complete with top of car audible warning signal (for Firefighters' Emergency Operation). Ensure controls are located between the car crosshead and the side of the hoistway normally used for access to the car top, such that the elevator can be placed on hoistway inspection prior to stepping on the car top.
- .2 Provide each elevator car top with a (guarded) dual lamp fluorescent light fixture. Fixture is to be classified as vapour-tight, complete with T8 lamps. Fixture shall have instant start ballasts while lamps shall have rotary and / or turret sockets to address vibration associated with elevator operation. Fixture(s) shall be controlled by a single control switch, with switch being accessible from landing, prior to boarding car top. Fixture is

to be mounted to top of car guardrail at rear of cab although for freight elevator two such fixtures shall be provided mounting same on the car top guardrail on the side wall, on either side of the crosshead. Car top shall also be provided with a grounded Type A GFCI duplex receptacle.

2.14 EMERGENCY CAB LIGHTING

- .1 Provide each elevator with battery powered emergency cab lighting as follows:
 - .1 Use uninterrupted power supply emergency lighting equipment, per governing Electrical Safety Code, to provide illumination in car at operating panel for four (4) hours minimum.
 - .2 Emergency lamps shall consist of two (2) lamps, with an approximate light output of 135 lumens, which shall immediately energize in the event of a power loss (normal and emergency power). When lighting power supply returns, emergency lamps shall extinguish and battery unit recharge.
 - .3 In-car emergency lighting fixture lens shall be flush mounted within each car operating panel, directly above car operating buttons.
 - .4 Battery unit shall be of sufficient strength to support a 90 kg person without causing malfunction or damage, where unit is located on car-top.
 - .5 Include means for convenient manual operation and testing of emergency lighting fixtures from within car. Testing means shall consist of a spring return key-switch, located within in-car service cabinet.
 - .6 Provide sealed rechargeable battery, however, include means of containing leakage or spillage of electrolyte.

2.15 CAR TOP RAILING

- .1 Provide each elevator with car top guardrails in accordance with requirements enforced in the province, including but not limited to the following:
 - .1 Car top guardrails shall have a top rail not less than 1070 mm above the working surface;
 - .2 Car top guardrails shall have a mid-rail (or equivalent structural member);
 - .3 Car top guardrails shall have a toe-board to a height of 125 mm above the working surface.

2.16 EXTINGUISHING OF CAR LIGHTS

- .1 In-car lights shall automatically extinguish when all conditions detailed in Item 2.14.7.2.2 of the Elevator Code are met. Lights shall automatically illuminate when there is momentary interruption of any of these conditions.

2.17 C.C.T.V.

- .1 Travelling cable for all elevators shall include wiring (as specified elsewhere) to support a CCTV camera. Cable to run from elevator cab to machine room junction box, in a continuous arrangement, without splices.
- .2 Where CCTV cameras exist, this Division shall ensure that cameras are functional once the alteration of the respective elevator is completed.
- .3 Coordinate with other disciplines in the testing of the CCTV camera, including providing access and supervision of work performed within the elevator cab, hoistway and machine room.

2.18 SECURITY CARD READERS

- .1 Travelling cable for all elevators shall include wiring to support in-car security card reader devices. Cable to run from elevator cab to machine room junction box, in a continuous arrangement, without splices.
- .2 Existing security card readers shall be removed and re-installed by this Division in the new car operating stations.
- .3 Should Departmental Representative elect to install one additional security card reader adjacent to the new car operating panel of the freight elevator, card reader device shall be supplied by others and installed by this Division.
- .4 This Division shall ensure that the security card readers are functional once the alteration of the respective elevator is completed.
- .5 Coordinate with other disciplines in the testing of the security card reader, including providing access and supervision of work performed within the elevator cab, hoistway and machine room.
- .6 Once security mode of operation is initiated by master security controller, elevators equipped with card readers shall only accept car calls to a restricted floor if placed in combination with a proper security card. Car calls to main entry level shall not be controlled by card reader under security mode.
- .7 Under security mode, when not responding to landing or car calls, elevators shall park with their doors closed. Cars shall only open their doors in response

to hall calls or, alternatively, by activation of in-car DOOR OPEN button(s).

- .8 Include the following provisions:
 - .1 Provide logic and apparatus required to interpret and act on commands given to elevator controller by master security controller.
 - .2 Mount existing security interface cabinets on the exterior of the new elevator controllers including the extension of the wiring harness as required.
 - .3 Provide for each car call selection circuit, a labelled pair of dry contacts, set in a terminal strip, mounted in the elevator machine room, for interconnection to the security system.
 - .4 Isolate car call signal circuits to prevent unwarranted feedback through interconnections with security system relay controls.
 - .5 Provide signals at security interface panel to insure Phase I and II firefighters' emergency operation automatically override security provisions.
 - .6 Car calls shall be enabled when security system relay controls close in response to a cleared or authorized access card.
 - .7 Security system will keep car call circuit enabled for a limited time period. Elevator controls shall ensure car call circuit, once established, is self-holding until the elevator responds to that call.

2.19 PROTECTIVE PADS

- .1 Provide four complete sets of protective pads for the passenger elevators. One set shall be sized to suit elevator 1, one shall suit elevator 2, one shall suit elevators 4 to 6 and the final set shall suit cars 8 and 9. Provide protective pads in accordance with the following:
 - .1 Protective pads shall be specifically sized to suit platform dimensions completely covering all cab non-access walls.
 - .2 For access wall(s), protective pads shall be provided to cover return panels and transom, with a cut out for car operating stations, hands-free telephone speaker, car position indicator, firefighters' panel and service cabinet.
 - .3 Pads shall hang from cab suspended ceiling to 100 mm above car floor.
 - .4 Each wall shall be covered by a single piece pad, with adjacent pads overlapping a minimum of 150 mm.
- .2 Protective pads shall be manufactured from heavy-duty fire resistant canvas, padding, edging and thread. Pads shall be quilted, with all edges

selvaged and all seams shall be doubled. Pad colour to be selected by Departmental Representative, from manufacturer's standard catalogue.

- .3 Where protective pad hooks do not exist on all cab walls, provide same, with pad hook finish matching existing hooks.

2.20 REMOTE LOCATION OF ELEVATOR LICENSE CERTIFICATES

- .1 Co-ordinate with Departmental Representative and arrange with TSSA to allow elevator license certificates to be mounted in a location other than within elevator cab.
- .2 It is proposed that the certificates be maintained in the Level G Security Office unless directed otherwise by the Departmental Representative.
- .3 Assist the Departmental Representative in the preparation (and submission to TSSA) of a Notification of Minor Type B Alteration confirming this request. This Division shall include costs for such a notification where applicable.
- .4 Within the cab, surface engrave elevator installation number, carrying capacity (in number of persons and kilograms) and any other information required by Elevator Code or local regulations on the car operating station.

2.21 PIT AND HOISTWAY ACCESS

- .1 Provide pit and car top access provisions complying with Elevator Code clauses 2.12.6 and 2.12.7.
- .2 Hoistway access key-switches shall be provided at terminal floors, complying with the following:
 - .1 Provided that it is acceptable to the jurisdictional authorities, key-switch and back box shall be secured to the back of the landing door, piercing the sight guard to accept the key barrel. Alternatively this Division shall propose alternate mounting locations for same for review with the Departmental Representative.
 - .2 Centerline of key-switch shall be 1070 mm above landing sill.
 - .3 Key-switch must be capable of running elevator in both directions (i.e. to return elevator back to floor level).
 - .4 Where activation of more than one key-switch is required for hoistway access (i.e. car and lobby key-switches), key barrels must be identical.

.5 Engrave key-switch, indicating function and direction of operation (i.e. "Access", "Up", "Down").

- .3 In the case where existing key switches are no longer required, this Division shall remove fixture faceplate and provide a new blank faceplate in its place, with faceplate finish matching that of other fixtures in the lobby.

2.22 REMOTE CONTROL PANEL

- .1 Remove existing elevator remote panel located at the Commissionaires Station (adjacent to cars 4 to 6) and provide a complete new panel in its place. Panel replacement schedule is to be coordinated with Departmental Representative proposing that panel replacement occur when final elevators are being worked on and remote monitoring system has been activated.
- .2 Provide panel with a hinged cover-plate, to allow for ready service access. Cover-plate shall be finished in stainless steel and overall dimensions shall match existing to be accepted by existing back box. Where modifications to back box are required, this will be the responsibility of this Division.
- .3 Provide panel with the following controls:
- .1 Elevator emergency power reselection key switches as specified elsewhere;
 - .2 Elevator emergency power indicators to confirm when the respective elevator groups are being fed from the emergency generator and indicating the respective unit which is selected to operate from the emergency generator;
 - .3 Elevator emergency power LED indicators consistent with requirements of the Elevator Code to confirm when each of the respective elevators controlled by the reselection key switches is at the recall level with doors open. Indicators shall be designated with engraving stating "ELEVATOR AT RECALL LEVEL WITH DOORS OPEN";
 - .4 "OUT OF SERVICE" indicators for each elevator which illuminates when respective elevator is not in normal group operation;
 - .5 "DISTRESS" indicator for each elevator which illuminates and provides a temporary audible indication when the in-car alarm button is activated. Indicator shall consist of a push button, with activation of the button serving as a reset feature to extinguish the illuminating indicator;
 - .6 Position indicators for each elevator and respective landing served arranged in columns to

match the existing panel (Note: The use of Flush mounted manufacturer's standard LED digital readout position indicators can be pursued with the Departmental Representative with further direction being provided at the time of shop drawing reviews). These indicators will continually display the level an elevator is stopped at or by-passing (regardless of elevator's mode of operation), and have a minimum character display height of 38 mm.

.7 Provide a momentary position, spring-return key-switch, labelled "PARKING" for each elevator. Activating key switch will prevent elevator from being assigned further hall calls, and after responding to registered car calls, return car non-stop to Level 1 (with exception of cars 4, 5, and 6 which shall recall to Level E), where doors shall open and car will park for an adjustable period of time initially set at 30 seconds. During this time, if car is not placed on service, elevator will resume normal group operation (Note: Time frame is to be adjustable to 300 seconds in maximum increments of 5 seconds);

.8 Firefighters' Emergency Operation two-position key-switch, for each elevator group, complete with operating instructions and indicator lights (Note: Further direction for the FEO key switches will be provided during the shop drawing review stage following clarification with TSSA whether such FEO keys can continue to be provided in this panel;

.9 Keyed lock box, within panel faceplate, designed to house firefighters' emergency operation keys.

.10 As part of survey, where existing panel has additional features not listed here-in this Division shall advise Departmental Representative and ensure that these features are provided with the new panel, complete with details of how they will operate.

- .4 Supply wiring between elevator hoistways and remote control panel, with installation of wires and provision of conduit being by others per Electrical Drawing E-100. Terminate wires and assume responsibility for correct functioning of panel.
- .5 Panel indicator lights shall be L.E.D. type. Colour of indicators shall be manufacturer's standard, unless specified otherwise or required by Code to be red.
- .6 Panel lettering shall be surface engraved in manufacturer's standard font style, although engraving shall be in both English and French.

2.23 ELEVATOR REMOTE
MONITORING SYSTEM

- .1 Provide a remote monitoring system locating a single terminal within the Level G Security Office, coordinating the final placement of the terminal with the Departmental Representative.
- .2 Supply wiring between elevator machine rooms, hoistways and remote monitoring system to establish the network for this system. Installation of wires and provision of conduit between the elevator hoistways and Security Office shall be by others per Electrical Drawing E-100.
- .3 Assume responsibility for correct functioning of remote monitoring system.
- .4 Remote monitoring system will include:
 - .1 Interactive communication and control between monitoring unit and each elevator controller.
 - .2 System shall be arranged to display real time operating information on monitor.
 - .3 Information shall be displayed in a graphic and tabular or typed graphics format.
 - .4 System shall be provided with a minimum 533 mm TFT LCD monitor, complete with brightness, tint and colour controls.
 - .5 Workstation shall utilize high-performance processor consisting of the most current version at time of installation.
 - .6 Ethernet network interface cards, graphics cards, and read-write CD ROM's.
 - .7 Workstation shall include at least one Gigabyte RAM. New computer system shall be delivered with latest Windows software pre-installed.
 - .8 Provide one keyboard unit complete with alphanumeric keys, number pad and function keys. Keyboard unit shall allow building personnel to input keystroke commands allowing modification and alteration of existing car and group operating parameters.
 - .9 Monitoring system shall be network based and non-proprietary.
 - .10 Monitoring system shall be provided with a master menu of various system information and interactive control functions including, but not limited to:
 - .1 Group status display which shall detail:
 - .1 Elevator identification number
 - .2 Location of elevators
 - .3 Location of registered hall calls
 - .4 Direction of car travel
 - .5 Door operating status
 - .6 Car loading information
 - .7 Group supervisory system operating mode

- .8 Individual car operating mode (Firefighter's Emergency Operation, Independent Service, etc.)
 - .2 Event and Error Record displaying:
 - .1 Date of error or event
 - .2 Location of error or event
 - .3 Type of event or error
 - .4 Number of occurrences
 - .11 In addition, provide the following operational and control features:
 - .1 Performance Characteristics, including waiting time distribution, per floor, and maximum and average waiting times.
 - .2 Provide interactive command function to allow building personnel to program elevators to perform Parking, Independent Service, Out of Service and Security functions.
 - .3 Allow building personnel to program elevators, on a group or individual basis, to disable car calls to specific floors (or all floors), to prevent registration of up hall calls, down hall calls, or both, at certain floors or to prevent specific elevators from responding to certain hall calls.
 - .4 Record events and elevator operation statistics in memory and provide features to allow playback of events and retrieval of information. Provide sufficient memory for storage of information and retrieval or playback for a minimum 3-month period.
 - .5 System software shall allow for unique password designations to protect against unwarranted access to system modification and control functions.
- .5 Provide Departmental Representative with three (3) complete sets of training and operation manuals and required reference material to allow building personnel to become familiar with this monitor and recording unit. Provide a digital copy of all submitted manuals and reference material.
- .6 At completion of modernization arrange training session's specific to this remote monitoring system. Include for a minimum of four 2-hour training sessions, to be scheduled with Departmental Representative.
- .1 Clean and subsequently paint retained elevator pit equipment including (as applicable) governor rope tension weight assemblies, buffer support channels, working platform and counterweight guards.

2.24 PAINTING

- .2 Paint retained Machine Room equipment.
- .3 Clean and then paint hoistway fascia plates and car aprons in their entirety with flat black paint.
- .4 Painting within common areas, such as the machine room, shall be scheduled for the end of the project when the modernization of all elevators has been completed. Ensure holes in the machine room floor slab (no longer required following the equipment modernization) are sealed, or covered, prior to painting the floor.
- .5 Where retained equipment has surface rust, provided that equipment is sound, sand equipment to bare metal and apply a primer before applying the final coat of paint. Where retained equipment is not sound, replace same as part of work with no further compensation.
- .6 Car identification number (minimum of 100 mm high) shall be permanently stencilled on car crosshead, controller and disconnects, in a prominent colour (yellow), once final coat of paint has dried.
- .7 Prior to painting equipment, ensure that all signage, nameplates, labels and tags are covered and protected from paint splashes or being painted over. Protective coverings shall be removed once painting is complete.
- .8 When painting equipment, protect signage, nameplates and all other tags from paint splashes or being painted over. After painting, apply minimum 50 mm high car number designations to equipment components.
- .9 Permanently stencil floor levels on hoistway side of landing doors and fascia plates, once final coat of paint has dried. Floor numbers shall be a minimum of 100 mm high and in a prominent colour (such as yellow).
- .10 Schedule for painting shall be coordinated with Departmental Representative although where paint fumes are evident within the building, painting shall cease immediately and resume after hours or on weekends as coordinated with Departmental Representative.

2.25 ENGRAVING

- .1 Key-switch, signage and signal/control device engraving shall be filled in black colour, except

where required by Code to be filled red or specified otherwise.

- .2 Engraving filler shall consist of permanent adhesive epoxy paint. Provide engraved identification and instructions on car operating panel and on all elevator signal equipment.
- .3 Where possible, engraving shall be minimum 6 mm high and in manufacturer's standard font style.

2.26 KEY-SWITCHES

- .1 Key-switches for elevator maintenance, inspection, etc. shall be manufacturer's standard type and grouped as required by Elevator Code item 8.1, although shall be identical in all cars for the same function.
- .2 Provide Departmental Representative with a minimum of 25 copies of keys (unless specified otherwise) used for the following switches:
 - .1 Cab light
 - .2 Cab fan
 - .3 Independent Service
 - .4 Emergency Battery Light Test
 - .5 Parking
 - .6 Firefighters' Emergency Operation.

2.27 POLISHED METAL AND SHEET STEEL

- .1 Reinforce polished metal panels to prevent noticeable distortions.
- .2 Stainless steel shall have a No. 4 brushed finish, with final selection and grain direction being confirmed by the Departmental Representative, at time of shop drawing reviews.
- .3 Bronze finishes utilized within the passenger elevator cab enclosures and lobby fixtures shall match the finish of the existing material.
- .4 Sheet steel used shall also be to ASTM A366. Steel sheets shall be uncoated and pickled to allow for on-site painting. Sheet steel members shall be free of all defects.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Take critical site dimensions to ensure that new equipment is engineered to suit existing site conditions.

3.2 HOISTING

- .1 Required hoisting and movement of elevator equipment shall be the complete responsibility of this Division.
- .2 This Division shall familiarize themselves with existing conditions at the site including means of access to the machine room and location of hoist beams.
- .3 It is acknowledged that some machine rooms are equipped with oversized doors which open to the building roof level. In cases where it is intended to use these doors for transfer of equipment, methods of accessing these doors must be established by this Division. This Division also assume responsibility and costs for protection of the roof membrane and shoring for load distribution.
- .4 This Division shall incur craning costs where it is intended to crane material.

3.3 INSTALLATION AND TOUCH-UP

- .1 Arrange new equipment in existing elevator machine room space.
- .2 Dismantle and remove from site equipment replaced under these Specifications.
- .3 Upon completion, touch-up and restore to new condition, damaged or defaced factory finished surfaces.
- .4 Where rust has developed, brush surface to bare metal and repaint with, minimum, two (2) coats of rust inhibiting primer.
- .5 Remove any protective coverings and clean exposed surfaces after completion and leave in first class condition.

3.4 ERECTION

- .1 Erect elevator closures in accordance with Code requirements.
- .2 Exposed work in car and at entrances shall be fabricated in true planes, flat and straight, free of buckles, waves and other visible imperfections.
 - .1 Joints shall be accurately fitted and properly aligned.
 - .2 Fasteners shall be concealed unless permitted by Departmental Representative to be exposed.
 - .3 Welds shall be undetectable in finished work.
- .3 Set fixture boxes in vertical alignment and install cover-plates so they are plumb, parallel and square with entrance frames and lobby finish grid.

3.5 TOUCH-UP

- .1 Upon completion, touch up and restore to new condition damaged or defaced factory finished surfaces.
- .2 Remove protective coverings and clean exposed surfaces after completion and leave in first class condition.
- .3 Clean running faces of all guide rails before final acceptance of elevator installation.
- .4 Conduct a thorough clean down throughout the elevator hoistway, pit, machine room and car top.

3.6 INSPECTIONS AND ACCEPTANCE OF WORK

- .1 Comply with and meet safety testing and provincial inspection requirements, as required under the Elevating Devices Act and ASME A17.1-2010/CSA B44-10. Obtain and pay for required inspections and permits. Make such tests, as are required by the regulating authorities. Submit to Departmental Representative, test and approval certificates issued by jurisdictional authorities.
- .2 Per TSSA's Code Adoption Document Amendment 250/11, "Where category 5 (CAT5) tests require the use of load for testing purposes, alternative no load methods shall be permitted where the alternative method is acceptable to the Director." Alternative CAT5 tests may be performed without load if the elevating device (at some point in time) was tested with load and directly afterwards was tested using alternative testing tools (and no load). The documentation of the load test followed by the no load test forms the "baseline" documents to be used

going forward (i.e. at the next 5 year anniversary). In accordance with the above, this Division shall establish a procedure for these tests which is acceptable to TSSA, providing a copy of same in the Maintenance Control Program. As part of the commissioning for each elevating device, this Division must perform tests based on the procedure to establish the "baseline" identified above, and mitigate the need to carry out full load CAT5 tests in the future.

- .3 Departmental Representative acceptance shall be carried out after completion of modernization work, on each specific unit, and acceptance of unit by TSSA.
 - .4 These reviews will consist of individual performance measurements, and will require this Division to provide assistance of a team of competent personnel and one full set of test weights throughout the course of this review. Car is to be loaded between 50% and 60% of full load to test related features such as load weighing and levelling. Elevator operation with balanced load will also be monitored at time of review. Car is then to be loaded to 100% rated capacity to test performance criteria including flight time, speed variation, levelling accuracy and brake operation. Load will then be removed from cab and review of hoistway, car and machine room devices will be carried out.
 - .5 Acceptance tests will also be carried out upon completion of final elevator in each group and will include testing and review of all controller features including: group operation, car calls, hall calls, Firefighters' Emergency Operation, emergency power operation, remote monitoring and two-way voice communication.
 - .6 Provide Departmental Representative, a minimum two (2) weeks advance notice of completion of individual units.
 - .7 Provide a team of competent men to assist during the course of the Departmental Representatives follow-up review to confirm completion of deficiencies.
 - .8 Prior to calling for an acceptance review, this Division shall record a complete set of performance criteria (as identified below) for respective elevator. This recorded data shall be forwarded to the Departmental Representative along with a written request for the review of the respective unit. As a minimum the following data shall be recorded:
 - .1 Elevator number;
-

- .2 Running speed with full load (UP and DOWN);
- .3 Single typical floor flight times with full load (UP and DOWN);
- .4 Single typical floor brake-to-brake times with full load (UP and DOWN);
- .5 Door performance, including Door Open and Close times and Closing Force;
- .6 Car and Hall call dwell times;
- .7 Door re-opening device Interrupt Time and Door Close time on Nudging Operation;
- .8 Confirmation of 6 mm levelling accuracy (on initial stop), at all floors, in both directions of travel, with full load, no load and any load between;
- .9 Full load starting and running currents.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Comply with Division 01, General Requirements and documents referred to therein.
- .2 Read and conform to all sections of Division 14.
- .3 Where a device or piece of equipment is referred to in singular number, it is intended that such references shall apply to as many devices or pieces of equipment as are required for the completion of this Project.

1.2 SUMMARY

- .1 This Section applies to the major alteration of one freight elevator.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

- .1 Provide all labour, materials, equipment, services, and perform all operations required for modernization work of one (1) traction freight elevator, as specified herein.
- .2 Elevator work shall be in accordance with all applicable requirements of the Contract Documents and the ASME A17.1-2010/CSA B44-10.

2.2 DESCRIPTION OF EXISTING EQUIPMENT

- .1 Building Freight Elevator 3:
 - .1 TSSA Numbers: 039811.
 - .2 Type and Manufacturer: Overhead geared traction; manufactured and installed by Otis Canada Inc., with a major alteration subsequently being performed by Montgomery KONE Elevator.
 - .3 Rated Capacity: 3630 kg, with Class C2 loading.
 - .4 Rated Speed: 0.5 m/s.
 - .5 Existing Floors served: Front openings at 2, 3, 4, 5, 6 and rear openings at G, 1.

2.3 PERFORMANCE

- .1 Adjust elevator to travel at specified rated speed, within maximum variation of $\pm 3\%$, in either direction, with full rated load.
- .2 Start-to-stop time shall be a maximum of 8.0 seconds with car loaded to full rated capacity.
- .3 Start-to-stop time is based on a floor to floor rise of 4040 mm.
- .4 Elevator shall start to move within a maximum of 1.0 second following the closing of the car gate and landing door.
- .5 Acceleration and deceleration to be smooth. Transitions shall be without noticeable shifts.
- .6 Out of service, or delayed car timer shall be set at 30.0 seconds.
- .7 All timing devices shall be readily adjustable.

2.4 HANDICAPPED PROVISIONS

- .1 As use of freight elevator is to be limited to freight handlers and other trained and designated staff, unit will not be designed in full conformance with Appendix E of the ASME A17.1-2010/CSA B44-10, although efforts for compliance will be made in the following areas:
 - .1 New car operating stations
 - .2 New hall button fixtures installed at the existing height, although modifications may be required at some level to accommodate additional features.
 - .3 Provide lobby entrance tactile plates, mounted on both entrance jambs, at all levels served, with no visible fastening devices.
 - .4 In-car directional lantern with dual electronic chimes, sounding once to indicate UP travel and twice for DOWN travel. Fixtures shall be vandal-resistant and located in the side wall adjacent to the car operating panel. Fixture shall be located so that centreline is a minimum of 1830 mm above the cab floor, with the faceplate being applied directly to the wall.
 - .5 Audible signals to be electronic with adjustable volume control.
 - .6 Electronic voice annunciator.

2.5 GEARED MACHINE AND DEFLECTOR SHEAVE

- .1 Dismantle the existing geared hoisting machine and dispose of same, removing it from site.

- .2 Provide elevator with one new single worm geared traction machine with reversible motor, driving sheave and brake mounted on a cast iron or steel bedplate, complete with sound isolation. Worm shall be of high-grade steel, integral with worm shaft and provided with a ball bearing thrust unit designed to absorb thrust of worm in both directions. Thrusts shall be removable without dismantling machine. Include roller or anti-friction metal bearings with adequate means of lubrication.
 - .3 Hob worm gear from a bronze rim, which shall be accurately fitted and securely fastened to gear spider. Include inspection plate for visual inspection of gear without removing gear casing.
 - .4 Machine bedplate shall be sound isolated from Building structure by means of elastomer pads properly loaded for machine developed static and dynamic forces. Provide adjustable mechanical stops to prevent rocking and equip machine with sufficient number of isolation pads so as to eliminate structurally borne machine noise transmissions.
 - .5 Machine shall be specifically designed for elevator overhead service. Provide left or right hand machine designed to fit into existing Machine Room space. Machine bearings shall be designed to accommodate equipment reactions.
 - .6 Provide required material to allow the new machine to be supported by existing beams, including any modifications to accomplish this. Provide steel filler pieces and acoustical baffling material designed to prohibit machine room noise from filtering through machine room floor slab holes.
 - .7 Where retained, rope deflector sheave shall be refurbished including a clean-down of the sheave and supports, inspection of the sheave bearings, replacement of bearings where required and lubrication of same. Under this circumstance this Division must ensure that compatibility is maintained between the new machine and the deflector sheave.
 - .8 Where sheave replacement is warranted this shall be performed as part of the bid amount, at no additional cost. Where deflector sheave is replaced, this Division is to raise the machine on a suitable platform to permit deflector sheave to be located in the machine room.
-

2.6 HOIST MOTOR

- .1 Provide alternating current squirrel cage induction motor. Motor shall be designed for elevator service application, and shall have the following features as a minimum: EEMAC, T-Frame, Open Drip Proof Design B, Class H insulation, Service Factor 1.15, ball bearing, 65 Co temperature rise.
- .2 Motor shall be capable of meeting performance, condition and reliability requirements of the installation, with sufficient horsepower to drive elevator, under full load conditions, and operate at minimum 240 starts per hour, for a minimum period of eighteen (18) consecutive hours, without over-stressing or over-heating hoist motor.
- .3 Certify that hoist motor/machine type as selected can meet full load running test consisting of operating elevator at 100% of contract load, running at 100% contract speed, starting and stopping 240 times, during a one hour period with a temperature rise, measured at the motor housing, not in excess of the manufacturer's specified motor rating, starting at an ambient of approximately 20 degrees Celsius. Test shall be based upon procedure where stop or dwell time between successive starts shall be approximately equal over the hour period.
- .4 Provide closed loop motor control feedback system which automatically regulates motor drive by comparing actual car acceleration, deceleration and velocity profiles with preset optimized values.

2.7 BRAKE

- .1 Brake shall be direct-current operated, electrically released, spring applied, and shall be capable of stopping and holding car securely with load of 125 percent of rated capacity.
- .2 Permanently identify and mark brake spring lengths.
- .3 After the brake is adjusted and set, drill the outer brake spring lock nut and the threaded adjusting rod and insert a dowel pin.
- .4 Provide brake with switches and monitor same to ensure that machine will not run until such a time that the brake has lifted.

2.8 MOTOR DRIVE

- .1 Provide variable voltage variable frequency (VVVF) drive for alternating current motor.
-

- .2 Use automatic closed loop system providing instant and noiseless response to power requirements.
- .3 VVVF control system shall transform incoming alternating current (AC) power to direct current (DC) power. AC power of variable frequency and variable voltage shall be generated from the DC power.
- .4 Include required power smoothing filters to provide satisfactory elevator performance and long term reliability.
- .5 Switching frequencies shall be at least 16 KHz.
- .6 Provide noise suppression devices and harmonic filtering where required to ensure that noise levels within machine room do not exceed 65 DbA within 1000 mm of equipment, and that noise levels at harmonic frequencies shall not exceed 70 Db within 1000 mm of equipment.
- .7 Provide a regenerative drive to return excess power (created by overhauling loads or regenerative braking conditions) back into line supply, while filtering any emanating rectifier drive frequencies to prevent objectionable interaction with Building components and personnel.
- .8 Provide a written statement confirming that the total harmonic contribution from the manufacturer's equipment is less than 3%, and individual harmonic distortion is less than 5%. Provide harmonic filters and or harmonic mitigating transformers to meet these conditions.
- .9 The motor drive unit shall be capable of detecting and reacting in safe mode to loss of supply voltage, loss of phase, loss of fuse, and/or excessive heating or short circuits in either the machine or motor drive.
- .10 Drive system and motor shall be rated for 240 starts per hour.
- .11 Size motor drive to handle full starting current plus a safety factor of 10%. Protect against voltage "spikes". Motor drive shall continue to perform under conditions of fluctuations in line (voltage) supply of +5% and -10% and frequency variations of +2% from normal values without any degradation to normal elevator service.

- .12 Design solid state devices to handle current in excess of rated amount.
- .13 Isolate solid state drive unit to prevent vibration transmission to Building structure.

2.9 CAR AND COUNTERWEIGHT GUIDES

- .1 Remove existing car and counterweight guides and provide new heavy duty guide shoes in accordance with the following:
 - .1 Guide shoe assemblies shall be mounted at the top and bottom of the respective frame.
 - .2 Guide shoes shall be spring loaded, complete with adjustable stops for limiting the overall float.
 - .3 Guide shoes shall be manufactured of an energy efficient aluminum.
 - .4 Guides shall be provided with replaceable UHMW Polyethylene gibs which can run on unlubricated guide rail surfaces.
 - .5 Prior to installing the guide shoe assemblies, ensure that car and counterweight are statically balanced to limit the pressure on any guide member.

2.10 COUNTERWEIGHT

- .1 Counterweight shall be reused and following field verification, weights shall be adjusted as required to maintain appropriate counterbalance between 45 and 50%.
- .2 Permanently identify maximum counterweight run-by in accordance with the Elevator Code. Signage shall be provided with characters which are a minimum of 25 mm high.
- .3 Counterweight bricks and frame shall be cleaned and painted with a minimum of one coat of rust inhibiting paint.

2.11 CAR AND COUNTERWEIGHT BUFFERS

- .1 Clean, refurbish and re-use car and counterweight buffers.

2.12 SAFETY DEVICES

- .1 Refurbish existing car safety device and fittings. Completely overhaul including:
 - .1 Examination of guides and stops for wear and replacement where required.
 - .2 Clean and lubricate.
 - .3 Adjustment check of relating rods.

- .2 Perform full load drop test, at over-speed, prior to hand over of elevator. Tests to be co-ordinated with and witnessed by the TSSA or Departmental Representative.
- .3 Retain and refurbish existing rope gripper, thoroughly cleaning and lubricating equipment and replacing the complete set of pads. Verify operation of the rope gripper to ensure unit functions in accordance with requirements of the Elevator Code. Where adjustment or part replacement are required, provide same as part of this work.
- .4 Existing unit shall be maintained as part of the preventive maintenance agreement, appreciating that where future replacement is required this will form part of the agreement at no additional cost to the Departmental Representative.

2.13 GOVERNOR

- .1 Provide new overspeed governor complete with new rope and governor weight tension device.

2.14 CAR FRAME AND PLATFORM

- .1 Refurbish frame and platform including:
 - .1 Clean and paint.
 - .2 Check all bolted connections for proper tension and tightness.
 - .3 Check sound isolation and fireproofing. Modify where required.
 - .4 Check frame for soundness repairing same as required.
- .2 Adjust cab mounting to allow cabin to move freely in a vertical direction. Set horizontal guiding members to hold cab firmly without restraint during vertical movement. Insure cab isolation is sound and not impaired by contact with cab attachments.
- .3 Provide elevator with car top railing in accordance with requirements of the Elevator Code. Railings must be engineered and designed so as to not reduce effectiveness of cab isolation.

2.15 HOISTING CABLES AND FASTENINGS

- .1 Replace existing hoisting cables and provide new hoist rope data tags.
- .2 As part of hoist rope replacement provide new alternate length wedge clamp cable shackles, having

threaded rods with adjustment to equalize rope tension.

- .3 When adjusting hoist rope lengths ensure that all counterweight blocks are installed and that the counterweight runby is set at the maximum permitted. Following installation, new hoist ropes must be monitored bi-weekly (in the first 6 months (minimum)) for stretch such that adjustments can be made as required.
- .4 Hobble car and counterweight end rope shackles.

2.16 HOISTWAY DOOR PANELS AND HARDWARE

- .1 Existing door panels and rails shall be retained and reused. The following replacement hardware shall be provided on all existing landing doors:
 - .1 Guide shoes on all panels;
 - .2 Door chains, connecting links and chain rods;
 - .3 Landing door interlocks (complete with new wiring).
- .2 Verify operation of landing doors making adjustments as required.
- .3 Provide unlocking devices at all levels.
- .4 Landing doors shall be provided with pull straps to permit manual closing and opening, provided the elevator is with the levelling zone.

2.17 HOISTWAY DOOR OPERATOR

- .1 Provide a new Peele controller to permit automatic sequenced power operation of hall doors and car gates to allow for transportation of freight handlers, designated employees and emergency personnel.
- .2 Door operators shall be refurbished and adjusted to ensure consistent, smooth and quiet door operation.
- .3 Doors, at the appropriate landing, shall open by momentary pressure on "Door Open" button or, automatically, when car responds to a registered car or landing call.
- .4 Doors shall close with constant pressure on "Door Close" button or, automatically, after expiration of adjustable dwell time, initially set at 40 seconds. Dwell time shall be adjustable from 0 to 300 seconds in maximum increments of 20 seconds.

- .5 Provide elevator with a warning bell, designed to sound a minimum of 5 seconds prior to doors closing in accordance with the Elevator Code.

2.18 VERTICAL SLIDING CAR GATE

- .1 Remove existing car gates and provide new power operated vertical lift car gates, as manufactured by Peelle.
- .2 Gates shall consist of 1830 mm high single-section slide-up car doors, with 10 mm rectangular wire mesh panels, power operated sheaves, gate contact, rails, chain, mounting hardware, limit, dual light curtains, 2" x 12" wood bumpers, counterweight and standard baked on powder coat RAL 7010 finish.
- .3 Gates shall run on new steel tracks and be counterbalanced by weights. Car gate panel and counterweight shall be supported by dual, independent roller chains.
- .4 Car gates shall be provided with pull straps to permit manual closing and opening, provided the elevator is with the levelling zone.
- .5 Provide electric contacts to prevent operation of elevator when car gate is open.
- .6 Modify existing cab enclosure as required to suit space requirement for new car gate assemblies and associated hardware.

2.19 CAR OPERATING PANEL

- .1 Provide a new car operating station in place of the existing station, modifying the cab enclosure as required to accommodate the new panel.
- .2 As part of alteration provide a second car operating station at the opposite side of the cab containing the same features as the main car operating station with exception of the FEO cabinet and service cabinet. Modify the cab enclosure as required to accommodate this additional car operating station.
- .3 Car operating panel shall be finished in stainless steel and provided with hinges to allow for ready service access.
- .4 Panels shall contain car operating buttons, flush mounted position indicator and flush mounted emergency battery lighting fixture. Panel on side of cab for which doors open at recall level shall

contain firefighter's operation cabinet, communication system perforations, service cabinet and ability to accommodate the security card reader. Final configuration of panels will be confirmed at time of shop drawing reviews, taking into account field measurement by this Division. New car operating shall accommodate security card reader device where such a device is supplied by others.

- .5 Both panels shall contain a "DOOR HOLD" button which will serve to extend the time which the car gate and landing door remain in the fully open position. This dwell time is to be readily adjustable from 20 to 300 seconds, initially being set at 60 seconds. Pressing the "DOOR HOLD" button when the doors are open will automatically initiate this operation, re-starting the dwell time, with the dwell time being overridden by Door Close buttons in the car and at the landing which the elevator is parked. This dwell time shall also be automatically overridden by Phase I of FEO operation.
- .6 Provide illuminating car call buttons using LED's, corresponding to each level served. Car call buttons shall consist of manufacturer's standard vandal resistant fixtures. Registration of a car call shall result in a momentary audible signal and cause corresponding button to illuminate.
- .7 Once call has been answered, call shall cancel and light extinguish.
- .8 In addition to car call buttons, provide the following control items:
 - .1 Emergency alarm button;
 - .2 Door open button;
 - .3 Door close button;
 - .4 Phone button, which activates hands-free telephone;
 - .5 All of the above fixtures shall be illuminating type buttons.
- .9 Provide a lockable FEO cabinet, flush-mounted at top of main return panel. Cabinet faceplate finish shall match car operating panel and be equipped with a concealed hinge. Cabinet shall contain devices and instructions in accordance with the requirements of the Elevator Code.
- .10 Provide a lockable flush mounted service cabinet. Cabinet faceplate finish shall match car operating panel and be equipped with a concealed hinge. Cabinet shall contain the following:
 - .1 Keyed stop switch;

- .2 Independent Service key-switch, with key removable in both positions;
- .3 Momentary position emergency battery lighting test switch;
- .4 Three-position fan switch ("OFF", "LOW", "HIGH");
- .5 Car light switch;
- .6 GCFI duplex receptacle;
- .7 Any other switch required to operate or service elevator. When maintenance switch is provided, it shall be a keyed switch;
- .8 Permanently identify function and key-switch positions (i.e. "LIGHTS", "ON", "OFF") for all key-switches, either by engraving or collar ring;
- .9 Key-switch on service cabinet door shall be keyed the same as Independent Service key-switch within.
- .11 In-car signage shall be surface engraved (or etched) on car operating panel(s). Signage shall include, but not be limited to: car number, no smoking signage, communication instructions, capacity (in kg and persons) and provincial installation number. Surface mounted signage plaques are unacceptable.
- .12 Provide raised Arabic numerals (characters), and equivalent Braille marking, corresponding to each button and control switch within elevator. Braille tags shall be mounted to the left of respective button or key-switch. Markings shall have no backing plate or visible fastenings. Submit full size sample of tactile plate, for Departmental Representative's review.
- .13 Where additional signage associated with the freight operation of this unit is required to comply with the Elevator Code, provide same as part of this Work.

2.20 IN-CAR DIRECTIONAL INDICATORS

- .1 Provide elevator with in-car directional arrows, mounted adjacent to the car operating panels. Mount indicators at no less than 1830 mm above car floor.
 - .2 Design indicators to illuminate to indicate actual and intended car direction of travel. Fixture shall consist of vandal-resistant arrows and illuminate green for UP and red for DOWN. Provide unit with internal baffles to prevent slippage of light between adjacent lantern chambers.
 - .3 Directional arrows shall be within a stainless steel fixture face-plate fastened with tamperproof screws.
-

- .4 Modify cab side wall as required to accommodate the in-car directional lanterns.
- .5 Lanterns shall be provided with dual stroke electronic chimes sounding once for the up direction and twice for down.

2.21 LANDING BUTTONS

- .1 Remove existing landing buttons and provide new fixtures at all floors served.
- .2 New fixtures shall be finished to match the existing fixtures and mounted at a height to satisfy requirements of Appendix E of the ASME A17.1-2010/CSA B44-10. This Division shall design new fixtures in accordance with same, with faceplates being secured in place with tamperproof fasteners.
- .3 In addition to the respective call buttons, fixture faceplates at the primary recall level must contain:
 - .1 Firefighter's Emergency Operation 3-position keyed switch, indicators and associated engraving;
 - .2 Emergency Power LED and engraving;
 - .3 Monitoring provisions associated with elevator two-way voice communication system in accordance with the ASME A17.1-2010/CSA B44-10.
- .4 New hall call buttons shall consist of vandal resistant fixtures to match those provided inside the cab, with LED illumination.
- .5 Provide intermediate floors with one (1) Up and one (1) Down direction hall button, while terminal landings shall be provided with a single hall button. Hall button shall illuminate and remain illuminated so long as a hall call is registered. Once hall call has been responded to, LED shall extinguish.
- .6 In addition to the hall buttons, fixtures at all landings must accommodate "Door Open", "Door Close" and "Door Hold" buttons together with a combined digital position indicator and directional arrow. These buttons shall permit operation of landing doors and car gate while elevator is at that floor, with the "Door Hold" button functioning as detailed in Article 14 21 13 2.19. The position indicator and directional arrows shall have a character display height to ensure that these characters are legible when standing a minimum of 1000 mm from the fixture.

2.22 CAB ENCLOSURE

- .1 Modify cab enclosures as follows:
 - .1 Paint cab walls and ceiling with a minimum of two coats of paint in the colour selected by the Departmental Representative.
 - .2 Provide an additional wood bumper rail on both side walls matching the profile of the existing wood rail. Second rail shall be mount such that top of rail is approximately 1000 mm above the cab floor unless otherwise directed by the Departmental Representative.
 - .3 Existing cab lighting fixtures shall be removed and replaced with new 1200 mm, double lamp T8 fluorescent fixtures (with instant start ballasts) flush mounted with the underside of the cab canopy. Lamp replacement shall be possible from within the cab and fixtures shall be provided with protective lenses to prevent accidental damage to the fluorescent tubes. Lens shall be hinged allowing access for bulb replacement and fully cover the recess into which the light fixture is installed. Modify cab ceiling as required to accommodate installation of the new lighting fixtures. On car top, provide reinforcement overtop of these fixtures to provide a standing area which will accommodate a minimum weight of 120 kg without damage to the fixture.

2.23 SIMPLEX
SELECTIVE
COLLECTIVE
OPERATION

- .1 Provide Simplex Selective Collective Automatic Control operation.
- .2 Operation shall be controlled from the hall buttons and car call buttons. Activation of one or more landing or car buttons, other than those at the landing where the elevator is located, shall cause the car to start, provided safety circuits are closed. Elevator shall travel and stop at the first landing for which a car or hall call is registered, corresponding to the direction of car travel.
- .3 Elevator shall stop at all landings for which car or hall calls are registered. Stops shall be made in the order the landings are reached, not in the order or sequence in which the calls were placed. Elevator shall stop for calls registered for the direction of intended travel, provided the call has been registered sufficiently in advance of car arrival to permit a safe stop.
- .4 Once elevator stops in response to a hall or car call, the doors shall remain open for an adjustable period of time. Upon expiration of this dwell interval, the car and hall doors shall close.

- .5 When car is designated to park at a landing, it shall do so with its doors closed.

2.24 OPERATION AND CONTROL FEATURES

- .1 Provide hall push button failure operation, designed to allow elevator to continue to serve all floor levels when hall push button riser is lost (i.e. wild car or continuous car call operation). When elevator is operating on auxiliary means of dispatching, registered car calls shall not cause elevator to bypass scheduled dispatching stops.
 - .2 Provide microprocessor-based control system with solid-state devices which shall not be affected by electrical noise, caused by switching and operation of other electrical equipment.
 - .3 Equipment shall be capable of problem-free operation within ambient temperature ranges between 5 and 32 degrees C.
 - .4 Microcomputer shall be housed within a drip-proof free-standing or wall-mounted cabinet enclosure. Cabinet shall be located in elevator controller room. Enclosures shall be designed to accommodate compartmentalized control systems. Provide adequate means of ventilation and filtration of air into controller enclosures.
 - .5 Printed circuit cards shall be readily removable and interchangeable where cards perform identical functions. Cards shall be electrically interlocked and mechanically keyed to ensure proper seating.
 - .6 Card terminal assemblies shall be plug-in type to provide easy removal and replacement without disturbing conductor wiring.
 - .7 Provide microprocessor with sufficient READ ONLY memory storage for required operation and control programmes, plus a minimum of 25% spare capacity for future programme expansion. Software-based programmes shall be readily changeable without undue disruption in service. Protect all programme memories against loss due to power failure.
 - .8 Control system shall incorporate required interfaces to allow for connection of portable service and maintenance service equipment.
 - .9 Control system shall be provided with complete self-diagnostic capabilities which automatically identify
-

and log (in memory) specific system faults and safety device failures.

- .10 A full list of monitored events and their respective codes (visible on diagnostic equipment) shall be included in the maintenance manuals. Diagnostic equipment shall be a permanent device(s) mounted in each controller and shall remain property of the Departmental Representative, for the life of the equipment.
- .11 Provide directional reversal so that a car arriving at a landing where both UP and DOWN hall calls are registered, will first answer call placed for the direction that car was travelling. If no car call is placed in initial direction and car is assigned to respond to opposite direction hall call, elevator will have the ability to respond to the opposite direction hall call without cycling the doors. In-car lantern operation shall always correspond to intended direction of elevator travel.
- .12 Provide reversal feature, which will allow car to automatically stop at next floor, and reverse without opening its doors, upon assignment of opposite direction hall call, when changing traffic conditions have cancelled previous hall call assignment. When car stops at floor for reassignment, in-car lantern shall not illuminate.
- .13 When car arrives at terminal floor, automatically cancel all registered car calls. Alternatively, car calls shall not register for levels located below an UP traveling car or above a DOWN direction elevator.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Comply with requirements as set out in Part 3 of Section 14 05 00.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL
REQUIREMENTS

- .1 Comply with Division 01, General Requirements and documents referred to therein.
- .2 Read and conform to all sections of Division 14.
- .3 Where a device or piece of equipment is referred to in singular number, it is intended that such references shall apply to as many devices or pieces of equipment as are required.

1.2 SUMMARY

- .1 This Section applies to the major alteration of seven passenger elevators.
 - .2 Passenger elevators consist of three separate groups of elevators, with two groups containing 2 elevators each (Cars 1, 2 and 8, 9), with a third group containing 3 elevators (Cars 4, 5, 6).
 - .3 To limit service disruption to the building and its occupants, replacement of the hall button risers shall be scheduled in advance with the Departmental Representative to occur outside of normal working hours or alternatively on a weekend such that active landing buttons are always available during the course of the elevator alteration for each elevator group. This Division shall propose viable options for the Departmental Representatives review and direction.
 - .4 For the Centre Court elevators, this Division shall ensure that in advance of commencing with the alteration of the second group elevator that a cross-cancellation system is established to ensure that both the modernized and unmodernised elevator can function as a group in response to registered landing calls. Details of this proposed cross-cancellation system shall be presented to the Departmental Representative for review and direction.
-

PART 2 - PRODUCTS

2.1 WORK INCLUDED

- .1 Provide all labour, materials, equipment, services, and perform all operations required for modernization work of seven (7) traction passenger elevators, as specified herein.
- .2 Elevator work shall be in accordance with all applicable requirements of the Contract Documents and the ASME A17.1-2010/CSA B44-10.

2.2 DESCRIPTION OF EXISTING EQUIPMENT

- .1 East Court Elevators 1 & 2:
 - .1 TSSA Numbers: 010235 & 010236
 - .2 Type and Manufacturer: Overhead gearless traction, with 2:1 roping; manufactured and installed by Otis Canada Inc., with a major alteration subsequently being performed by Montgomery KONE Elevator.
 - .3 Rated Capacity: 1134 kg.
 - .4 Rated Speed: 2.54 m/s.
 - .5 Existing Floors served: G, 1, 2, 3, 4, 5 with front openings.
- .2 Centre Court Elevators 4, 5 & 6:
 - .1 TSSA Numbers: 061359, 061360 & 061361.
 - .2 Type and Manufacturer: Overhead gearless traction, with 2:1 roping; manufactured and installed by Otis Canada Inc., with a major alteration subsequently being performed by Montgomery KONE Elevator.
 - .3 Rated Capacity: 1361 kg.
 - .4 Rated Speed: 2.54 m/s.
 - .5 Existing Floors served: Front openings at E, 2, 3, 4, 5, 6 and rear openings at G, 1.
- .3 West Court Elevators 8 & 9:
 - .1 TSSA Numbers: 010231 & 010232
 - .2 Type and Manufacturer: Overhead gearless traction, with 2:1 roping; manufactured and installed by Otis Canada Inc., with a major alteration subsequently being performed by Montgomery KONE Elevator.
 - .3 Rated Capacity: 1134 kg.
 - .4 Rated Speed: 2.54 m/s.
 - .5 Existing Floors served: G, 1, 2, 3, 4, 5 with front openings.

2.3 PERFORMANCE

- .1 Adjust elevator to travel at specified rated speed, within maximum variation of $\pm 3\%$, in either

direction, with full rated load.

- .2 Maximum single floor flight times shall be:
 - .1 11.0 seconds for cars 1, 2, 8 & 9.
 - .2 9.5 seconds for cars 4, 5 & 6.
- .3 Flight times shall be measured under the following conditions:
 - .1 Floor-to-floor rise of 4040 mm (Level 1 to Level 2).
 - .2 Time starts when car doors begin to close and ends when car is stopped level at the next landing with car doors three quarters open.
 - .3 Car carrying full rated capacity. Times to be same for both directions of travel.
 - .4 Adjusted such that time can be readily maintained.
 - .5 Acceleration and deceleration to be smooth. Transitions shall be without noticeable shifts.
 - .6 Door kinetic force limitations, as set out in the ASME A17.1-2010/CSA B44-10 shall be met.
 - .7 Maximum brake-to-brake time shall be 5.0 seconds.
 - .8 Maximum start delay of 0.5 seconds from when car door is fully closed to when car movement begins.
- .4 Door times shall be set to the following:
 - .1 Door open time of:
 - .1 2.5 seconds for cars 1, 2, 8 & 9.
 - .2 2.0 seconds for cars 4, 5 & 6.
 - .2 Door close time of:
 - .1 4.0 seconds for cars 1, 2, 8 & 9.
 - .2 2.5 seconds for cars 4, 5 & 6
 - .3 Car call dwell time of 2.0 seconds.
 - .4 Hall call dwell time initially be set at 4.0 seconds. This time must be independently adjustable at all floors.
 - .5 Door protective device interrupt time set at 20.0 seconds.
- .5 Timing devices shall be independently adjustable.
- .6 Acceleration component of side-to-side or front-to-back sway, measured by PMT EVA-625 tri-axial accelerometer, shall not exceed 15 milli(g) peak to peak, measured with a maximum 225 kg non-eccentric car load. Horizontal readings shall be taken in plane of, and perpendicular to, car guide rails.

2.4 GEARLESS MACHINE, MOTOR AND SHEAVES

- .1 Retain existing DC hoisting machines. The motors shall be overhauled by a reputable motor rewind company to provide "as new" performance, condition and reliability. In addition include the following:

- .1 Load test motor.
- .2 Remove armature brush collector bus bars, clean all connections, reinstall and tighten all connections.
- .3 Re-insulate field coils recording megger readings of each field coil before and after this work is performed, providing a copy of recordings to the Departmental Representative. Where tests indicate a variation in consistency amongst field coils, rewind the respective coils to address same.
- .4 Provide not less than two megohm insulation resistance between motor windings and motor frame.
- .5 Refurbish brush gear and provide complete new set of brushes.
- .6 Check existing sheave for wear, replacing or refurbishing same as required.
- .7 Inspect and confirm status of bearings providing new as required.
- .8 Drain and flush bearing lubricant cavity, seal plugs and gaskets and replenish with new lubricant. Where sleeve bearings still utilize flat link chain replace same with a round link bronze chain.
- .9 Machine and undercut commutator as required.

- .2 Once overhauling of the hoist motor is completed, provide Departmental Representative with a written report on tests and observations witnessed by the rewind company including recorded measurements from the megger tests.
- .3 Pre-torque the machine to eliminate rollback due to imbalance of car or counterweight when brake has lifted and drive is not yet activated.
- .4 Check all air gap clearances and replace main motor bearings in cases where measured clearance is less than the manufacturer's recommended minimum clearances. A copy of the recorded measurements (for each machine) are to be submitted for Departmental Representatives records together with listing the manufacturer's recommended clearances and tolerances.
- .5 Remove and replace existing rope deflector sheaves with new sheaves complete with sealed bearings.

2.5 BRAKE

- .1 Completely dismantle and refurbish existing spring applied and electrically released brake. Clean and lubricate moving parts. Replace brake wiring, core sleeves, bearing or pivot pins and any other parts required to make the brake operate as new.
- .2 Remove existing brake shoe linings, replacing same

with new asbestos free linings. Adjust brake setting to bring car to a smooth stop without resettlement.

- .3 Set brake so that under normal operation, stop and start shall be smooth, quiet and without jerk.
- .4 Permanently identify and mark brake spring lengths.
- .5 Provide new micro switches on all hoist motor brake assemblies to replace existing switches. Monitor brake switches to ensure that machine will not run until such a time that the brake has lifted.
- .6 Once the brake adjustment is complete, drill through the outer brake spring lock nuts and install a dowel pin.

2.6 MOTOR CONTROL

- .1 Provide new solid-state digital motor drives, complete with reduced voltage starting, to convert main A/C supply to variable voltage DC power for hoisting motor operation, preferably using a 12 pulse system.
- .2 Use automatic closed loop system, providing instant and noiseless response to power requirements.
- .3 Filter converted power, to provide highly regulated, ripple free, stepless speed control, producing smooth performance and accurate floor landings.
- .4 Provide means to regenerate excess power (created by overhauling loads or regenerative braking conditions) back into line supply. Filter any emanating rectifier drive frequencies and prevent objectionable interaction with building components and personnel.
- .5 Size motor drive to handle full starting current plus a safety factor of 10%. Protect against voltage "spikes". Motor drive shall continue to perform under conditions of fluctuations in line supply of +5% and -10% and frequency variations of +2% from normal values, without any degradation to normal elevator services.
- .6 Provide two (2) independent means for removing power from hoist motor. One shall be a contactor, in series with both sides of armature, and second means shall be thyristors. Contactor shall open each time car stops. Elevator machine brake shall be applied while contactors are dropped out.
- .7 Continuously monitor armature voltage, or car speed,

while elevator is in a levelling mode.

- .8 Design solid-state devices to handle current in excess of rated amount.
- .9 Motor drive unit shall be capable of detecting and reacting in safe mode to loss of supply voltage, loss of phase, loss of fuse, and/or excessive heating or short circuits in either machine or motor drive.
- .10 Isolate solid-state drive unit, to prevent vibration transmission to building structure.

2.7 MOTION (SPEED) CONTROL

- .1 Remove existing acceleration and deceleration devices and replace with new speed control, consisting of closed loop digital feedback system, which continually compares actual speed with design values, ensuring smooth, efficient rides.
- .2 Provide speed control system which controls rate of acceleration and maximum rate of change in acceleration, capable of attaining performance times as specified.

2.8 CAR AND COUNTERWEIGHT ROLLER GUIDES

- .1 Retain and refurbish existing car and counterweight roller guide assemblies as follows:
 - .1 Remove all roller guide assemblies from respective car and counterweight frames.
 - .2 Completely overhaul entire assembly, including re-bushing and replacement of roller guides and pins. Existing parts to be retained on site for Departmental Representatives review.
 - .3 Once overhauling is completed, re-install roller guides and make necessary adjustments so maximum roller guide pressure on any guide member does not exceed 135 N when measured at half way point of travel, in the hoistway, and car doors are fully closed. Cars shall be statically balanced.

2.9 COUNTERWEIGHT

- .1 Counterweights and frames shall be reused and following field verification, weights shall be added or removed as required to maintain appropriate counterbalance between 45 and 50%.
- .2 Acknowledging that counterweight run-by signage was present in elevator pits, confirm that run-by listed is acceptable following the alteration modifying

same as required. In cases where signage is not present in all pits provide same.

- .3 Counterweight bricks and frame shall be cleaned and painted with rust inhibiting paint.
- .4 Counterweight sheave and guards shall be thoroughly cleaned and painted.
- .5 Counterweight rope sheaves and bearings shall be thoroughly examined and refurbished, including repair and or replacement of same, as required

2.10 CAR TOP SHEAVES

- .1 Car top rope sheaves and bearings shall be thoroughly examined and refurbished, including repair and or replacement of same, as required.
- .2 Rope keepers shall be adjusted to provide a maximum clearance of 2 mm between the keepers and hoist ropes.
- .3 Complete the refurbishment by cleaning and then painting the sheave in a prominent colour (preferably yellow) to allow a differentiation of this rotating element.
- .4 Sheave guards shall be thoroughly cleaned and painted.

2.11 CAR AND COUNTERWEIGHT BUFFERS

- .1 Clean, refurbish and re-use car and counterweight buffers.
- .2 Buffers are to be drained and replenished with new oil.

2.12 SAFETY DEVICES

- .1 Refurbish existing car safety devices and fittings. Completely overhaul including:
 - .1 Examination of guides and stops for wear and replacement where required.
 - .2 Clean and lubricate.
 - .3 Adjustment check of relating rods.
- .2 Perform full load drop test, at over-speed, prior to hand over of each elevator. Tests to be co-ordinated with and witnessed by the TSSA or Departmental Representative. Check guide rails after test, re-fitting and aligning same if required.

- .3 Retain and refurbish existing rope grippers, thoroughly cleaning and lubricating equipment and replacing the complete set of pads. Verify operation of the rope grippers to ensure units function is in accordance with the requirements of the Elevator Code. Where adjustment or part replacement are required, provide same as part of this work.
- .4 Safety devices and rope grippers shall be maintained as part of the preventive maintenance agreement, appreciating that where future replacement is required this will form part of the agreement at no additional cost to the Departmental Representative.

2.13 GOVERNORS

- .1 Provide new overspeed governor devices for each elevator complete with new ropes and governor rope weight tension device.

2.14 CAR FRAME AND PLATFORM

- .1 Retain existing car frame and platform. As part of this Work:
 - .1 Check all bolted connections for proper tension and tightness, adjusting same as required.
 - .2 Check sound isolation and fireproofing modifying same as required.
 - .3 Check stringers and steel frame for soundness repairing these elements as required.
 - .4 Reinforce existing cab sub-flooring, as required.
- .2 Adjust cab mounting, to allow cabin to move freely in a vertical direction. Set horizontal guiding members to hold cab firmly without restraint during vertical movement. Insure cab isolation is sound and not impaired by contact with cab attachments.

2.15 CABLES AND FASTENINGS

- .1 Replace existing hoist cables and provide new hoist rope data tags.
- .2 As part of hoist rope replacement provide new alternate length wedge clamp cable shackles, having threaded rods with adjustment to equalize rope tension.
- .3 When adjusting hoist rope lengths ensure that all counterweight blocks are installed and that the counterweight runby is set at the maximum permitted. Following installation, new hoist ropes must be

monitored bi-weekly (in the first 6 months (minimum)) for stretch such that adjustments can be made as required.

2.16 DOOR OPERATOR

- .1 Retain existing door operators, refurbishing same in accordance with the following:
 - .1 Provide a complete set of new belts and make adjustments to chain.
 - .2 Thoroughly clean door operator and associated equipment adjusting same as required.
 - .3 Verify that door operators are provided with tags in accordance with the ASME A17.1-2010/CSA B44-10, providing same where required together with associated data.
 - .4 Provide complete new wiring from door operator back to the elevator controller.
- .2 Adjust door operator to provide positive true and quiet door operation.
- .3 Door operators shall open and close doors quietly and smoothly. Doors shall be capable of opening automatically when car is level at respective landings (pre-opening is permitted) and close after a predetermined interval. Adjust doors to provide full opening width of hall entrance.
- .4 Door operators shall be maintained as part of the preventive maintenance agreement.

2.17 ELECTRONIC DOOR PROTECTION DEVICE

- .1 Retain existing multi-beam door protection devices, verifying operation in accordance with requirements of the Elevator Code, making adjustments or modifications as required. Alternatively, this Division may elect to replace same with new multi-beam door protection system.
- .2 Door protection device, including warning buzzer, shall be inoperative when elevator is operating under Firefighters' Emergency Operation or Independent Service, as door closing, in these instances, is controlled by constant pressure.
- .3 When closing of doors is prevented by blocking the door protective device, after an adjustable period of time, initially set at 20 seconds, a buzzer on car shall sound and doors shall close at a reduced speed.
- .4 Arrange equipment so that 20 second interrupt time, as described herein, is adjustable from 20 - 120

seconds.

- .5 Door protection devices shall be maintained as part of the preventive maintenance agreement.

2.18 CAR DOOR HARDWARE

- .1 Replace existing car door hardware with new heavy-duty type components. This includes but shall not be limited to car door rollers, car door gibs and upthrust eccentrics.
- .2 Where existing car door track can be used with new door hardware, remove, refurbish and re-install same to ensure entire running is smooth and free of grooves.
- .3 New car door rollers shall be heavy-duty type, fabricated with steel, and shall contain an isolation insert or liner within each rollers running surface. Rollers must be designed to run on an unlubricated surface and shall rotate on precision ball bearings. Rollers consisting of hardened plastic shall not be accepted.
- .4 In the event of power interruption, car doors (and adjacent hall landing doors where they are mechanically interlocked) shall be readily operated by hand from within cab with a maximum force of 200 N, while car is in a unlicking zone.
- .5 Retain and refurbish car door clutch adjusting same to ensure that landing doors attain full clear opening, with leading edge of panel being flush with the adjacent entrance frame.
- .6 Provide complete new hardware for the car gate switch, adjusting same as required.

2.19 EXHAUST FAN

- .1 Retain and refurbish existing cab ventilation fans, ensuring that fan controls are connected to a key switch in the service cabinet.
- .2 Maintain fan as part of the preventive maintenance agreement.

2.20 CAB INTERIORS

- .1 Protect elevator cab interiors from damage during the course of the elevator alteration, making repairs to same unless such damage was outside of this Divisions control.

2.21 CAR OPERATING PANELS

- .2 Refurbishment of cab interiors shall be limited to those areas required to accommodate the new car operating stations and fixtures.
- .1 Remove existing car operating stations and modify return panels as required to accept new swing type car operating stations.
- .2 New car operating stations finish shall match the existing panels and must be provided with hinges to allow for ready service access, and appropriate locking hardware to secure panel in place preventing vibration.
- .3 Panels contain car operating buttons and flush mounted emergency battery lighting fixtures.
- .4 For elevators with multiple car operating stations, main panel shall contain firefighter's operation cabinet, communication system perforations and security card reader, while the auxiliary panel shall contain the service cabinet. For elevators with a single car operating station the above shall be configured into a single panel.
- .5 Final configuration of panels will be confirmed at time of shop drawing reviews.
- .6 Provide illuminating car call buttons using LED's, corresponding to each level served. Car call buttons shall consist of manufacturer's standard top of the line fixtures with a finish matching the car operating panel unless directed otherwise by the Departmental Representative at time of shop drawing reviews.
- .7 Registration of a car call shall result in a momentary audible signal and cause corresponding button to illuminate.
- .8 Once call has been answered, call shall cancel and light extinguish.
- .9 In addition to car call buttons, each car operating station must contain:
 - .1 Emergency alarm button;
 - .2 Door open button;
 - .3 Door close button;
 - .4 Phone button, which activates hands-free telephone;
 - .5 All of the above fixtures shall be illuminating type buttons.

- .10 Provide a lockable FEO cabinet, flush-mounted at the top of main return panel. Cabinet faceplate finish shall match car operating panel and be equipped with a concealed hinge. Cabinet shall contain devices and instructions in accordance with the requirements of the ASME A17.1-2010/CSA B44-10.
 - .11 Provide each elevator with a lockable flush mounted service cabinet. Cabinet faceplate finish shall match car operating panel and be equipped with a concealed hinge. Cabinet shall contain the following:
 - .1 Keyed stop switch;
 - .2 Independent Service key-switch, with key removable in both positions;
 - .3 Momentary position emergency battery lighting test switch;
 - .4 Three-position fan switch ("OFF", "LOW", "HIGH");
 - .5 Car light switch, with a dimmer switch;
 - .6 GCFI duplex receptacle;
 - .7 Any other switch required to operate or service elevator. When maintenance switch is provided, it shall be a keyed switch;
 - .8 Permanently identify function and key-switch positions (i.e. "LIGHTS", "ON", "OFF") for all key-switches, either by engraving or collar ring;
 - .9 Key-switch on service cabinet door shall be keyed the same as Independent Service key-switch within.
 - .12 In-car signage shall be surface engraved (or etched) on car operating panel(s). Signage shall include, but not be limited to: car number, no smoking signage, communication instructions, capacity (in kg and persons) and provincial installation number. Surface mounted signage plaques are unacceptable.
 - .13 Provide raised Arabic numerals (characters), and equivalent Braille marking, corresponding to each button and control switch within elevator. Braille tags shall be mounted to the left of respective button or key-switch. Markings shall have no backing plate or visible fastenings. Submit full size sample of tactile plate, for Departmental Representative's review.
 - .14 Where there is a requirement for customized engraving or signage on the return panels for designation of specific floors, such instructions shall be provided as part of the shop drawing review and incorporated into the panels.
-

2.22 CAR POSITION
INDICATORS

- .1 Remove existing car position indicators and provide new manufacturer's standard LED type dot matrix or digital vacuum fluorescent car position indicators in their place complete with fixture faceplates. Fixture faceplate shall match the adjacent cab finish and be secured in place with tamperproof fasteners.
- .2 Position indicators shall constantly indicate relative car position to level stopped at or being by-passed and have a minimum 50 mm high display.

2.23 ELEVATOR
ENTRANCES, DOOR
PANELS AND LOCKS

- .1 Retain existing hall entrance frames and doors.
 - .2 Retain and refurbish existing hall door interlocks as follows:
 - .1 Provide complete new wiring and contacts.
 - .2 Replace any worn or damaged rollers.
 - .3 Adjust locks as required to achieve positive engagement and wipe.
 - .3 Verify the presence of unlocking devices at all landings providing same as required inclusive of all labour and associated hardware. For existing unlocking devices verify operation of same refurbishing or providing new hardware as required.
 - .4 Provide new door gibs at all landings. New door gibs must be composed of a composite material and be designed to allow for lateral adjustment of door panels in both directions.
 - .5 Refurbish existing hall door tracks. Where required, door tracks shall be removed and machined to provide a smooth running surface.
 - .6 Provide new hanger rollers at all landings. Rollers shall be heavy-duty, fabricated with steel, complete with an isolation insert or liner within each sheave's running surface. Rollers must be designed to run on an unlubricated surface and shall rotate on sealed precision ball bearings. Rollers consisting of hardened plastic shall not be accepted.
 - .7 Refurbish and adjust hall door eccentrics.
 - .8 Provide new hall landing door relating cables at all landings.
 - .9 Replace worn or damaged sight guards.
-

- .10 Re-use and refurbish existing door closers, adjusting same to ensure that they achieve a full door closing. Where field review establishes that new closing devices are required at some floors provide same.
- .11 For all multi-speed door panels, ensure that secondary means for interconnecting door panels are present and engineered in accordance with requirements of the Elevator Code. Where findings dictate otherwise provide same as part of Work.
- .12 Verify the presence and operation of fire retainers on all landing doors, providing same as required.

2.24 LANDING BUTTONS

- .1 Remove existing landing buttons and provide new fixtures at all floors served, to match quantity as currently exists.
- .2 New fixtures shall be finished to match the existing fixtures and mounted at a height to satisfy requirements of Appendix E of the ASME A17.1-2010/CSA B44-10. This Division shall design new fixtures in accordance with same, with faceplates being secured in place with tamperproof fasteners.
- .3 In addition to the respective call buttons, fixture faceplates at the primary recall level must contain:
 - .1 Firefighter's Emergency Operation 3-position keyed switch, indicators and associated engraving;
 - .2 Emergency Power LED indicator and engraving;
 - .3 Monitoring provisions associated with elevator two-way voice communication system in accordance with the ASME A17.1-2010/CSA B44-10.
- .4 New hall call buttons shall match those provided in each cab, with LED illumination.

2.25 HALL LANTERNS

- .1 Remove existing hall lanterns and provide new fixtures at all floors served, to match quantity as currently exists.
- .2 New fixtures shall be mounted in place of the existing fixtures, utilizing the existing back boxes.
- .3 Unless directed otherwise by the Departmental Representative at the time of shop drawing reviews, lantern faceplates shall be finished to match the

existing fixture and as such this Division must undertake a detailed site review to confirm the finish of fixtures at all landings.

- .4 Fixture faceplates shall be secured in place with tamperproof fastening devices to permit servicing of the lanterns from the lobby.
- .5 Lanterns shall consist of manufacturer's standard top of the line fixtures, with LED illumination, provided that such fixtures allow for a 180 degree viewing angle. Alternatively, this Division must source an alternate fixture and submit cut-sheets for review and approval by the Departmental Representative.
- .6 Lanterns must conform to requirements of Appendix E, including dual stroke electronic chimes. Chimes shall sound once to indicate UP direction travel and twice to annunciate a DOWN bound elevator.
- .7 Lanterns shall illuminate and sound chime sufficiently in advance of car arrival facilitating positioning of passengers (minimum 4 seconds).
- .8 Where a 4.0 second advance warning is not provided (ie. if car is at the floor, etc.) extend the dwell time to 7.0 seconds to allow sufficient passenger transfer time.
- .9 Hall lanterns shall illuminate in response to car calls (when elevator stops at a landing) provided further travel demands exist for that elevator. Hall lantern shall remain illuminated until car doors commence closing.
- .10 Lantern chimes shall only sound when elevators are responding to hall call demands (not car calls).
- .11 Should car over-travel from the scheduled stop, respective hall lantern shall remain illuminated, indicating original direction of travel.

2.26 GROUP SUPERVISORY CONTROL

- .1 Provide microprocessor-based group supervisory control system. Microcomputer and accompanying software programmes shall be specifically designed to coordinate and control individual and group elevator activities.
- .2 Provide control system with solid-state devices which shall not be affected by electrical noise, caused by switching and operation of other electrical equipment. Equipment shall be capable of

problem-free operation within ambient temperature ranges between 5°C and 32°C.

- .3 Microcomputer shall be housed within a drip-proof free-standing or wall-mounted cabinet enclosure. Enclosures shall be designed to accommodate compartmentalized control systems. Provide adequate means of ventilation and filtration of air into controller enclosures.
 - .4 Printed circuit cards shall be readily removable and interchangeable where cards perform identical functions. Cards shall be electrically interlocked and mechanically keyed to ensure proper seating.
 - .5 Card terminal assemblies shall be plug-in type to provide easy removal and replacement without disturbing conductor wiring.
 - .6 Provide microprocessor with sufficient READ ONLY memory storage for required operation and control programmes, plus a minimum of 25% spare capacity for future programme expansion. Software-based programmes shall be readily changeable without undue disruption in service. Protect all programme memories against loss due to power failure.
 - .7 Control system shall incorporate required interfaces to allow for connection of portable service and maintenance service equipment.
 - .8 Control system shall be provided with complete self-diagnostic capabilities which automatically identify and log (in memory) specific system faults and safety device failures. A full list of monitored events and their respective codes (visible on diagnostic equipment) shall be included in Owner's maintenance manuals. Diagnostic equipment shall be a permanent device(s) mounted in controller and shall remain property of Departmental Representative, for the life of the equipment.
 - .9 Microprocessor-based control system shall calculate car assignments, based on real-time response to current traffic conditions in selecting and assigning cars (based on their availability and present status) to answer hall calls.
 - .10 Control system shall monitor a series of car activity and status data, including, but not limited to:
 - .1 car position
 - .2 car direction
 - .3 car velocity
 - .4 motor power status
-

- .5 previous car assignments
- .6 car door position
- .7 existing car calls
- .8 car load
- .9 Main floor status
- .11 Assessments shall be made prior to initiating car assignment to particular hall call. These parameters shall be constantly assessed, minimum of two (2) times per second.
- .12 Hall calls shall be assigned to car which is best suited to answer call. Suitability of car assignment shall be determined by particular control system operations.
- .13 Once car has been assigned hall call, it shall proceed to answer that call. Supervisory system shall continuously evaluate operation state, of that and every other car, and be capable of reassigning hall calls until assigned car commences deceleration to answer call. If 'assigned car' becomes delayed, supervisory system shall automatically assign hall call to next most suitable car. Any car delayed beyond 30 seconds shall automatically be removed from group service.
- .14 Supervisory system shall anticipate traffic in certain sectors of the Building and position free or non-assigned cars at these floors accordingly.
- .15 System shall be provided with control algorithms to allow for Up peak, Down peak, Two-way and Normal traffic peaks.

2.27 MAIN LOBBY DESIGNATION

- .1 Main lobby for passenger cars 1, 2, 8 and 9 shall be Level 1.
- .2 Main lobby for passenger cars 4, 5 and 6 shall be Level E (street side opening).

2.28 OPERATION AND CONTROL FEATURES

- .1 Provide elevator control system with operation and control features as specified herein:
 - .1 Provide load weighing to dispatch car ahead of prevailing operating intervals once it is filled to approximately 60% of rated capacity. Load weighing shall be provided to by-pass hall calls in event car becomes and/or remains filled at 50% rated capacity. Both settings shall be independently adjustable.
 - .2 Provide anti-nuisance service, which automatically cancels registered car calls when

number of registered car calls exceeds proportional load in car.

.3 Provide directional reversal so that a car arriving at a landing where both UP and DOWN hall calls are registered, will first answer call placed for the direction that car was travelling. If no car call is placed in initial direction and car is assigned to respond to opposite direction hall call, car doors shall close and immediately re-open to respond to opposite direction hall call. Hall lantern operation shall always correspond to intended direction of elevator travel.

.4 Provide reversal feature, which will allow car to automatically stop at next floor, and reverse without opening its doors, upon assignment of opposite direction hall call, when changing traffic conditions have cancelled previous hall call assignment. When car stops at floor for reassignment, hall lantern shall not illuminate.

.5 When car arrives at terminal floor, automatically cancel all registered car calls. Alternatively, car calls shall not register for levels located below an UP travelling car or above a DOWN direction elevator.

.6 Provide dispatch protection to ensure auxiliary means of dispatching in both directions of travel that will automatically be initiated when normal dispatching fails. When elevator is operating on auxiliary means of dispatching, registered car calls shall not cause elevator to bypass scheduled dispatching stops.

.7 Provide high call -- low call reversal so that car is capable of making high call -- low call reversals without having to travel to a terminal floor, except to answer landing call or car call at that level.

.8 Provide for advance selection feature to illuminate appropriate hall lantern and sound chime when no selected car is at lobby. Advance timing shall be adjustable and initially set for 4.0 seconds.

.9 Once car has responded to a hall call, and car doors have started to close, registration of further hall call demands at that floor shall not cause closing car doors to stop and re-open, provided elevator has further travel demand(s).

.10 When all elevators in a respective group are out of service, hall buttons shall be de-activated.

PART 3 - EXECUTION

| | | |
|--------------------|----|--|
| <u>3.1 GENERAL</u> | .1 | Comply with requirements as set out in Part 3 of Section 14 05 00. |
|--------------------|----|--|

END OF SECTION

ANNEX A

Specifications

for

Elevating Devices Maintenance

ELEVATING DEVICES MAINTENANCE SPECIFICATIONS

Specification no.

Section 2
Particular Requirements

Project Name: Dominion Public Building

Project Name: Dominion Public Building
Project Name: Dominion Public Building
1 Front Street West
Toronto, Ontario

Specification Number: R.049549.001

Index

Section 1 General Requirements

| | Page |
|--|------|
| 1. Scope..... | 1 |
| 2. Performance..... | 1 |
| 2.1 Elevating Device Maintenance Log..... | 1 |
| 2.2 Maintenance Services..... | 1 |
| 2.3 Safety Devices and Tests..... | 1 |
| 2.4 Safety Codes..... | 2 |
| 2.5 Operation..... | 2 |
| 2.6 Group Dispatching System..... | 2 |
| 2.7 Exclusions..... | 2 |
| 2.8 Working Hours..... | 3 |
| 2.9 Answering Service..... | 3 |
| 2.10 Callback Service..... | 3 |
| 2.11 Stock of Parts for Maintenance Service..... | 3 |
| 2.12 Repairs..... | 3 |
| 2.13 Cleaning and Painting..... | 3 |
| 2.14 Wiring, Adjustment Procedures and Operational Descriptions..... | 3 |
| 2.15 Reporting Requirements..... | 4 |
| 2.16 Environment Protection..... | 4 |

Section 2 Particular Requirements

| | Page |
|---|------|
| 1. Special Exclusions..... | 1 |
| 2. Pro-ration..... | 1 |
| 3. Special Labour..... | 1 |
| 4. Other Special Conditions..... | 1 |
| 5. Examination Frequency..... | 1 |
| 6. Callback Service..... | 1 |
| 7. Response Time..... | 1 |
| 8. Maintenance Task & Frequency Table Elevators | 2 |

ELEVATING DEVICES MAINTENANCE SPECIFICATIONS

Specification no.

Section 2
Particular Requirements

1. SCOPE

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

2. PERFORMANCE

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

2.1 Elevating Devices, Maintenance Log

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

2.2 Maintenance Services

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

2.3 Safety Devices and Tests

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

ELEVATING DEVICES MAINTENANCE SPECIFICATIONS

Specification no.

Section 2
Particular Requirements

2.4 Safety Codes

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

2.5 Operation

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

2.6 Group Dispatching System

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

2.7 Exclusions

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

ELEVATING DEVICES MAINTENANCE SPECIFICATIONS

Specification no.

Section 2
Particular Requirements

measures are recommended or directed by an insurance company or by an enforcing/inspection authority.

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

2.8 Working Hours

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

2.9 Answering Service

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

2.10 Callback Service

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

2.11 Stock of Parts for Maintenance Service

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

2.12 Repairs

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

2.13 Cleaning and Painting

- .1 The Contractor shall thoroughly clean and paint within one (1) year of the commencement date stipulated in under Article "Period of Contract" of the resultant contract , and every three (3) years thereafter:
 - .1 all elevator machine room equipment and
 - .2 the elevator machine room, secondary level and pit floors.

2.14 Wiring Diagrams, Adjustment Procedures and Operational Descriptions

- .1 The Contractor shall prove to the satisfaction of the Departmental Representative:

ELEVATING DEVICES MAINTENANCE SPECIFICATIONS

Specification no.

Section 2
Particular Requirements

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

2.15 Reporting Requirements

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

2.16 Environmental Protection

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

ELEVATING DEVICES MAINTENANCE SPECIFICATIONS

Specification no.

Section 2
Particular Requirements

| | |
|-----------------------------------|---|
| Building Name and Address: | Dominion Public Building 1 Front Street West Toronto, Ontario |
| Equipment Inventory: | Seven (7) Passenger Elevators: Car Number (TSSA Installation Number) 1 (010235), 2 (010236), 4 (061359), 5 (061360), 6 (061361), 8 (010231), 9 (010232). One (1) Freight Elevator: Car Number (TSSA Installation Number) 3 (039811), |

1. **SPECIAL EXCLUSIONS:** **NONE**
2. **PRO-RATION:** **NONE**
3. **SPECIAL LABOUR:** Contractor to provide a cost breakdown for each elevating device, per inspection, based on the **EXAMINATION FREQUENCY** requirements indicated in item 5 below.
4. **OTHER SPECIAL CONDITIONS:** A written Maintenance Control Program shall be in place to maintain the equipment in compliance with the requirements of ASME A17.1 - 2010 & CSA B44.2010. This program shall be available, upon request, for review/acceptance by the Departmental Representative.
5. **EXAMINATION FREQUENCY:** Shall be once per month

Task inspections and frequency intervals as described in the “*CSA B44.2-07 Maintenance requirements and intervals for elevators, dumbwaiters, escalators, and moving walks*”, shall be adhered to as a minimum. (See tables provided on Pages 2 & 3 of *Particular Requirements*).
However if the manufacturer or contractor deems that frequencies and intervals be increased they shall be permitted to do so but there shall be no increase in maintenance costs.
6. **CALLBACK SERVICE:** Include Twenty four (24) hour per day, seven (7) days per week, callback service for emergencies at no additional cost.
7. **RESPONSE TIME:** For release of trapped passengers, on-site, response times are: thirty (30) minutes during regular working hour calls and within one (1) hour for after hour calls.
On-site response time for all other calls: within one (1) hour from receipt of call.

ELEVATING DEVICES MAINTENANCE SPECIFICATIONS

Specification no.

Section 2
Particular Requirements

.8 MAINTENANCE TASK & FREQUENCY TABLE ELEVATORS:

Table 1

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

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

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

PART 1 - GENERAL

1.1 TRIAL USAGE

- .1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Split system: AC-1 to 7, and CU-1 to 4.
 - .2 Unit heater: UH-1 to 4.

1.2 PROTECTION OF OPENINGS

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

1.3 PAINTING

- .1 To Section 09 91 23.01.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.4 SPARE PARTS

- .1 Furnish spare parts as follows:
 - .1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

1.5 SPECIAL TOOLS

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.6 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .2 Where specified elsewhere in Mechanical Divisions, manufacturers to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

1.7 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data to Departmental Representative.
- .2 Operation and maintenance manual to be approved by, and final copies deposited with, Departmental Representative before final inspection.
- .3 Operation data to include:
 - .1 Control schematics for each system including environmental controls.
 - .2 Description of each system and its controls.
 - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for each system and each component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
- .4 Maintenance data shall include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .5 Performance data to include:
 - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified elsewhere.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93.
- .6 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.

- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.8 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Shop drawings and product data shall show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances, eg. access door swing spaces.
- .3 Shop drawings and product data shall be accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify as to current model production.
 - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.9 CLEANING

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

1.10 AS-BUILT DRAWINGS

- .1 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark there on all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection at all times.
- .2 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and

Balancing (TAB), finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor,) (date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 TAB to be performed using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.3 Submit copies of as-built drawings for inclusion in final TAB report.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.12 HALOCARBONS

.1 Comply with Federal Halocarbon Regulations 2003 under the Canadian Environmental Protection Act 1999, EPAM and PWGSC Ontario Region Halocarbon Information Sheet dated March 2010.

.2 Federal Halocarbon Regulations require compliance with the following:

.1 Decommissioning:

.1 All halocarbons shall be recovered by certified personnel into approved containers prior to decommissioning/ dismantling/ disposal of the system.

- .2 Prior to dismantling, decommissioning or disposal of a system, a decommissioning notice /tag shall be affixed to the system (see Halocarbon Management Plan for details).
- .3 A record of the notice/ tag shall be maintained at the site.
- .4 Ensure all Inventory updates are coordinated with, and/or reference to, the Computerized Maintenance Management System (CMMS).
- .2 Installation:
 - .1 Ensure Federal Halocarbon Regulations are adhered to and the equipment inventory is updated.
 - .2 Ensure all Inventory updates are coordinated with, and/or reference to, the Computerized Maintenance Management System (CMMS).
 - .3 Forward required information to Environment Coordinator and/or Environment Manager when updates are made.
- .3 References:
 - .1 Federal Halocarbon Regulation.
<http://www.ec.gc.ca/ozone/default.asp?lang=En&n=E06A6B0D-1>.
 - .2 Halocarbon Management Plan for PWGSC Contract Facilities.
 - .3 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.
http://ec.gc.ca/ozone/127A4F77-AFD3-404B-A4E596A4BD3737F2/fluoro_cop.pdf.

PART 3 - EXECUTION

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- | | | |
|--|----|---|
| <u>1.1 REFERENCES</u> | .1 | Canadian General Standards Board (CGSB) .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating. |
| <u>1.2 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00. |
| <u>1.3 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle in accordance with Section 01 61 00. |
| | .2 | Deliver materials to site in original factory packaging, labelled with manufacturer's name, address. |

PART 2 - PRODUCTS

- | | | |
|---------------------|----|-----------|
| <u>2.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 3 - EXECUTION

- | | | |
|-------------------------------------|----|--|
| <u>3.1 APPLICATION</u> | .1 | Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets. |
| <u>3.2 CONNECTIONS TO EQUIPMENT</u> | .1 | In accordance with manufacturer's instructions unless otherwise indicated. |
| | .2 | Use valves and either unions or flanges for isolation and ease of maintenance and assembly. |
| | .3 | Use double swing joints when equipment mounted on |

vibration isolation and when piping subject to movement.

3.3 CLEARANCES

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

3.4 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.

3.5 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible.
- .11 Ream pipes, remove scale and other foreign material before assembly.

- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.

3.6 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

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

3.7 EXISTING SYSTEMS

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

3.8 CLEANING

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2010, Power Piping.
- .2 ASTM International
 - .1 ASTM A125-96(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

instructions.

- .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58 and ASME B31.1.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

- .1 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed 13 mm FM approved.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed FM approved to MSS-SP 58 and MSS-SP 69.
- .2 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved to MSS SP 69.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed FM approved.
- .3 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed and FM approved to MSS SP 69.
- .4 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .5 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel black.
 - .2 Attachments for copper piping: copper plated black.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.

2.4 INSULATION PROTECTION SHIELDS

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

welded-in centre plate for pipe sizes NPS 12 and over,
carbon steel to comply with MSS SP 69.

2.5 EQUIPMENT SUPPORTS

- .1 Equipment supports to be provided by equipment manufacturer.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

- .1 Plumbing piping: to authority having jurisdiction.
- .2 Copper piping: up to NPS 1/2: every 1.5 m.
- .3 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is

not required.

- .4 Within 300 mm of each elbow.

| Maximum Pipe Size : NPS | Maximum Spacing Steel | Maximum Spacing Copper |
|----------------------------|--------------------------|---------------------------|
| up to 1-1/4 | 2.4 m | 1.8 m |
| 1-1/2 | 3.0 m | 2.4 m |
| 2 | 3.0 m | 2.4 m |
| 2-1/2 | 3.7 m | 3.0 m |
| 3 | 3.7 m | 3.0 m |
| 3-1/2 | 3.7 m | 3.3 m |
| 4 | 3.7 m | 3.6 m |
| 5 | 4.3 m | |
| 6 | 4.3 m | |
| 8 | 4.3 m | |
| 10 | 4.9 m | |
| 12 | 4.9 m | |

3.4 HANGER INSTALLATION

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

3.5 HORIZONTAL MOVEMENT

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

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.
- .2 Adjustable clevis:
- .1 Tighten hanger load nut securely to ensure proper hanger performance.
- .2 Tighten upper nut after adjustment.

- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

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

PART 1 - GENERAL

1.1 GENERAL

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS
OF TAB PERSONNEL

- .1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF
SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, caulking.
- .5 All pressure, leakage, other tests specified elsewhere in Division 23.
- .6 All provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.

- .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
- .4 Correct fan rotation.
- .5 Fire, smoke, volume control dampers installed and open.
- .6 Coil fins combed, clean.
- .7 Access doors, installed, closed.
- .8 Outlets installed, volume control dampers open.

1.10 APPLICATION
TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 5%, minus 5%.

1.11 ACCURACY
TOLERANCES

- .1 Measured values to be accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY
TAB REPORT

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 Format to be in accordance with referenced standard.

- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide manpower and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results to be at discretion of Departmental Representative.
- .4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

1.17 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

- .1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

- .1 Standard: TAB to be to most stringent of this section or TAB standards of AABC, NEBB, SMACNA, or ASHRAE.
- .2 Do TAB of systems, equipment, components, controls specified Division 23.
- .3 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB or qualified to standards of AABC or NEBB.
- .4 Quality assurance: Perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
- .5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components,

controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.
- .2 Related Sections:
 - .1 Section 23 05 05.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-13, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-12, Standard Specification for Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA),

- 1992, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide (Revised 2005).
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
 - .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 ULC-S702.2-10, Standard for Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

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

- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix label beneath sample indicating service.

1.5 DELIVERY,
STORAGE AND
HANDLING

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

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE
RATING

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

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702, ASTM C547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.

- .5 TIAC Code A-6: flexible unicellular tubular elastomer.
- .1 Insulation: with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 VAPOUR RETARDER LAP ADHESIVE

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

2.5 INDOOR VAPOUR RETARDER FINISH

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

2.6 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 INSTALLATION

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

3.4 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3
 - .1 Securements: Tape at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.
 - .1 Insulation securements: per manufacturer's specifications.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: per manufacturer's specifications.
- .5 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves, fittings.

| Applic ation | Temp degree s C | TIAC code | Pipe sizes (NPS) and insulation thickness (mm) | | | | |
|-------------------------|-----------------------|--------------|---|---------------|--------|-------------|----|
| | Run out | to 1 | 1 1/4 to 2 | 2 1/2 to 4 | 5 to 6 | 8 & over | |
| Hot Water Heating | 60 - 94 | A-1 | 25 | 38 | 38 | 38 | 38 |

| | | | | | | | | |
|-------------------|----------|-----|----|----|----|----|----|----|
| Hot Water Heating | up to 59 | A-1 | 25 | 25 | 25 | 25 | 38 | 38 |
| Chilled Water | 4 - 13 | A-3 | 25 | 25 | 25 | 25 | 25 | 25 |
| Refrigerant | 4 - 13 | A-6 | 25 | 25 | 25 | 25 | 25 | 25 |
| Refrigerant | below 4 | A-6 | 25 | 25 | 38 | 38 | 38 | 38 |

3.5 FIELD QUALITY CONTROL

- .1 Verification requirements include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Certified wood.
 - .8 Low-emitting materials.

3.6 CLEANING

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 23 05 05 - Installation of Pipework.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME B16.22-2001(R2010), Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
 - .2 ANSI/ASME B16.24-2011, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 600, 900, 1500 and 2500.
 - .3 ANSI/ASME B16.26-2011, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .4 ANSI/ASME B31.5-2010, Refrigeration Piping and Heat Transfer Components.
- .2 ASTM International
 - .1 ASTM A307-10, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B280-08, Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
- .3 Canadian Standards Association (CSA)
 - .1 CSA B52-05(R2009), Mechanical Refrigeration Code.
- .4 Environment Canada (EC)
- .5 EPS 1/RA/1-96, Environmental Code of Practice for the Reduction of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan
- .2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 TUBING

- .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .1 Hard copper: to ASTM B280, type ACR, B.
 - .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

- .1 Service: design pressure 2070 kPa and temperature 121°C.
- .2 Brazed:
 - .1 Fittings: wrought copper to ASME B16.22.
 - .2 Joints: silver solder, 45% Ag-15% Cu or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.
- .3 Flanged:
 - .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
 - .2 Gaskets: suitable for service.
 - .3 Bolts, nuts and washers: to ASTM A307, heavy series.
- .4 Flared:
 - .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

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

2.4 VALVES

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

PART 3 - EXECUTION

3.1 GENERAL

- .1 In accordance with Section 23 05 05, supplemented as specified herein
- .2 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5.

3.2 BRAZING
PROCEDURES

- .1 Bleed inert gas into pipe during brazing.
- .2 Remove valve internal parts, solenoid valve coils, sight glass.
- .3 Do not apply heat near expansion valve and bulb.

3.3 PIPING
INSTALLATION

- .1 General:
 - .1 Soft crimping/ constriction or annealed copper tubing: bend without crimping/ constriction or hard drawn copper tubing: do not bend. Minimize use of fittings.
- .2 Hot gas lines:
 - .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
 - .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
 - .3 Provide inverted deep trap at top of risers.
 - .4 Provide double risers for compressors having capacity modulation.
 - .1 Large riser: install traps as specified above.
 - .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.4 PRESSURE AND
LEAK TESTING

- .1 Close valves on factory charged equipment and other equipment not designed for test pressures.
- .2 Leak test to CSA B52 before evacuation to 2 MPa and 1 MPa on high and low sides respectively.
- .3 Test Procedure: Build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.5 DEHYDRATION AND CHARGING

- .1 Close service valves on factory charged equipment.
- .2 Ambient temperatures to be at least 13°C for at least 12 hours before and during dehydration.
- .3 Use copper lines of largest practical size to reduce evacuation time.
- .4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5 Pa absolute and filled with dehydrated oil.
- .5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.
- .6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
 - .1 Twice to 14 Pa absolute and hold for 4 h.
 - .2 Break vacuum with refrigerant to 14 kPa.
 - .3 Final to 5Pa absolute and hold for at least 12 h.
 - .4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.
 - .5 Submit test results to Departmental Representative.
- .7 Charging:
 - .1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.
 - .2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.
 - .3 Re-purge charging line if refrigerant container is changed during charging process.
- .8 Checks:
 - .1 Make checks and measurements as per manufacturer's operation and maintenance instructions.
 - .2 Record and report measurements to Departmental Representative.

3.6 INSTRUCTIONS

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

END OF SECTION

PART 1 - GENERAL

- | | | |
|---|----|---|
| <u>1.1 REFERENCES</u> | .1 | Canadian General Standards Board (CGSB). 1 CAN/CGSB 51.40-95, Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering. |
| | .2 | Canadian Standards Association (CSA) .1 CSA B52S1-09, Mechanical Refrigeration Code. .2 CAN/CSA C656-05 (2010), Performance Standard for Split-system and Single-Package Central Air Conditioners and Heat Pumps. |
| <u>1.2 SHOP DRAWINGS AND PRODUCT DATA</u> | .1 | Submit shop drawings and product data in accordance with Section 01 33 00. |
| | .2 | Indicate major components and accessories including sound power levels of units. |
| | .3 | Refrigerant shall be HFC R410-A, it shall have no ozone depletion potential. No other refrigerant will be accepted. |
| <u>1.3 CLOSEOUT SUBMITTALS</u> | .1 | Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00. |
| <u>1.4 WARRANTY</u> | .1 | The units shall have a manufacturer's parts warranty for a period of at least one (1) year from date of installation. |

PART 2 - PRODUCTS

- | | | |
|-------------------------------|----|---|
| <u>2.1 SYSTEM DESCRIPTION</u> | .1 | The heat pump system (heating and cooling) shall be packaged with variable compressor speed inverter technology. Units to be nitrogen charged upon arrival; after leak testing has been completed unit to be charged with R-410 and weighed. CX Manager to witness testing. The system shall consist of a wall or ceiling mounted evaporator section with wired controller and a horizontal discharge, single or three phase power, |
|-------------------------------|----|---|

| | | |
|---------------------|-----------------------|------------------|
| PWGSC Ontario | DUCTLESS SPLIT SYSTEM | Section 23 81 11 |
| Region Project | A/C UNITS | Page 2 |
| Number R.049549.001 | | 2013-08-29 |

matching outdoor condensing unit.

2.2 QUALITY ASSURANCE

- .1. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
- .2. The units shall conform to ANSI/UL STD. 1995 and certified to CAN/CSA C22.2 No. 236-05.
- .3. The units shall be rated in accordance with ARI Standard 210/240 and bear the ARI label.
- .4. The units shall be line tested for correct operation and coils pressure tested for leaks.
- .5. Helium holding charge shall be provided in the evaporator.

2.3 DELIVERY STORAGE AND HANDLING

- .1. Unit shall be stored and handled according to the manufacturer's recommendation.

2.4 PERFORMANCE

- .1. Each system shall perform in accordance to ARI 210/240
- .2. Ultra-low ambient cooling operation at minimum ambient temperatures per equipment scheduling shall be factory design and pre-installed.
- .5. Windscreens shall be factory developed for low ambient $\leq -5^{\circ}\text{C}$ (23°F) cooling operation.

2.5 C-1, C-3, C-4 - OUTDOOR UNIT

- .1. General:
 - .1. The system shall consist of the outdoor unit, indoor units, and wired controls by the same manufacturer. The outdoor units shall be equipped with multiple circuit boards that interface to the controls system and shall perform all functions necessary for operation. The outdoor unit shall have a powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be thoroughly run tested at the factory without exception. Alternate product offerings shall provide the owner with written confirmation and results for the factory run test on each unit.
- .2. System Performance Rating:
 - .1. System manufacturer should be consulted to ensure that the outdoor unit properly interfaces with indoor units. Consult with the manufacturer for a

design review.

- .3 Acoustic Performance:
 - .1 Outdoor unit shall have a sound pressure level (SPL) rating no higher than a maximum of 60 dB (A) individually. The sound pressure rating is as measured a horizontal distance 1 m from the unit
- .4 System Refrigerant Pipework:
 - .1 Both refrigerant lines from the outdoor unit to indoor units shall be individually insulated. The outdoor unit is a heating and cooling module. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. The outdoor unit shall have a high pressure safety switch, over-current protection and DC bus protection. The outdoor units shall have the ability to operate with a maximum height difference of 164 feet and can, when combined in a modular format have a total refrigerant tubing length of 3,280 feet when serving up to Qty 50 indoors units. The greatest length is not to exceed 541 feet between the outdoor unit and the indoor units without the need for line size changes or traps. Please confirm system layout limitations and piping sizes with the manufacturers and technical performance sheets. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
- .5 Condensing Unit Cabinet Construction:
 - .1 The casing(s) shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel. Units cabinets shall be able to withstand 960 hours of Salt Spray in accordance with JRA9002 (Japanese Refrigeration and Air-conditioning) testing criteria.
- .6 Variable Speed Condenser Fan:
 - .1 The outdoor unit module shall be furnished with one direct drive, inverter driven, variable speed propeller type fan. The unit shall be manufactured and factory set for operating under 0 'WG external static, but capable of operation under a maximum of 0.24" W.G external static via a dipswitch setting.
 - .2 The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. The fan motor shall be mounted for quiet operation.
 - .3 The fan shall be provided with a raised guard to prevent contact with moving parts.
 - .4 The outdoor unit shall have vertical discharge airflow.
- .7 Refrigerant:
 - .1 Unit shall be shipped nitrogen charged upon arrival, after leak testing has been completed unit

to be charged with R-410 and weighted. Cx manager to witness testing.

.8 High Efficiency Condenser Coil:

.1 The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing. The coil fins shall have a factory applied corrosion resistant blue-fin finish particularly effective in urban environments. The blue fin treatment is a standard feature on condensing units. The outdoor coil shall include four (4) circuits with two position valves for each circuit, except for the last stage. The coil shall be protected with an integral metal guard. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

.9 Variable Speed Scroll Compressor:

.1 The outdoor units shall be provided complete with an inverter driven scroll hermetic compressor(s) (72/96 MBH one compressor single fan and 120/144 MBH single compressors twin fan). The compressor motor shall be of DC Brushless configuration to achieve optimum compressor/motor performance levels particularly during off design conditions. Non inverter-driven compressors shall not be deemed acceptable for this application. Compressors driven by induction are not allowed in this instance.

.2 A crankcase heater(s) shall be factory mounted on the compressor(s). Each compressor shall be capable of modulation down to 19% of rated capacity.

.3 The compressor(s) shall be equipped with an internal thermal overload. The compressor shall be mounted to avoid the transmission of vibration.

.10 Unit Electrical Characteristics:

.1 The outdoor unit electrical power shall match mechanical schedules. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz). The outdoor unit shall be controlled by integral microprocessors.

.2 The control circuit between the indoor units and the outdoor unit shall be 30VDC completed using a 2-conductor, twisted pair non-polar shielded cable to provide total integration of the system. The inrush current to the outdoor unit shall not exceed the design full load amp FLA rating for the unit. Alternate systems with solid state or constant speed scroll compressors with significant inrush current characteristic will not be acceptable for this application.

2.7 A-1, A-2, A-4,
A-5, A-6, A-7 -
INDOOR UNIT

- .1 General:
 - .1 The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board, condensate pump and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
- .2 Unit Cabinet:
 - .1 The casing shall have a white finish. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
 - .2 There shall be a separate back plate which secures the unit firmly to the wall. Integral condensate pump shall be provided.
- .3 Fan:
 - .1 The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right). A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
- .4 Filter:
 - .1 Return air shall be filtered by means of an easily removable, washable filter.
- .5 Coil:
 - .1 The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. Both refrigerant lines to the indoor units shall be insulated.
- .6 Electrical:
 - .1 The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).
- .7 Controls:
 - .1 This unit shall use controls provided by the

manufacturer. Manufacturer to provide necessary controls to tie into the building BMS. Coordination and services of the buildings controls contractor is required to connect each split system to the BMS.

2.8 A-3 INDOOR
UNIT

- .1 General:
 - .1 The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit in conjunction with the remote controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit refrigerant pipes will be charged with nitrogen before shipment from the factory.
- .2 Unit Cabinet:
 - .1 The casing shall have galvanized steel plate finish. The cabinet shall have provision for adjacent round duct for filtered fresh air intake. Drain pump with float switch shall be a part of unit assembly and provided by the indoor unit manufacturer.
- .3 Fan:
 - .1 The evaporator fan shall be driven by a single DC motor. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four (4) speeds, Low, Mid, Hi and auto.
- .4 Filter:
 - .1 Return air shall be filtered by means of an easily removed washable honeycomb filter. Filter cleaning indication 0, 100 and 2,500 hours.
- .5 Coil:
 - .1 The evaporator coil shall be of nonferrous construction with aluminum strake pre-coated fins on copper tubing. All tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.
- .6 Electrical:
 - .1 The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The evaporator shall be powered from the outdoor unit.

2.9 REMOTE
CONTROLLER
(ELEVATOR
MACHINE ROOM 1&2,
4&5&6, 8&9)

- .1 General:
- .1 The Remote Controller) shall be capable of controlling up to 2 or more indoor units (defined as 1 group). The Remote Controller shall be white in colour with a LCD display. Remote controller shall support a selection from multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information. The remote controller supports temperature display selection of Fahrenheit or Celsius. The remote controller shall control the following grouped operations: On/Off, Operation Mode (cool, heat, auto, dry, and fan), temperature set point, fan speed setting, and airflow direction setting. The remote controller shall support timer settings of on/off/temperature up to 8 times in a day in 1-minute increments. The remote controller shall support an Auto Off timer. The remote controller shall be able to limit the set temperature range from the remote controller. The room temperature shall be sensed at either the remote controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The remote controller shall display a four-digit error code in the event of system abnormality/error.
- .2 The remote controller shall require no addressing. Remote controller shall connect using two-wire, stranded, non-polar control wire to TB15 connection terminal on the indoor unit. The remote controller shall require cross-over wiring for grouping across indoor units.
- .3 The remote controller shall be connected to the building BMS through a factory provided BACNET compatible adapter. Input variables include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, and filter sign reset. Output variables include, but are not limited to, model size, alarm state, error code, and error address.

2.10 REMOTE
CONTROLLER
(ELEVATOR MACHINE
ROOM 3)

- .1 General:
- .1 This unit shall have a wired controller to perform input functions necessary to operate the system. The wire controller shall have multi-language, a large liquid crystal display and a weekly timer with eight pattern settings per day. The controller shall consist of an On-Off switch, Cool/Dry-Fan selector, Thermostat setting, Timer Mode, High-Low fan speed, Test Run switching and Check Mode switching. The controller shall have a built in temperature sensor. Temperature changes shall be by 1°F/1°C increments with a range of 67 – 87°F (19–30°C). Temperature displayed in both °F and °C. The control system shall consist of two (2) microprocessors interconnected by a single non-polar two wire cable. Normal operation of the remote controller provides individual system control in which one remote controller and one indoor unit are

| | | |
|---------------------|-----------------------|------------------|
| PWGSC Ontario | DUCTLESS SPLIT SYSTEM | Section 23 81 11 |
| Region Project | A/C UNITS | Page 8 |
| Number R.049549.001 | | 2013-08-29 |

installed in the same room. Systems at a maximum developed control cable distance of 1,500 feet.

- .2 Field Wiring:
 - .1 Field wiring shall run direct from the indoor unit to the controller with no splices. Manufacturer shall provide 2 conductor non-polar 22 AWG. stranded wire for connection to remote controller.
 - .2 The system shall include self-diagnostics including total hours of compressor run time. Diagnostics codes for indoor and outdoor unit shall be displayed on wired remote panel. Controller shall display operating conditions such as pipe temperatures (i.e. liquid, discharge, indoor and outdoor), compressor operating conditions, including (running current, frequency, input voltage, on/off status and operating time), LEV opening pulses, sub cooling and discharge super heat.
 - .3 The microprocessor within the wall mounted remote controller shall provide automatic cooling, display set point and room temperature. Control system shall control the continued operation of the air sweep vanes, as well as provide on/off and system/mode function switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay. Two remote controllers can be used to control one unit.
 - .4 The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit. The control voltage from the controller to the indoor unit shall be 12 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. The system shall be capable of automatic restart when power is restored after power interruption.
- .3 The remote controller shall be connected to the building BMS through a factory provided BACNET compatible adapter. Input variables include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, and filter sign reset. Output variables include, but are not limited to, model size, alarm state, error code, and error address.

2.10 CONTROL & BMS INTERFACE

- .1 Retain service of Johnson Controls to provide necessary control and BMS wiring.
- .2 Provide equipment and control components for BACNET interface with existing BMS.
- .3 Consult split system manufacturer for control

schematics for tying split systems into the building BMS.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Install as indicated, to manufacturer's recommendation.
- .2 Manufacturer to certify installation.
- .3 Make power and control connections.

3.2 EQUIPMENT PREPARATION

- .1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.46-M1988(R2011), Electric Air-Heaters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA 250-08, Enclosures for Electrical Equipment (1000 V Maximum).

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.3 CLOSEOUT
SUBMITTALS

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

1.4 DELIVERY,
STORAGE AND
HANDLING

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

PART 2 - PRODUCTS

2.1 UNIT HEATERS

- .1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet, explosion proof.
- .2 Fan type unit heaters with built-in high-heat limit protection, fan-delay switches.
- .3 Fan motor: totally enclosed, permanently lubricated ball bearing, sleeve bearing type with resilient mount explosion proof.
 - .1 Built-in fan motor thermal overload protection.
- .4 Hangers: as indicated.
- .5 Elements: insulated copper coated steel sheath with aluminum brazed fins.
 - .1 Explosion proof with sealed steel tube core with aluminum fin.
- .6 Cabinet: steel, 1.9 mm thick, fitted with brackets for rod or wall mounting.
 - .1 Epoxy coated.

2.2 CONTROLS

- .1 Wall mounted thermostats: type low voltage, electronic, Energy Star certified.
 - .1 Explosion proof in accordance with NEMA 7, 9 as per NEMA 250 with cast aluminum enclosure.
- .2 Built in thermostat and support controls.

PART 3 - EXECUTION

3.1 EXAMINATION

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

receipt of written approval to proceed from
Departmental Representative.

3.2 INSTALLATION

- .1 Suspend unit heaters from ceiling.
- .2 Install thermostats in locations indicated.
- .3 Make power and control connections.
- .4 Provide controller to ensure unit heater does not operate simultaneously with room split system.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Test cut-out protection when air movement is obstructed.
- .3 Test fan delay switch to assure dissipation of heat after element shut down.
- .4 Test unit cut-off when fan motor overload protection has operated.
- .5 Ensure heaters and controls operate correctly.

3.4 CLEANING

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

3.5 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
.1 CSA-C22.1-2012, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations.
- .2 National Electrical Manufacturer's Association (NEMA) Standards.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).
- .4 The Ontario Electrical Safety Code (OESC) 2012, and all bulletins (Ontario).
- .5 Hydro requirements and local applicable codes and regulations.
- .6 Other codes and standards as noted herein.
- .7 All code references denote the latest version of that code as of the tender closing date.

1.2 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English only.
- .4 Use one nameplate or label for each language.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Product Data: submit WHMIS MSDS.
- .3 Submit for review fire alarm riser diagram, plan and zoning of building.
- .4 Shop drawings:
 - .1 Submit drawings stamped and signed by

professional engineer registered or licensed in Province of Ontario within 3 weeks of Award of Contract.

- .5 Quality Control: in accordance with Section 01 45 00.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees. Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
 - .5 Submit certificate of acceptance from Electrical Inspection Department upon completion of Work to Departmental Representative.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

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

1.6 SYSTEM STARTUP

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

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 before delivery to site and submit such approval as described in PART 1 - Submittals.
- .2 Factory assemble control panels and component assemblies.
- .3 Provide drip-proof enclosures for equipment installed in sprinklered locations.

2.2 WIRING TERMINATIONS

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

2.3 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.
 - .2 Colour scheme to match existing in use in building.
 - .3 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 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

- .3 Allow for minimum of twenty-five (25) letters per nameplate.
- .4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .5 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. _____ " as directed by Departmental Representative.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.

2.4 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to match existing.

2.5 CONDUIT AND CABLE IDENTIFICATION

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

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with the OESC 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 LOCATION OF
OUTLETS

- .1 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m, and information is given before installation.

3.4 CO-ORDINATION OF
PROTECTIVE
DEVICES

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

3.5 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.

PART 1 - GENERAL

1.1 NOT USED .1 Not Used.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required.
.2 Fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Remove insulation carefully from ends of conductors and:
.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
.2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65.

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

END OF SECTION

PART 1 - GENERAL

| | | |
|---------------------|----|-----------|
| <u>1.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 2 - PRODUCTS

| | | |
|---------------------------|----|--|
| <u>2.1 BUILDING WIRES</u> | .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. |
| | .3 | Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V. |

PART 3 - EXECUTION

| | | |
|---|----|---|
| <u>3.1 INSTALLATION OF BUILDING WIRES</u> | .1 | Install wiring in conduit as indicated: |
|---|----|---|

END OF SECTION

| | | |
|---------------------|----------------|------------------|
| PWGSC Ontario | CONNECTORS AND | Section 26 05 22 |
| Region Project | TERMINATIONS | Page 1 |
| Number R.049549.001 | | 2013-08-29 |

PART 1 - GENERAL

1.1 NOT USED .1 Not Used.

PART 2 - PRODUCTS

2.1 CONNECTORS AND .1 Copper compression connectors as required sized for
TERMINATIONS conductors.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install terminations in accordance with manufacturer's
instructions.

END OF SECTION

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, copper conductors, size as indicated.
- .3 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install grounding equipment including, conductors, connectors, accessories.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.

- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.

3.2 GROUNDING BUS

- .1 Install copper grounding bus bars mounted on insulated supports in machine room as shown.
- .2 Connect bus bars to ground bus in main switchgear room using conductors as shown,
- .3 Grounding of elevator equipment to bus bars will be done under Division 14.

3.3 FIELD QUALITY CONTROL

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

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED .1 Not Used.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended as required.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

- .7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

PART 1 - GENERAL

| | | |
|---------------------|----|-----------|
| <u>1.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 2 - PRODUCTS

| | | |
|--|----|---|
| <u>2.1 JUNCTION AND PULL BOXES</u> | .1 | Construction: welded steel enclosure. |
| | .2 | Covers Surface Mounted: screw-on flat turned edge covers. |

PART 3 - EXECUTION

| | | |
|---|----|---|
| <u>3.1 JUNCTION AND PULL BOX INSTALLATION</u> | .1 | Install junction and pull boxes in inconspicuous but accessible locations. |
| | .2 | Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1. |

| | | |
|---------------------------|----|---|
| <u>3.2 IDENTIFICATION</u> | .1 | Equipment Identification: to Section 26 05 00. |
| | .2 | Identification Labels: size 2 indicating system name voltage and phase or as indicated. |

END OF SECTION

| | | |
|---------------------|------------------------|------------------|
| PWGSC Ontario | CONDUITS, CONDUIT | Section 26 05 34 |
| Region Project | FASTENINGS AND CONDUIT | Page 1 |
| Number R.049549.001 | FITTINGS | 2013-08-29 |

PART 1 - GENERAL

1.1 REFERENCES

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

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel, threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, steel, aluminum, liquid-tight flexible metal.

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 1.5 m on centre.

| | | |
|---------------------|------------------------|------------------|
| PWGSC Ontario | CONDUITS, CONDUIT | Section 26 05 34 |
| Region Project | FASTENINGS AND CONDUIT | Page 2 |
| Number R.049549.001 | FITTINGS | 2013-08-29 |

- .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 Use factory "ells" for 90 degree bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

2.5 FISH CORD

- .1 Polypropylene 6 mm.

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 All conduits within elevator shafts shall be installed under this Division 14, under the direction of the elevator installation trade.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Conceal conduits in all finished areas.
- .4 Use rigid galvanized steel threaded conduit in elevator shafts.
- .5 Use electrical metallic tubing (EMT) except where specified otherwise.
- .6 Use liquid tight flexible metal conduit for connection

| | | |
|---------------------|------------------------|------------------|
| PWGSC Ontario | CONDUITS, CONDUIT | Section 26 05 34 |
| Region Project | FASTENINGS AND CONDUIT | Page 3 |
| Number R.049549.001 | FITTINGS | 2013-08-29 |

to motors or vibrating equipment.

- .7 Minimum conduit size for lighting and power circuits: 19 mm.
- .8 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm diameter.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible.
- .3 Do not pass conduits through structural members except as indicated.
- .4 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 When installing conduits above accessible ceilings, carefully remove and replace ceiling tiles.
- .3 When installing conduits above inaccessible ceilings, run conduits to minimize damage to ceiling. Patching and refinishing will be done by the appropriate trades.

3.5 CLEANING

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

END OF SECTION

PART 1 - GENERAL

| | | |
|--|----|--|
| <u>1.1 REFERENCES</u> | .1 | CSA International |
| | .1 | CAN/CSA-C22.2 No.47-M90 (R2007), Air-Cooled Transformers (Dry Type). |
| | .2 | CSA C9-02 (R2007), Dry-Type Transformers. |
| | .3 | CAN/CSA-C802.2-06, Minimum Efficiency Values for Dry Type Transformers. |
| | .2 | National Electrical Manufacturers Association (NEMA). |
| <u>1.2 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Submit in accordance with Section 01 33 00. |
| | .2 | Product Data: |
| | .1 | Submit manufacturer's instructions, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations. |
| <u>1.3 CLOSEOUT SUBMITTALS</u> | .1 | Submit in accordance with Section 01 78 00. |
| | .2 | Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual. |
| <u>1.4 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions. |
| | .2 | Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. |
| | .3 | Storage and Handling Requirements: |
| | .1 | Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area. |
| | .2 | Store and protect dry type transformers from nicks, scratches, and blemishes. |
| | .3 | Replace defective or damaged materials with new. |

PART 2 - PRODUCTS

2.1 DESIGN DESCRIPTION

- .1 Design 1.
 - .1 Type: ANN.
 - .2 Single phase, 3 kVA, 600 V input, 210 V output, 60 Hz.
 - .3 Voltage taps: standard.
 - .4 Insulation: Class H, 150 degrees C temperature rise.
 - .5 Basic Impulse Level (BIL): standard.
 - .6 Hipot: standard.
 - .7 Average sound level: standard
 - .8 Impedance at 17 degrees C: standard
 - .9 Enclosure: NEMA, removable metal front panel.
 - .10 Mounting: floor.
 - .11 Finish: in accordance with Section 26 05 00.
 - .12 Copper windings.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Label size: 7.
- .3 Nameplate wording: To be specified on shop drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Mount dry type transformer on floor.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformer in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Energize transformer after installation is complete.
- .8 Make conduit entry into bottom 1/3 of transformer enclosure.

| | | |
|---------------------|--------------------------|---------------------|
| PWGSC Ontario | DRY TYPE TRANSFORMERS UP | Section 26 12 16.01 |
| Region Project | TO 600 V PRIMARY | Page 3 |
| Number R.049549.001 | | 2013-08-29 |

- | | | |
|-----------------------|----|---|
| <u>3.2 PROTECTION</u> | .1 | Protect installed products and components from damage during construction. |
| | .2 | Repair damage to adjacent materials caused by dry type transformers installation. |

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT
SUBMITTALS

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

1.4 DELIVERY,
STORAGE AND
HANDLING

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

PART 2 - PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 V panelboards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating of mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: baked grey enamel.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

3.3 CLEANING

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

3.4 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SWITCHES

- .1 15 A, 120 V, single pole, and three-way, switches.
- .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps.
- .4 Switches of one manufacturer throughout work.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Eight back wired entrances, four side wiring screws.
 - .4 Triple wipe contacts and rivetted grounding contacts.
 - .5 Class A ground fault interrupter, with test and reset buttons.
- .2 Receptacles of one manufacturer throughout project.

- 2.3 COVER PLATES
- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
 - .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
 - .3 Weatherproof single lift spring-loaded cast aluminum cover plates, complete with gaskets for ground fault receptacles as indicated.

- 2.4 SOURCE QUALITY CONTROL
- .1 Cover plates from one manufacturer throughout project.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height as indicated.
 - .2 Receptacles:
 - .1 Mount receptacles at height as indicated.
 - .2 Install GFI type receptacles as indicated.
 - .3 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
 - .4 Where existing switches are shown to be relocated, reuse the existing switch, and mount in new box.

END OF SECTION

PART 1 - GENERAL

| | | |
|---------------------|----|-----------|
| <u>1.1 NOT USED</u> | .1 | Not Used. |
|---------------------|----|-----------|

PART 2 - PRODUCTS

| | | |
|----------------------------|----|--|
| <u>2.1 FUSES - GENERAL</u> | .1 | Standard cartridge fuses based on CSA C22.2, No. 248. |
| | .1 | Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification. |
| | .2 | Fuses: product of one manufacturer. |

| | | |
|-----------------------|----|--|
| <u>2.2 FUSE TYPES</u> | .1 | Class J fuses. |
| | .1 | Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum. |
| | .2 | Type J2, fast acting. |

PART 3 - EXECUTION

| | | |
|-------------------------|----|--|
| <u>3.1 INSTALLATION</u> | .1 | Install fuses in mounting devices immediately before energizing circuit. |
| | .2 | Ensure correct fuses fitted to physically matched mounting devices. |
| | .3 | Ensure correct fuses fitted to assigned electrical circuit. |

END OF SECTION

PART 1 - GENERAL

- | | | |
|--|----|---|
| <u>1.1 REFERENCES</u> | .1 | CSA International (CSA) .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMJ-J-266-ANCE-2010). |
| <u>1.2 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Submit in accordance with Section 01 33 00. |
| | .2 | Product Data: .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations. |
| <u>1.3 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions. |
| | .2 | Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. |

PART 2 - PRODUCTS

- | | | |
|-----------------------------|----|---|
| <u>2.1 BREAKERS GENERAL</u> | .1 | Moulded-case circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5. |
| | .2 | Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient. |
| | .3 | Common-trip breakers: with single handle for multi-pole applications. |
| | .4 | Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. |
| | .5 | Circuit breakers to have minimum 10,000 symmetrical rms interrupting capacity rating. |

| | | |
|--|----|---|
| <u>2.2 THERMAL MAGNETIC BREAKERS</u> | .1 | Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection. |
|--|----|---|

PART 3 - EXECUTION

| | | |
|------------------------|----|--|
| <u>3.1 EXAMINATION</u> | .1 | Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions. .1 Visually inspect substrate in presence of Departmental Representative. .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery. .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative. |
|------------------------|----|--|

| | | |
|-------------------------|----|--|
| <u>3.2 INSTALLATION</u> | .1 | Install circuit breakers as indicated. |
|-------------------------|----|--|

| | | |
|---------------------|----|--|
| <u>3.3 CLEANING</u> | .1 | Progress Cleaning: clean in accordance with Section 01 74 11. .1 Leave Work area clean at end of each day. |
| | .2 | Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11. |
| | .3 | Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20. .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility. |

PART 1 - GENERAL

1.1 REFERENCES

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- | | | |
|--|----|---|
| <u>2.1 MATERIALS</u> | .1 | Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144. |
| | .2 | Components comprising ground fault protective system to be of same manufacturer. |
| <u>2.2 BREAKER TYPE GROUND FAULT INTERRUPTER</u> | .1 | Single pole ground fault circuit interrupter for 1 phase circuit c/w test and reset facilities. |
| <u>2.3 GROUND FAULT PROTECTOR UNIT</u> | .1 | Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with: <ul style="list-style-type: none"> .1 Solid state ground sensing device. .2 Facility for testing and reset. .3 CSA Enclosure 3 surface mounted with stainless steel face plate. |

PART 3 - EXECUTION

- | | | |
|-------------------------|----|---|
| <u>3.1 EXAMINATION</u> | .1 | Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions. <ul style="list-style-type: none"> .1 Visually inspect substrate in presence of Departmental Representative. .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery. .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative. |
| <u>3.2 INSTALLATION</u> | .1 | Do not ground neutral on load side of ground fault relay. |

- .2 Pass phase conductors including neutral through zero sequence transformers.
- .3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Arrange for field testing of ground fault equipment by Contractor before commissioning service.
- .3 Demonstrate simulated ground fault tests.

3.4 CLEANING

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

PART 1 - GENERAL

1.1 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible, and non-fusible, disconnect switches in CSA Enclosure, size as indicated.
- .2 Provision for padlocking in off switch position.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated, to Section 26 28 13.01.
- .5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

END OF SECTION

PART 1 - GENERAL

- | | | |
|--|----|---|
| <u>1.1 REFERENCES</u> | .1 | American National Standards Institute (ANSI) |
| | .1 | ANSI C82.1-2004, American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts. |
| | .2 | Canadian Standards Association (CSA International). |
| <u>1.2 ACTION AND INFORMATIONAL SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00. |
| | .2 | Product Data: |
| | .1 | Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations. |
| <u>1.3 DELIVERY, STORAGE AND HANDLING</u> | .1 | Deliver, store and handle materials in accordance with Section 01 61 00. |
| | .2 | Deliver materials to site in original factory packaging, labelled with manufacturer's name, address. |
| | .3 | Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 20. |

PART 2 - PRODUCTS

- | | | |
|---------------------|----|---|
| <u>2.1 LAMPS</u> | .1 | Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 3500 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80; or as indicated. |
| <u>2.2 BALLASTS</u> | .1 | Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic. |
| | .1 | Rating: 120 V, 60 Hz, for use with 2-32W, rapid start lamps. |
| | .2 | Totally encased and designed for 40 degrees Celsius ambient temperature. |

- .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
- .4 Current crest factor: 1.7 maximum.
- .5 Harmonics: 10 % maximum THD.
- .6 Operating frequency of electronic ballast: 20 kHz minimum.
- .7 Total circuit power: 62 Watts.
- .8 Ballast factor: greater than 0.90.
- .9 Sound rated: Class A.
- .10 Mounting: integral with luminaire.

| | | |
|---------------------|----|---|
| <u>2.3 FINISHES</u> | .1 | Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation. |
|---------------------|----|---|

| | | |
|------------------------------------|----|--------------------------------|
| <u>2.4 OPTICAL CONTROL DEVICES</u> | .1 | As indicated on Drawing E-001. |
|------------------------------------|----|--------------------------------|

| | | |
|-----------------------|----|--------------------------------|
| <u>2.5 LUMINAIRES</u> | .1 | As indicated on Drawing E-001. |
|-----------------------|----|--------------------------------|

PART 3 - EXECUTION

| | | |
|-------------------------|----|--|
| <u>3.1 INSTALLATION</u> | .1 | Locate and install luminaires as indicated. |
| | .2 | Provide adequate support to suit ceiling system. |

| | | |
|-------------------|----|--|
| <u>3.2 WIRING</u> | .1 | Connect luminaires to lighting circuits: |
| | .1 | Install flexible or rigid conduit for luminaires as indicated. |

| | | |
|--------------------------------|----|---|
| <u>3.3 LUMINAIRE ALIGNMENT</u> | .1 | Align luminaires mounted in continuous rows to form straight uninterrupted line. |
| | .2 | Align luminaires mounted individually parallel or perpendicular to building grid lines. |

- | | | |
|---------------------|----|---|
| <u>3.4 CLEANING</u> | .1 | Clean in accordance with Section 01 74 11. .1 Remove surplus materials, excess materials, rubbish, tools and equipment. |
| | .2 | Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20. |

PART 1 - GENERAL

1.1 DIVISION OF RESPONSIBILITY

- .1 All equipment and wiring for communication systems (intercom and CCTV) will be supplied under Division 14.
- .2 All communication devices will be installed under Division 14.
- .3 All wiring shall be pulled under Division 27.
- .4 All connections will be coordinated between Division 14 and the Owner's security provider.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 CLEANING

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

3.2 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Division 14.

1.2 SCOPE

- .1 All equipment and wiring for intercom system will be supplied under Division 14.
- .2 All intercom devices will be installed and connected under Division 14.
- .3 All intercom wiring shall be installed under Division 27.
- .4 All connection to existing equipment will be coordinated between Division 14 and the Owner's personnel.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install intercom wiring in conduit in conjunction with wiring for CCTV and miscellaneous controls, as described in Division 14.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section includes:
 - .1 Materials and installation for fire alarm systems.
- .2 Scope includes provision of fire detectors and wiring as shown on the drawings.

1.2 REFERENCES

- .1 Government of Canada
 - .1 TB OSH Chapter 3-04, 1994-12-22, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems.
 - .3 CAN/ULC-S531-02, Standard for Smoke Alarms.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .1 Shop drawings: stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Include:
 - .1 Layout of equipment.
 - .2 Zoning.
 - .3 Complete wiring diagram, including schematics of modules.
- .3 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 in accordance with ANSI/NFPA 20.
 - .2 Submit following:
 - .1 Manufacturer's Data for:
 - .1 Open-area smoke detectors.
 - .2 Output modules.

- .2 System wiring diagrams:
 - .1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.
 - .2 Show modules, relays, switches and lamps in control panel.

1.4 QUALITY ASSURANCE

- .1 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.
- .2 System:
 - .1 To TB OSH Chapter 3-04.
 - .2 Subject to Fire Commissioner of Canada (FC) approval.
 - .3 Subject to FC inspection for final acceptance.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.6 BUILDING SERVICE, PROVIDER

- .1 The existing fire alarm system is maintained and administered by a specific Building Service Provider (BSP).
- .2 The Owner will provide contact information for the BSP.

PART 2 - PRODUCTS

2.1 INTEGRATION WITH EXISTING SYSTEM

- .1 The building is equipped with an Edwards addressable fire alarm system.
- .2 Any new equipment shall be fully compatible with the existing system.
- .3 If products furnished are not by Edwards, provide a letter from the BSP for fire alarm certifying compatibility of the products.

2.2 MATERIALS

- .1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

2.3 AUTOMATIC ALARM INITIATING DEVICES

- .1 Open-Area Addressable Smoke Detectors: provide detectors designed for detection of abnormal smoke densities by ionization principle.
 - .1 Provide necessary control and power modules required for operation integral with control panel.
 - .2 Detectors and associated modules: compatible with control panel and suitable for use in supervised circuit.
 - .3 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.
 - .4 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.
 - .5 Each detector: plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.
 - .6 Detector head: removable from its base without disconnecting wires. Removal of detector head from its base to cause activation of system trouble signals.
 - .7 Screen each detector to prevent entrance of insects into detection chamber(s).
- .2 Ionization Detectors: multiple chamber type responsive to both invisible and visible particles of combustion.
 - .1 Detectors: not susceptible to operation by changes in relative humidity.
- .3 Provide detector bases with terminal screw type connections.
- .4 Removal of detector head from its base to cause activation of system trouble signals.

2.4 CONDUIT

- .1 Rigid Steel Conduit:
 - .1 Zinc-Coated.
- .2 Electrical Metallic Tubing (EMT).

2.5 WIRING

- .1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.
- .2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor

- .3 Insulation 75 degrees C minimum with nylon jacket.
- .4 Colour code wiring.

2.6 AS-BUILT RISER DIAGRAM

- .1 Fire alarm system riser diagram: in glazed frame, minimum size 600 x 600 mm.

2.7 ANCILLARY DEVICES

- .1 Addressable remote output relay with NC or NO contacts.
- .2 Coordinate with Division 14 trade to determine contact configurations.

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 equipment in accordance with CAN/ULC-S524-06-AM1.
- .2 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors.
- .3 Install detector mounting boxes and conduit recessed above ceiling. Minimize cutting of finished ceiling.
- .4 Install conduit and wiring in elevator shafts, under direction of Division 14 trade.
- .5 Make connections to existing wiring as shown.
- .6 Locate and install remote output relay units to control elevator operation.

3.3 FIELD QUALITY CONTROL

- .1 Verification:
 - .1 Verification of new fire alarm work will be carried out by the BSP for fire alarm.
- .2 Cooperate with the BSP, and correct any defects

| | | |
|---------------------|--------------------------|------------------|
| PWGSC Ontario | FIRE DETECTION AND ALARM | Section 28 31 00 |
| Region Project | | Page 5 |
| Number R.049549.001 | | 2013-08-29 |

identified in the verification process.

- .3 The BSP will reprogram the main control to accommodate the new devices. Provide direction and assistance as required.

END OF SECTION



Date: July 29, 2013

Mr. Ayan
Project manager
Public Works and Government Services Canada
4900 Yonge Street,
Toronto, ON M2N 6A6

Re: Project No. BRM-00350068-F0
Elevator Modernization Project – Hazardous Substances

Dear Mr. Ayan:

With respect to the Elevator Modernization Project, 1 Front Street West in Toronto, **exp** Services Inc. (**exp**) has conducted a review of the 99% Drawings and Specifications alongside the following reports:

1. Asbestos Product Survey, Government of Canada Building, 1 Front Street West, Toronto, Ontario, Complex #501096, dated December 7, 2006, prepared by Advanced Environmental Corp.
2. Designated Substance Survey (Selected Area), Government of Canada Building, 1 Front Street West, Toronto, Ontario, dated July 31, 2008, prepared by Advanced Environmental Corp.
3. SNC Lavalin O&M, Limited Asbestos and Designated Substances Survey, 1 Front Street West, Toronto, Ontario, Complex #501096, dated June 29, 2012, prepared by **exp** Services Inc.

Based on this review, **exp** concludes that the following building materials that have been shown to, or are suspected to, contain hazardous materials are located in or adjacent to sections of the building that may be impacted by the Elevator Modernization Project:

Asbestos:

No material known or suspected to contain asbestos has been identified within any of the elevator shafts within 1 Front Street West.

Table 1 (below) details building materials that contain, or are expected to contain, asbestos and which are located in rooms adjacent to elevator shafts:



Table 1: Elevator Modernization Project – Asbestos-Containing Materials

| Item | Location – 1 Front Street West | Type of Material | Asbestos Content | Approximate Quantity | Type of Removal |
|------|-------------------------------------|---------------------------|---------------------|-------------------------|--------------------|
| 1 | Ground Floor G-47 Main SCR | Vinyl Floor Tile | Unknown | 150 ft ² | Type 1 |
| 2 | Ground Floor G-48 Storage | Vinyl Floor Tile | Unknown | 150 ft ² | Type 1 |
| 3 | Fourth Floor 4-4 IT Room | Vinyl Floor Tile | Unknown | 75 ft ² | Type 1 |
| 4 | Sixth Floor 6-2 Mechanical Room | Caulking at Pipe Riser | 10% Chrysotile | 30 | Type 2/3 |
| 5 | East Elevator Mechanical Room | Brake shoes | Unknown | 2 | Type 1 |
| 6 | Central Elevator Mechanical Room | Brake shoes | Unknown | 3 | Type 1 |
| 7 | West Elevator Mechanical Room | Brake shoes | Unknown | 2 | Type 1 |
| 8 | Freight Elevator Mechanical Room | Brake shoes | Unknown | 1 | Type 1 |

Recommendations:

Exp recommends that, unless the above materials will be disturbed by the planned renovations or are currently in poor condition, no asbestos abatement activities be conducted in support of the Elevator Modernization Project.

If asbestos abatement is required abatement of vinyl floor tiles and/or brake shoes should be conducted in accordance with requirements specified in Ontario Regulation 278/05. Requirements are additionally detailed in “PWGSC Ontario, Region Project Number R.049549.001, Asbestos Abatement – Minimum Precautions, Sect. 02 82 00.01.

Further guidance should be sought if asbestos abatement of pipe riser caulking is required or if, during the project, suspect asbestos-containing material is discovered which is not apparent from drawings, specifications or reports pertaining to the Work.



Lead:

Table 2 (below) details surface coverings located within elevator shafts that have been identified as containing lead:

| Item | Location – 1 Front Street West | Type of Material | Lead Content | Approximate Quantity | Type of Removal |
|------|-----------------------------------|---------------------|--------------|-------------------------|--------------------|
| 9 | Elevator Shafts | Yellow paint | 0.33% | 1000 ft ² | Type 1 |

Recommendations:

Exp recommends that lead-containing paint which is in poor condition, or which may be disturbed, be removed following (as a minimum) Type 1 procedures as detailed in “Guideline, Lead on Construction Projects” issued by Occupational Health and Safety Branch, Ministry of Labour, dated September 2004. Paint that contains lead but which is in good condition with minimal risk of disturbance during the Elevator Modernization Project may be left in place.

Where possible, lead-containing paint to be abated should be removed from the elevator enclosures using power tools with an effective dust collection system equipped with HEPA filtration. Lead abatement requirements are detailed in “PWGSC Ontario, Region Project Number R.049549.001, Lead – Base Paint Abatement - Maximum Precautions, Sect. 02 83 12.” These precautions include requirements for abatement using abrasive blasting and dust removal using air mist extraction which are not recommended for use on this project.

Where abatement is conducted using power tools with an effective dust collection system equipped with HEPA filtration, **exp** recommends that the requirements of PWGSC Ontario, Region Project Number R.049549.001, Lead – Base Paint Abatement - Maximum Precautions, Sect. 02 83 12 be adopted with the following exceptions:

- 3.2.2.1 : Smoke tests not required
- 3.2.2.4 : Not required
- 3.2.4.3 : A wash basin is acceptable in place of a shower
- 3.2.4.5 : Elevator shafts provide barrier to work areas
- 3.5 : Not required



Other Hazardous Substances:

Whilst other hazardous substances have not been specifically identified within sections of the building that may be impacted by the Elevator Modernization Project, it is anticipated that hazardous materials will be present in forms that would not be expected to be of concern under normal circumstances, e.g. silica in concrete; mercury in fluorescent lighting. Standard construction practices should be adopted to prevent release of other hazardous substances into the building envelope.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Rebecca Orth'.

Rebecca Orth
Environmental Scientist

A handwritten signature in blue ink, appearing to read 'Bob Jowett'.

Bob Jowett
Team Leader

Attached: Section 02 82 00 Summary of Hazardous Materials Abatement

1.1 Summary of Hazardous Materials Abatement

- 1 Perform hazardous material abatement as specified. This work to include the following:
- 2 **Asbestos Abatement:** Perform the following asbestos abatement and related activities as and when instructed by the Departmental Representative in accordance with Sections 02 82 00.01:

| Item | Location – 1 Front Street West | Type of Material | Asbestos Content | Approximate Quantity | Type of Removal |
|------|-------------------------------------|---------------------------|---------------------|-------------------------|--------------------|
| 1 | Ground Floor G-47 Main SCR | Vinyl Floor Tile | Unknown | 150 ft ² | Type 1 |
| 2 | Ground Floor G-48 Storage | Vinyl Floor Tile | Unknown | 150 ft ² | Type 1 |
| 3 | Fourth Floor 4-4 IT Room | Vinyl Floor Tile | Unknown | 75 ft ² | Type 1 |
| 4 | Sixth Floor 6-2 Mechanical Room | Caulking at Pipe Riser | 10% Chrysotile | 30 | Type 2/3 |
| 5 | East Elevator Mechanical Room | Brake shoes | Unknown | 2 | Type 1 |
| 6 | Central Elevator Mechanical Room | Brake shoes | Unknown | 3 | Type 1 |
| 7 | West Elevator Mechanical Room | Brake shoes | Unknown | 2 | Type 1 |
| 8 | Freight Elevator Mechanical Room | Brake shoes | Unknown | 1 | Type 1 |

- 3 **Lead Abatement:** Perform the following lead abatement and related activities as specified in the following tables in accordance with Sections 02 83 12:

| Item | Location – 1 Front Street West | Type of Material | Lead Content | Approximate Quantity | Type of Removal |
|------|-----------------------------------|---------------------|--------------|-------------------------|--------------------|
| 9 | Elevator Shafts | Yellow paint | 0.33% | 1000 ft ² | Type 1 |

1.2 Restraints and Sequence of Work

- .1 Complete all abatement before commencing renovation activities within the same building.
- .2 Perform all work in accordance with the Work Schedule, reviewed and approved by the Departmental Representative.

1.3 Existing Conditions

- .1 The following reports are available for review:
 - .1 Asbestos Product Survey, Government of Canada Building, 1 Front Street West, Toronto, Ontario, Complex #501096, dated December 7, 2006, prepared by Advanced Environmental Corp.
 - .2 Designated Substance Survey (Selected Area), Government of Canada Building, 1 Front Street West, Toronto, Ontario, dated July 31, 2008, prepared by Advanced Environmental Corp.
 - .3 SNC Lavalin O&M, Limited Asbestos and Designated Substances Survey, 1 Front Street West, Toronto, Ontario, Complex #501096, dated June 29, 2012, prepared by **exp** Services Inc.
- .2 Notify the Departmental Representative of suspect Designated Substances or Hazardous Materials discovered during the work and not apparent from the drawings, specifications, or report, pertaining to the work. Do not disturb such material pending instructions from the Departmental Representative.

Part 2 – Products (not used)

Part 3 – Execution (not used)

End of Section 02 82 00





- **SNC Lavalin O & M**

**Limited Asbestos & Designated Substances
Survey**

Type of Document
Draft

Project Name
1 Front Street West, Toronto, ON

Project Number
BRM-00350068-E0

Prepared By: Bob Jowett

Reviewed By: Rebecca Orth

exp Services Inc.
1595 Clark Blvd
Brampton, ON L6T 4V1
Canada

Date Submitted
29.06.12

SNC Lavalin O & M

Limited Asbestos & Designated Substances Survey

Type of Document:

Draft

Project Name:

1 Front Street West
Toronto, Ontario

Project Number:

BRM-00350068-E0

Prepared By:

exp

1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada

T: +1.905.793.9800

F: +1.905.793.0641

www.exp.com



Rebecca Orth, B.Sc.
Hazardous Materials Technologist
Environmental Division



Bob Jowett, B.Sc.
Team Leader, Hazardous Materials Services
Environmental Division

Date Submitted:

29/06/12

Table of Contents

| | Page |
|---|-----------|
| Chapter 1 – | 1 |
| Introduction | 1 |
| 1. Introduction | 2 |
| 1.1 Regulatory Requirements..... | 2 |
| 1.2 Purpose..... | 2 |
| 1.3 Scope of Work | 3 |
| 1.4 Background Information on Designated Substances and Hazardous Materials | 3 |
| 1.4.1 Asbestos | 3 |
| 1.4.2 Lead..... | 3 |
| 1.4.3 Mercury..... | 4 |
| 1.4.4 Silica | 4 |
| 1.4.5 Vinyl Chloride | 4 |
| 1.4.6 Acrylonitrile..... | 5 |
| 1.4.7 Arsenic | 5 |
| 1.4.8 Benzene..... | 5 |
| 1.4.9 Coke Oven Emissions | 5 |
| 1.4.10 Ethylene Oxide..... | 5 |
| 1.4.11 Isocyanates..... | 6 |
| 1.4.12 Polychlorinated Biphenyls (PCBs) | 6 |
| 1.4.13 Ozone Depleting Substances (ODS)..... | 6 |
| 1.4.14 Radioactive Materials | 7 |
| 1.4.15 Mould..... | 8 |
| Chapter 2 – | 9 |
| Survey Methodology | 9 |
| 2 Survey Methodology | 10 |
| 2.1 ACMs Survey..... | 10 |
| Table 1 – O. Reg. 278/05 s. 3(3) - Minimum Asbestos Bulk Material Sample Requirements | 10 |
| 2.2 Lead..... | 11 |
| 2.3 Mercury..... | 11 |
| 2.4 Silica | 11 |
| 2.5 Other Designated Substances..... | 11 |

| | | |
|-----------------------------|--|-----------|
| 2.6 | Polychlorinated Biphenyls (PCBs) | 11 |
| 2.7 | Ozone Depleting Substances (ODS) | 11 |
| 2.8 | Radioactive Materials | 11 |
| 2.9 | Mould | 12 |
| 2.10 | Survey Limitations | 12 |
| Chapter 3 – | | 13 |
| Results and Findings | | 13 |
| 3 | Results and Findings | 14 |
| 3.1 | Property Description | 14 |
| 3.2 | ACM Survey | 14 |
| | Table 2 – Asbestos Sampling Locations and Laboratory Results | 14 |
| 3.2.1 | Friable Asbestos | 16 |
| 3.2.2 | Non - Friable Asbestos | 16 |
| 3.2.3 | Hazard Assessment of Additional ACMs | 16 |
| 3.3 | Lead | 16 |
| | Table 3 – Lead Sampling Locations and Laboratory Results | 17 |
| 3.4 | Mercury | 17 |
| 3.5 | Silica | 17 |
| 3.6 | Vinyl Chloride | 17 |
| 3.7 | Acrylonitrile | 17 |
| 3.8 | Arsenic | 17 |
| 3.9 | Benzene | 17 |
| 3.10 | Coke Oven Emissions | 17 |
| 3.11 | Ethylene Oxides | 18 |
| 3.12 | Isocyanates | 18 |
| 3.13 | Polychlorinated Biphenyls (PCBs) | 18 |
| 3.13.1 | Light Ballasts | 18 |
| 3.13.2 | Transformers | 18 |
| 3.14 | Ozone Depleting Substances (ODS) | 18 |
| 3.15 | Radioactive Materials | 18 |
| 3.16 | Mould | 18 |

| | |
|--|-----------|
| Chapter 4 – | 19 |
| Conclusions and Recommendations | 19 |
| 4 Conclusions & Recommendations | 20 |
| 4.1 Additional ACMs Survey | 20 |
| 4.1.1 Friable Asbestos..... | 20 |
| 4.1.2 Non - Friable Asbestos..... | 20 |
| 4.2 Lead..... | 20 |
| 4.3 Mercury | 20 |
| 4.4 Silica | 21 |
| 4.5 Other Designated Substances..... | 21 |
| 4.6 Polychlorinated Biphenyls (PCBs) | 21 |
| 4.7 Ozone Depleting Substances (ODS)..... | 21 |
| 4.8 Radioactive Materials | 21 |
| 4.9 Mould..... | 22 |
| General Limitations | 23 |
| 5 General Limitations | 24 |
| Hazard Ranking Decision Tree | 1 |
| Appendix B – | 3 |
| Laboratory Analytical Results | 3 |
| Appendix C – | 4 |
| List of Distribution | 6 |

Chapter 1 – Introduction

1. Introduction

Exp was retained by SNC Lavalin O & M (SNC Lavalin) to carry out a limited Asbestos and Designated Substances Survey (DSS) of the building located at 1 Front Street West in Toronto, Ontario. It is our understanding that the purpose of the survey was to identify any designated substances or hazardous materials which may be present in elevator shafts and elevator mechanical rooms within the building. By request, the Site visit was conducted out of office hours. **Exp** was accompanied by an elevator engineer (Kone) and a security officer during the Site visit.

1.1 Regulatory Requirements

The Occupational Health and Safety Act, R.S.O. 1990, c.0.1, s.30 (1) requires:

"Before beginning a project, the owner shall determine whether any Designated Substances are present at the project site and shall prepare a list of all Designated Substances that are present at the site".

Designated Substances are defined as any biological, chemical, or physical agent or combination thereof prescribed as a Designated Substance to which exposure of a worker is prohibited, regulated, restricted, limited or controlled.

Section 30 of the Act requires that the list of Designated Substances be provided to prospective contractors and subcontractors working on the site.

The Ministry of Labor Designated Substances are the following:

| | |
|---------------------|----------------|
| Acrylonitrile | Isocyanates |
| Arsenic | Lead |
| Asbestos | Mercury |
| Benzene | Silica |
| Coke Oven Emissions | Vinyl Chloride |
| Ethylene Oxide | |

In addition to the Designated Substances listed above, the sections of the building covered by this survey were also surveyed for the presence of other Hazardous Materials such as Polychlorinated Biphenyls (PCBs), Ozone Depleting Substances (ODS), and Radioactive Materials.

This Designated Substance survey report complies with the requirements of the Occupational Health & Safety Act.

1.2 Purpose

The purpose of the survey was to:

1. Determine the presence or absence of ACMs within elevator shafts and associated mechanical rooms;
2. Establish the type, location, condition, approximate quantities and hazard ranking of ACMs;
3. Determine the presence or absence of Designated Substances and Hazardous Materials within elevator shafts and associated mechanical rooms; and,

4. Establish the type, location, condition and approximate quantities of Designated Substances and Hazardous Materials.

1.3 Scope of Work

The survey entailed:

- Visual review of elevator shafts and associated mechanical rooms to identify materials which could contain asbestos and/or Designated Substances;
- Bulk sampling and analysis of representative materials suspected of containing asbestos;
- Assessment of the condition of the asbestos-containing materials (Hazard Assessment);
- Bulk sampling and analysis of materials suspected of containing lead; and,
- Recommendations for appropriate corrective action where required.

1.4 Background Information on Designated Substances and Hazardous Materials

1.4.1 Asbestos

Asbestos is a generic name that has been given to a group of naturally occurring fibrous minerals. In the past, asbestos was commonly used as a component in building materials such as insulation, fireproofing, and acoustic or decorative panels. Although there are many types of asbestos, the three main forms of commercial importance in Ontario are chrysotile, amosite, and crocidolite.

An Asbestos-Containing Material (ACM) is defined by the Ontario Regulation 278/05, the *Regulation respecting Asbestos on Construction Projects in Buildings and Repair Operations* – made under the Occupation Health and Safety Act (O. Reg. 278/05) as a material that contains 0.5 % or more asbestos by dry weight. ACMs are placed into two general classes, “friable” and “non-friable” ACMs. Friable ACMs are those materials that when dry can be crumbled, pulverized and reduced to powder by hand pressure. Typical friable ACMs include acoustical or decorative texture coats, fireproofing, some ceiling tiles, and thermal insulation. Non-friable ACMs are much more durable as they are held together by a binder such as cement, vinyl or asphalt. Typical non-friable ACMs include floor tiles, fire blankets, roofing materials and cementitious products such as wallboards, pipes or siding.

It has been recognized that hazardous situations may exist in buildings where asbestos-containing materials are found. This is especially true where asbestos fibers may become airborne as a result of material aging, physical damage, water damage, or air movement. Diseases associated with the inhalation of asbestos fibres include asbestosis, mesothelioma and lung cancer. In contrast, there is little reason for concern if the asbestos is in good condition, has not been damaged, and is not in a location where it is likely to be disturbed.

1.4.2 Lead

Lead is a pale, silver-grey coloured material when freshly cut, but darkens, when exposed to air. Lead may be used in its pure metallic form or combined chemically with other elements. Through various manufacturing processes, lead may be distributed through lead-containing dust, fumes, mists, liquids and as vapors of liquid organic lead compounds. Industrial uses of lead include, smelting and refining, electroplating, and various chemical manufacturing processes.

Lead may be inhaled, ingested or absorbed through the skin. Various body functions are affected by lead. Lead may interfere with the ability to manufacture hemoglobin in the blood. It reduces the kidneys ability to filter wastes from the blood stream. In the gastro-intestinal system, lead poisoning may result in abdominal pain, loss of appetite, vomiting, nausea, constipation and diarrhea. Lead may affect the nervous system, resulting in behavioral changes, impaired vision, hearing loss, brain disorders and peripheral nerve damage causing convulsions, coma, and death.

Heavy metals including primarily lead, cadmium, and mercury were added to paint for various desirable properties such as rust prevention or as a bactericide. When major building renovation or demolition operations are proposed, painted surfaces should be extensively sampled and analyzed to confirm if abatement precautions are required. Under no circumstances should heat be used to remove paint or cutting torches be applied to painted surfaces, as hazardous levels of metals may be released in the fumes.

There is no existing governmental regulation which defines what concentration of lead in paint is required in order to consider the paint to be lead-containing. There are guidelines (i.e. Hazardous Products Act Guideline and United States – Environmental Protection Agency – Housing and Urban Development Guideline) that suggest that paint is to be considered as containing lead if the lead concentration is equal to or greater than 5,000 ppm (0.5% by weight). In addition, there are no existing governmental regulations for the control of lead on construction projects, however, a guideline addressing lead on construction projects has been issued by the Ministry of Labor (September 2004).

1.4.3 Mercury

Mercury is a silver-colored heavy metal that is liquid at room temperature. It exists as a pure element and as inorganic mercury compounds. Metallic mercury is used in the following products and operations; batteries, electrical equipment, fluorescent light tubes, mercury vapor arc lamps, dental offices, chlorine products, and jewelry making. Mercuric compounds are found in the following industries: dye and ink manufacturing, explosives and fireworks manufacturing, paint manufacturing, paper manufacturing, photography processing, pesticide production and use, vinyl chloride production, and urethane foam production. Mercury is used in liquid form, but may also be present as a vapor. Mercury compounds may be found in liquid or solid form including dust particles. Mercury exposure may occur when it is inhaled, ingested or absorbed. Mercury poisoning can damage the nervous system, kidneys, skin, respiratory system, reproductive system and gastro-intestinal system.

1.4.4 Silica

Silica is found as a free crystalline or amorphous material. Free crystalline silica is not bound with a metal atom. It occurs naturally as quartz and in combination with clays, feldspars and other silicates. Quartz alone constitutes 30% of the earth's crust. Silica is used in several different industries and products such as sandblasting, molds forecasting work, manufacture of abrasives, grinding compounds, paint fillers and mastic, glass, pottery, ceramics, electronic components, fiberglass, steel industries, and quarries.

The primary exposure pathway of silica is through inhalation. A lung disease, silicosis, occurs as a result of the scarring of lung tissue from exposure to the crystalline form of silica.

1.4.5 Vinyl Chloride

Vinyl chloride is a member of a group of chemicals referred to as vinyl halides. It is a gas at standard room temperature and pressure. Vinyl chloride is used extensively in the chemical industry in the production of ethylene oxide as an extraction solvent. This material may be used in its vapor form or solubilized in a liquid.

Exposure may occur through inhalation, ingestion, dermal contact, or eye contact. Short-term exposure to vinyl chloride can cause dizziness, light-headaches, nausea, dullness of visual and auditory responses, drowsiness and loss of consciousness. Irritation of the skin and eyes can also occur. Skin contact with

the liquid can cause frostbite. Long term exposure to vinyl chloride can cause thickening of the skin, contact and allergic dermatitis, fatigue, coughing and sneezing, abdominal pain, gastrointestinal bleeding, nausea, vomiting, indigestion, diarrhea, jaundice, weight loss, anorexia, and a cold tingling sensation of the hands and feet.

1.4.6 Acrylonitrile

Acrylonitrile is a translucent liquid that reacts with other chemicals to produce polymers such as resin. Acrylonitrile may also be found in the vapor (gaseous) state in the workplace. It is used in the production of nitrile rubbers, plastics, acrylic fibers, coatings, and adhesives. Industries that use these products include automotive parts, clothing, carpets, plastic and gasket manufacturing.

Workers may be exposed to acrylonitrile through inhaling its vapors and through ingestion. Skin contact can cause itching and rashes. Diseases associated with acrylonitrile exposure are cancer and acute acrylonitrile poisoning (which can be fatal). Symptoms of acute acrylonitrile poisoning include headaches, nausea, diarrhea, and vomiting.

1.4.7 Arsenic

Arsenic is a heavy metal found in low concentrations in the earth's crust. It may be used in elemental form or as a chemical compound. Principal uses of or exposure to arsenic in industry include, metal workers, refiners (principally associated with copper refining), petroleum refining and herbicides. Exposure is generally via inhalation. Chronic effects of exposure to arsenic and its compounds include lung cancer, blood disorders, heart failure, bronchitis, and laryngitis. Acute effects include pulmonary neoplasms or bronchitis.

1.4.8 Benzene

Benzene is a very flammable and volatile aromatic organic hydrocarbon. Although usually used in liquid form, it may also be present in vapor (gaseous) form. Benzene is a by-product of the refining of petroleum. It is also used in the manufacture of styrene and synthetic rubber, adhesives, sealants, paints, paper coating, detergents, plastics, various organic solvents, and petrochemical products.

Exposure to benzene is primarily the result of breathing its vapors and mists. Liquid benzene can also be absorbed by the skin and ingested. This may result in eye, skin or throat irritation. Benzene exposure may result in the onset of leukemia and may affect the blood forming system, particularly in bone marrow.

1.4.9 Coke Oven Emissions

Coke oven emissions are the result of gases created by the combustion of bituminous coals. The principal industries of concern with respect to coke oven emissions include smelting and thermal electrical generating plants. Inhalation of coke oven emissions has been linked to lung cancer.

1.4.10 Ethylene Oxide

Ethylene oxide is a colorless gas with an ether-like odor at room temperature and pressure. It may be used in the gaseous state or compressed as a liquid. It is a major industrial chemical used largely in the production of ethylene glycol for automotive antifreezes, in the polyester industry and for the production of detergents.

Exposure to humans can occur through inhalation, ingestion and by dermal or eye contact. Short-term exposure to ethylene oxide can cause nausea, headache, weakness, vomiting, drowsiness, uncoordination and irritation of the eyes, nose throat and lungs. Skin contact with ethylene oxide can cause blisters, edema, burns, frostbite, and severe dermatitis. Long term exposure to ethylene oxide can cause skin sensitization, numbing of the sense of smell and respiratory infection.

1.4.11 Isocyanates

Isocyanates are a class of chemicals used in the manufacture of certain plastics, coatings, foams and other products. Isocyanates contain a group of atoms (-NCO) which readily react with certain other types of molecules. They may be found in liquid form (colorless to pale yellow or dark brown and viscous) or solid form (white or yellow in colour). The following products and processes use isocyanates: foams, soft synthetic rubbers, adhesives, sealants, coatings, insulation, packaging, paint hardeners, printing inks, foundry core binders, wire varnish, and textile finishing.

Exposure to isocyanates may occur from inhalation of vapor, mist, or dust. This may cause eye, nose or throat irritation. Liquid isocyanates can damage the skin or eyes on contact; however they are not absorbed into the body through the skin. High exposure can cause chest tightness, bronchitis, bronchospasm, fluid in the lungs and asthmatic attacks. Other health risks include, skin sensitization, rashes and temporary decreases in sharpness of vision.

1.4.12 Polychlorinated Biphenyls (PCBs)

PCBs were commonly used as dielectric fluid in electrical equipment such as transformers and capacitors, and in the ballasts of fluorescent light fixtures and high intensity discharge (HID) lamps. Lamp ballasts are designed to maintain constant electrical current despite variations in applied voltage. The most common fluorescent lamp ballasts are the rapid start ballasts used to operate two (2) four-foot fluorescent light tubes. These ballasts are typically mounted between the tubes on the light fixture and are shielded by a metal cover to reduce heat radiation. The production of PCBs in North America started in 1929 and was banned at the beginning of 1979. After 1981, no manufacturers produced fluorescent lamps with PCB-containing ballasts.

Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals.

1.4.13 Ozone Depleting Substances (ODS)

Controls on the consumption of ozone depleting substances were initiated with the introduction of the Montreal Protocol in 1987. Within Ontario, the general use of ozone depleting substances is controlled through Regulation 356 of the Environmental Protection Act (EPA). Control of the use of ozone depleting substances as refrigerants is further specified in Regulation 189/94 of the Environmental Protection Act.

Presently, regulation of ozone depleting substances by the EPA is limited to the substances listed below. There is, however, provision within the EPA for the control of additional ozone depleting substances at a future date.

| | |
|---------|------------|
| CFC-11 | Halon-1211 |
| CFC-12 | Halon-1301 |
| CFC-113 | Halon-2402 |
| CFC-114 | |
| CFC-115 | |

Production of ODS in the form of hydrochlorofluorocarbons (HCFCs) and chlorofluorocarbons (CFCs) ceased in Canada in 1993 as a result of their ozone-depleting characteristics. Importation of CFCs into Canada ceased in 1997 and a total ban on their use is proposed for 2010. The use of these materials is still permitted in existing equipment, but equipment must be serviced by a licensed contractor such that CFCs are contained and not released to the environment during servicing or operation.

Use of the HCFC (R-22), commonly found in air conditioning and refrigeration equipment, is not currently regulated, however strict controls over their manufacture and supply are in place. Under the management of a licensed contractor, equipment containing R-22 does not represent a significant threat to human health or the environment; however, consideration should be given to future phase out of any equipment containing R-22.

It is imperative to note that the Environmental Protection Act specifies that, effective *January 1, 2009*, *large refrigeration equipment (compressors with a total capacity greater than 22kW) will no longer be refilled with CFC refrigerant. Effective December 31, 2011, this equipment must be converted to an alternate refrigerant or replaced with equipment that uses an alternate refrigerant.*

Chillers

Effective January 1, 2009, chillers that are filled with CFC refrigerant cannot be refilled with CFC refrigerant upon first major overhaul. If a refill is required, the chiller will need to be converted to a non-CFC refrigerant chiller or replaced with a non-CFC refrigerant chiller. Beginning January 1, 2012, chillers will no longer be operated with CFC refrigerant and this practice must be discontinued.

Exemptions:

Chillers that have undergone a major overhaul may be refilled with a CFC refrigerant if prior to January 1, 2009, the owner submitted a written notice to the Director stating that by December 31, 2011 the equipment will be converted to or replaced by a system that uses a non-CFC refrigerant.

Refills will also be allowed for chillers that have undergone a major overhaul if there is an immediate threat to human health, crops, plant life or animal life foodstuffs on a farm or at a food packing, processing or storage facility. The chiller must be converted or replaced within one year of the date of refill and a notice of the date of refill must be submitted within seven days of the refill to the Director of the Ministry of Environment.

1.4.14 Radioactive Materials

Radiation is defined as energy that travels in the form of waves or high speed particles. Radioactive materials that decay spontaneously produce ionizing radiation. Any living tissue in the human body has the potential to be damaged by ionizing radiation. There are three (3) main routes of exposure to radiation. These are inhalation, ingestion, and direct exposure. Health effects associated with radiation exposure include radiation poisoning and cancer.

1.4.15 Mould

Mould is found in the natural environment and is required for the breakdown of plant debris such as leaves and wood. Mould spores are found in the air in both the indoor and outdoor environments. In order for mould to grow it requires a food source (i.e. gypsum wallboard, carpets, wallpaper, wood, etc.) and moist conditions. Mould can have an impact on human health depending on the species and concentration of the mould. Health effects can include allergies and mucous membrane irritation.

Currently there are no regulations governing mould; however, there are several guidelines addressing mould assessments and abatement. At the moment the industry standards include the Canadian Construction Association (CCA) document 82-2004 titled *"mould guidelines for the Canadian construction industry"* and the Environmental Abatement Council of Ontario (EACO) guidelines titled *"EACO Mould Abatement Guidelines, Edition 2 (2010)"*.

It is important to note that The Ministry of Labour (MOL) has governed protecting workers under the Occupational Health and Safety Act, which states that employers are required to take every precaution reasonable to protect their workers. This includes protecting workers from mould within workplace buildings.

Chapter 2 – Survey Methodology

2 Survey Methodology

The survey included a visual assessment for the presence of asbestos, lead, mercury, other Designated Substances, and Hazardous Materials. In addition, materials suspected of containing asbestos as well as lead were sampled and sent to an accredited laboratory for testing and analysis. The site work was carried out from June 19, 2012 to June 20, 2012 by Mr. Bob Jowett of **exp**. Laboratory certificates of analyses are attached in Appendix B. The following subsections present descriptions of the methodologies employed.

2.1 ACMs Survey

The asbestos survey included the identification of potential friable and non-friable asbestos-containing materials within elevator shafts and associated mechanical rooms. Accessible friable and non-friable materials suspected of containing asbestos were sampled. In addition, the condition, accessibility, friability and hazard ranking of the additional suspected materials were noted. The locations of inaccessible materials that are suspected to contain asbestos (e.g. elevator brake shoes) were noted.

O. Reg. 278/05 outlines requirements for the collection of multiple samples of each homogeneous material suspected of containing asbestos, as presented in Table 1, O. Reg. 278/05 s. 3 (3).

Table 1 – O. Reg. 278/05 s. 3(3) - Minimum Asbestos Bulk Material Sample Requirements

| Item | Type of material | Size of area of homogeneous material | Minimum number of bulk material samples to be collected |
|------|--|---|---|
| 1. | Surfacing material, including without limitation, material that is applied to surfaces by spraying, by troweling or otherwise, such as acoustical plaster on ceilings and fireproofing materials on structural members | Less than 90 square meters | 3 |
| | | 90 or more square meters, but less than 450 square meters | 5 |
| | | 450 or more square meters | 7 |
| 2. | Thermal insulation, except as described in item 3 | any size | 3 |
| 3. | Thermal insulation patch | Less than 2 linear meters or 0.5 square meters | 1 |
| 4. | Other material | Any size | 3 |

The number of bulk material samples collected from a homogeneous area were taken in accordance with Table 1 O. Reg. 278/05 s. 3 (3).

Materials suspected of containing asbestos were collected using wetting techniques and hand sampling tools. These materials (approximately one teaspoon full in quantity) were placed in sealable plastic bags and labeled for QA/QC review. A total of 32 samples of potentially asbestos-containing materials were collected from the subject building and were sent to an accredited laboratory for analysis.

A hazard assessment of identified ACMs was also carried out as part of this survey. The rankings of potential hazard range from 1 (most hazardous) to 4 (least hazardous). A decision tree to assist in the Hazard Ranking of the ACM is attached to this report in Appendix A.

All bulk samples were analyzed for asbestos content by EMSL Canada Inc. (EMSL), an independent laboratory that participates in the National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos fiber analysis (NVLAP code# 200877-0). A chain of custody form containing relevant information accompanied all submissions. As required under O. Reg. 278/05 s. 3(1), the bulk samples for asbestos were analyzed by Polarized Light Microscopy (PLM) in accordance with the U.S. Environmental Protection Agency Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, June 1993.

In accordance with the O. Reg. 278/05, if a material was found to contain greater than 0.5% asbestos, additional bulk material samples taken from the same homogeneous material were not analyzed.

A summary of potential asbestos-containing samples collected and the locations where these samples were taken are presented in Table 2 in Section 3.3.

2.2 Lead

Samples of materials suspected of containing lead were collected and placed in sealed plastic bags and labeled for QA/QC review by our Hazardous Materials Manager. One (1) sample was collected from the building interior and submitted to an accredited laboratory to determine the presence of lead. The specific sample location and laboratory results are noted in Table 3 in Section 3.4.

All samples were analyzed by EMSL Canada Inc. (EMSL), an independent industrial hygiene laboratory that participates in the Environmental Lead Proficiency Analytical Testing Program (ELPAT code# 196142) for dust/wipe, soil, and paint chip sample analysis. A chain of custody form containing relevant information accompanied all submissions.

2.3 Mercury

A visual survey of the building was conducted to determine whether any equipment or devices containing mercury were present. The type, quantity, and location of mercury-containing equipment was noted.

2.4 Silica

A visual survey of the building structural materials was made to determine if silica was present.

2.5 Other Designated Substances

A visual survey of the building was made to determine if other Designated Substances (acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates and vinyl chloride) were present.

2.6 Polychlorinated Biphenyls (PCBs)

A visual survey of the premises was conducted to determine if any electrical components which may contain PCBs were present.

2.7 Ozone Depleting Substances (ODS)

Fixed equipment suspected of containing hydrochlorofluorocarbons (HCFCs) and/or chlorofluorocarbons (CFCs) within surveyed sections of the subject site was reviewed. Name plate details from any potential ODS-containing equipment were recorded to determine the likelihood of ODS content.

2.8 Radioactive Materials

A visual survey of the premises was conducted to determine if any electrical components containing radioactive materials were present.

2.9 Mould

A visual assessment consisting of a walk through of the building to identify water damaged building materials and/or suspect visible mould growth was performed.

2.10 Survey Limitations

In general, the survey was limited to accessible areas only. The survey of the elevator shafts was conducted by riding on top of selected elevator cars. The elevator travel range limited the accessibility of some areas within the shafts. In addition, no sampling was conducted that could jeopardize the health and safety of workers. Intrusive sampling was conducted during the site visit however, it is possible Designated Substances and Hazardous Materials may be present in inaccessible areas such as behind walls, above drywall or plastered ceilings or within bulkheads. **Exp's** survey of the subject building was based on clear, unobstructed visual identification of suspect Designated Substances and Hazardous Materials. Analytical results reflect the sampled materials at the specific sampling locations. Visually similar materials were referenced to specific analyzed samples.

Fibreglass pipe straight insulation was not submitted for analysis as it can be identified visually and was never manufactured with asbestos.

Chapter 3 – Results and Findings

3 Results and Findings

3.1 Property Description

The subject building is a Government building housing various government agencies. The building consists of six (6) storeys with a basement.

The building was observed to be constructed with a poured concrete foundation and steel deck framing. Interior walls within the elevator shafts were observed to be either plaster or cinder block and within associated mechanical rooms were concrete or cinder block. Ceilings were plaster or metal (mechanical rooms). Flooring was of concrete construction.

The subject building was reportedly constructed in 1929 – 1932. Some renovations were completed in 1935 – 1936. It was observed that renovations had been conducted on the central elevator shaft and a freight elevator shaft had been added. From elevator equipment present within shafts it appears that these renovations / additions were completed in the 1980's however full renovation history is unknown at this time.

3.2 ACM Survey

The laboratory test results for suspected ACMs sampled are summarized in Table 2. The laboratory certificates of analysis are included in Appendix B. Detailed summary tables are located in Appendix C presenting the locations, approximate quantities and condition of the additional confirmed ACMs.

Table 2 – Asbestos Sampling Locations and Laboratory Results

| Sample ID | Location | Material | Asbestos Type and Content | Reliability |
|-----------|---------------------------------|--------------|---------------------------|-------------|
| AS-01 | Hoist pit, east mechanical room | Fireproofing | None Detected | N/A |
| AS-02 | Hoist pit, east mechanical room | Fireproofing | None Detected | N/A |
| AS-03 | Hoist pit, east mechanical room | Fireproofing | None Detected | N/A |
| AS-04 | West mechanical room | Pipe wrap | None Detected | N/A |
| AS-05 | West mechanical room | Pipe wrap | None Detected | N/A |
| AS-06 | West mechanical room | Pipe wrap | None Detected | N/A |
| AS-07 | West elevator shaft | Skim plaster | None Detected | N/A |

| Sample ID | Location | Material | Asbestos Type and Content | Friability |
|-----------|--|--------------|---------------------------|------------|
| AS-08 | West elevator shaft | Skim plaster | None Detected | N/A |
| AS-09 | West elevator shaft | Skim plaster | None Detected | N/A |
| AS-10 | West elevator shaft | Skim plaster | None Detected | N/A |
| AS-11 | West elevator shaft | Skim plaster | None Detected | N/A |
| AS-12 | West elevator shaft | Skim plaster | None Detected | N/A |
| AS-13 | West elevator shaft | Skim plaster | None Detected | N/A |
| AS-20 | 3 rd Floor, west elevator shaft | Base plaster | None Detected | N/A |
| AS-21 | 3 rd Floor, west elevator shaft | Base plaster | None Detected | N/A |
| AS-22 | 3 rd Floor, west elevator shaft | Base plaster | None Detected | N/A |
| AS-28 | Central elevator shaft | Skim plaster | None Detected | N/A |
| AS-29 | Central elevator shaft | Skim plaster | None Detected | N/A |
| AS-30 | Central elevator shaft | Skim plaster | None Detected | N/A |
| AS-31 | Central elevator shaft | Fireproofing | None Detected | N/A |
| AS-32 | Central elevator shaft | Fireproofing | None Detected | N/A |
| AS-33 | Central elevator shaft | Fireproofing | None Detected | N/A |
| AS-34 | Central elevator shaft | Fireproofing | None Detected | N/A |

| Sample ID | Location | Material | Asbestos Type and Content | Friability |
|-----------|------------------------|--------------|---------------------------|------------|
| AS-40 | Freight elevator shaft | Fireproofing | None Detected | N/A |
| AS-41 | Freight elevator shaft | Fireproofing | None Detected | N/A |
| AS-42 | Freight elevator shaft | Fireproofing | None Detected | N/A |
| AS-50 | East elevator shaft | Skim plaster | None Detected | N/A |
| AS-51 | East elevator shaft | Skim plaster | None Detected | N/A |
| AS-52 | East elevator shaft | Skim plaster | None Detected | N/A |
| AS-53 | East elevator shaft | Base plaster | None Detected | N/A |
| AS-54 | East elevator shaft | Base plaster | None Detected | N/A |
| AS-55 | East elevator shaft | Base plaster | None Detected | N/A |

N/A = Not Applicable

3.2.1 Friable Asbestos

No friable ACMs were identified within the surveyed sections of the subject building.

3.2.2 Non - Friable Asbestos

All elevator hoists within the subject building were in fully operable condition at the time of the Site visit. As a result mechanical parts within hoist machinery could not be sampled. It is suspected that asbestos will be present in hoist parts including, but not necessarily limited to, brake shoes. Hoists were observed to be in good condition and hoist parts are generally inaccessible; as a result any asbestos-containing materials present within hoists are assigned a Hazard Rank of 4 (low risk).

3.2.3 Hazard Assessment of Additional ACMs

The suspect ACMs identified throughout the subject building were found to be in good condition but with limited potential for significant damage during routine operations. As such, these materials are assigned a Hazard Rank of 4 (Low Risk).

3.3 Lead

One (1) sample of paint chips was collected from the subject building. The sample was analyzed to determine the lead concentration. With the exception of the location from which the paint sample from the east elevator shaft was collected, no peeling or flaking paint was observed at the time of the Site visit. The results are as follows:

Table 3 – Lead Sampling Locations and Laboratory Results

| Sample ID | Sample Location | Colour | Lead Concentration (% weight) |
|-----------|---------------------|--------|----------------------------------|
| Pb-01 | East elevator shaft | Yellow | 0.33 |

The peeling yellow paint observed within the east elevator shaft was found to contain a lead concentration of 0.33% (3,300 ppm) by weight, which exceeds the guideline of 600 ppm by weight set out by the Hazardous Products Act and is considered lead-based. Laboratory certificates of analysis for the paint samples are included in Appendix B. Visual observation indicates the presence of yellow paint in the central and west elevator shafts, paint in these shafts was generally observed to be well-bound to the substrate.

Lead may also be present in the following materials in the subject building:

Solder used in bell fittings for cast iron pipes; and,

Solder used in electrical equipment.

Lead in these additional materials is considered to be in a stable form and as such, is not expected to be of concern.

3.4 Mercury

Mercury is likely to be present in vapor form in the fluorescent light tubes found throughout the surveyed sections of the subject building. Approximately 15 mounted fluorescent light fixtures, each containing two (2) fluorescent tubes, were observed. Thermostats were found to be electrical (dry type) thermostats.

3.5 Silica

Silica is expected to be present in building materials such as concrete, brick and mortar.

3.6 Vinyl Chloride

Generally, vinyl chloride (monomer) is likely to be present in stable form within poly-vinyl-chloride (PVC) piping and conduits and as a component of interior finishes.

3.7 Acrylonitrile

Acrylonitrile may be present in stable form in paints and adhesives.

3.8 Arsenic

Arsenic or arsenic compounds may be present in stable form in paints and adhesives.

3.9 Benzene

Benzene may be present in stable form in roofing materials, paints, and adhesives located throughout the subject buildings. In addition, benzene may also be present in hydraulic oils found in machinery such as air compressors, machine gears and switches, etc.

3.10 Coke Oven Emissions

Based on what is known of the history of the subject building, it is not expected that coke oven emissions are of concern.

3.11 Ethylene Oxides

It is not expected that ethylene oxides are of concern with respect to the subject building.

3.12 Isocyanates

Isocyanate compounds may be present in stable form in paint finishes, varnishes, polyurethane plastics, synthetic rubbers, foams and adhesives.

3.13 Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls (PCBs) are typically found in fluorescent lamp ballasts, transformers and other electrical equipment containing insulating fluids.

3.13.1 Light Ballasts

The surveyed section of the subject building contained approximately 15 fluorescent light ballasts. The light fittings were reportedly installed post 1990 and the associated light ballasts are therefore unlikely to contain PCBs.

3.13.2 Transformers

During the survey the transformers observed within the subject building were found to be of the dry type and are not suspected to contain PCBs.

3.14 Ozone Depleting Substances (ODS)

No equipment suspected of containing CFCs and / or HCFCs was observed within elevator shafts and associated mechanical rooms at the time of the Site visit.

3.15 Radioactive Materials

No equipment suspected of containing radioactive materials was observed within elevator shafts and associated mechanical rooms at the time of the Site visit.

3.16 Mould

No mould damaged building materials or signs of water intrusion were observed within elevator shafts and associated mechanical rooms at the time of the Site visit.

Chapter 4 – Conclusions and Recommendations

4 Conclusions & Recommendations

On the basis of our walk-through examination of the building, representative sampling and laboratory analysis of suspected asbestos and lead containing materials, the following conclusions and recommendations are presented.

4.1 Additional ACMs Survey

4.1.1 Friable Asbestos

No friable ACMs were identified within the subject building.

4.1.2 Non - Friable Asbestos

No non-friable asbestos-containing building materials were identified within the elevator shafts and associated mechanical rooms.

It is suspected that asbestos may be present within mechanical parts of the hoists (e.g. brake shoes). Hoists were observed to be in good condition with low potential for significant damage during normal operations.

Exp recommends:

- *Elevator brake shoes and similar parts be assumed to be asbestos-containing unless shown otherwise through sampling and analysis. In the event of renovation activities that may result in disturbance of elevator hoists, hoist parts that may contain asbestos should be removed following Type 1 procedures and waste should be disposed off in accordance with O.Reg. 347.*

4.2 Lead

Yellow coloured peeling paint within the east elevator shaft was found to contain a lead concentration of 0.33% (3,300 ppm) by weight, which exceeds the guideline of 600 ppm by weight set out by the Hazardous Products Act.

Exp recommends:

- *Prior to any renovations activities within the east, west or central elevator shafts, lead-based paint shall be removed by following Type 2a or Type 3 operations as described in the guideline, "Lead on Construction Projects" issued by the Ministry of Labour, dated September 2004 and disposed of as lead waste;*
- *Paint chips that may fall into the elevator pits shall be removed by following Type 1 operations as described in the guideline, "Lead on Construction Projects" issued by the Ministry of Labour, dated September 2004 and disposed of as lead waste; and,*
- *Sub-trades working with or in close proximity to lead-based paint should be informed of its presence.*

4.3 Mercury

Mercury vapours within fluorescent light tubes pose no risk to workers or occupants provided the fluorescent light tubes remain intact and undisturbed. Prior to any remediation or demolition activities that may disturb the fluorescent light tubes, all mercury containing devices must be removed and stored in a safe, secure location or disposed of following the requirements of Ontario Regulation 844/90.

- *Prior to renovation or demolition activities that may disturb fluorescent light tubes, mercury-containing equipment shall be removed and recycled by a licensed contractor.*

4.4 Silica

Precautions should be taken as required during renovation or demolition projects on concrete (i.e. coring through concrete slabs, demolition of masonry, etc.) to ensure that workers' exposure levels to silica does not exceed 0.05 mg/m³. This can be achieved by:

- *providing the workers with respiratory protection;*
- *wetting the surface of the materials to prevent dust emissions; and,*
- *Providing workers with facilities to properly wash prior to exiting the work area.*
- *Renovation or demolition work that is likely to impact silica-containing materials should be carried out in accordance with the requirements detailed in the Ontario Ministry of Labour document entitled "Guideline: Silica on Construction Projects", dated September 2004.*

4.5 Other Designated Substances

Other Designated Substances (acrylonitrile, arsenic, coke oven emissions, ethylene oxide, isocyanates, benzene or vinyl chloride) are either not expected to be present, expected to be present in stable form, or not expected to be present in the building in sufficient quantities to cause an exceedence of Ministry of Labour exposure guidelines.

4.6 Polychlorinated Biphenyls (PCBs)

The elevator shafts and associated mechanical rooms contained approximately 15 fluorescent light ballasts. The light fittings are of modern type and are considered unlikely to contain PCBs.

- *Prior to renovation or demolition activities that may disturb fluorescent light fittings, ballasts shall be removed from their fixtures and inspected to determine the presence of PCBs; and,*
- *Ballasts identified as PCB-containing, "likely" to contain PCBs, or not legible shall be treated as PCB-containing and disposed of as PCB waste by a licensed contractor.*

4.7 Ozone Depleting Substances (ODS)

Exp did not observe the presence of any equipment suspected of containing ODS within the elevator shafts or associated mechanical rooms.

- *Prior to renovation or demolition activities, equipment containing or suspected to contain ODS must be assessed and decommissioned by a licensed contractor such that ozone depleting substances are contained and not released to the environment.*

4.8 Radioactive Materials

Exp did not observe the presence of any equipment suspected of containing radioactive materials within the elevator shafts or associated mechanical rooms.

- *Prior to renovation or demolition activities, equipment containing radioactive materials or suspected of containing radioactive materials must be removed by a qualified firm*

(transportation/disposal) with the appropriate level of protection in accordance with applicable Regulations and Guidelines, including the Transportation of Dangerous Goods Act (TDGA); and,

- *The materials should be returned to the manufacturer where possible.*

4.9 Mould

Mould damaged building materials or signs of water intrusion were not observed during the survey.

Chapter 5 – General Limitations

5 General Limitations

The services performed and outlined herein were based in part, upon visual observations of the building and attendant structures. Our opinion cannot be extended to portions of the building that were unavailable for direct observation by objects or coverings at the time of our site visit.

Any of our observations relating to hazardous and toxic materials and asbestos in the environment at the building are described in this report. Where testing was performed, it was executed in accordance with our contract for these services. It should be noted that other compounds or materials not tested for may be present in the environment.

The objective of this report was to audit the environmental conditions at the building within the context of our contract with respect to existing Regulations and Guidelines within the applicable jurisdiction. Compliance of past and current owners with applicable local, provincial and federal government laws and regulations was not included in our contract for services.

The conclusions of this report are based, in part, on the information provided by others and any testing and analyses described in the report. The possibility remains that unexpected environmental conditions may be encountered at the building in locations not explored. Should such an event occur, **exp** should be notified in order that we may determine if modifications to our conclusions are necessary.

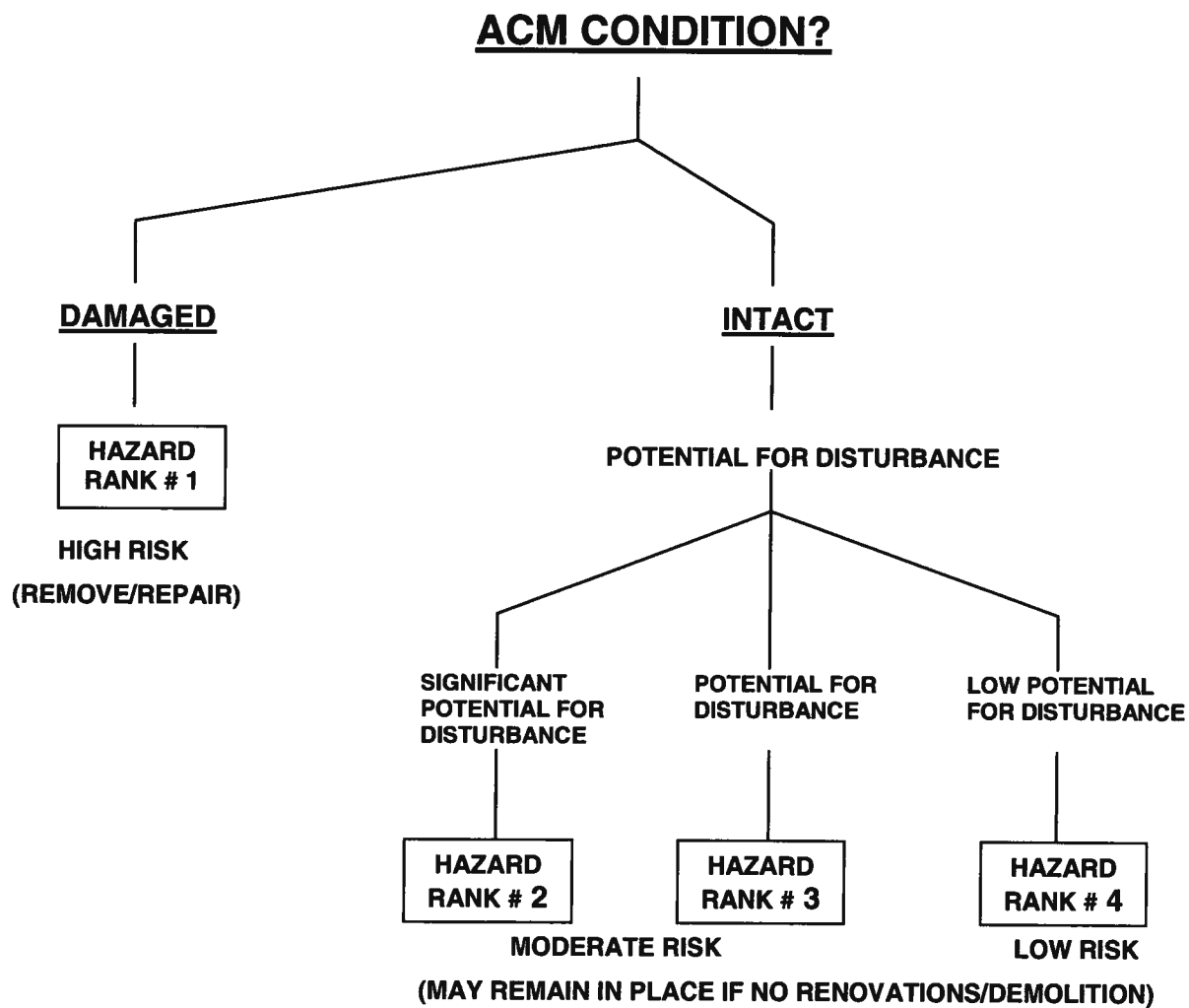
This report has been prepared in accordance with generally accepted environmental study and/or engineering practices. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.

This report has been prepared for the exclusive use of the SNC Lavalin in accordance with accepted environmental study and/or engineering practices for a Designated Substances Survey. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of the Survey and included in this report. Any use which a third party makes of this report, or any part hereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Exp** Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust the above report meets with your approval. Should you have any questions, please do not hesitate to contact us.

Appendix A – Hazard Ranking Decision Tree

**CLASSIFICATION FOR ASBESTOS HAZARD POTENTIAL
(DECISION TREE DISPLAY)**



Appendix B – Laboratory Analytical Results



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8

Phone/Fax: 289-997-4602 / (289) 997-4607

http://www.emsl.com / torontolab@emsl.com

EMSL Canada Order 551202768
Customer ID: 55TROW78
Customer PO:
Project ID:

Attn: Bob Jowett
exp Services Inc
561 Bryne Drive
Unit D
Barrie, ON L4N 9Y3

Phone: (703) 734-6222
Fax: (703) 734-6224
Collected:
Received: 6/22/2012
Analyzed: 6/25/2012

Proj: 1 FRONT STREET

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

| | | | | | | |
|---|---------------|--------------------|-------------------------------|-------------|---------------|---------|
| Client Sample ID: AS01 | | | Lab Sample ID: 551202768-0001 | | | |
| Sample Description: EAST MECHANICAL ROOM/FIREPROOFING | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |
| Client Sample ID: AS02 | | | Lab Sample ID: 551202768-0002 | | | |
| Sample Description: EAST MECHANICAL ROOM/FIREPROOFING | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |
| Client Sample ID: AS03 | | | Lab Sample ID: 551202768-0003 | | | |
| Sample Description: EAST MECHANICAL ROOM/FIREPROOFING | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |
| Client Sample ID: AS04 | | | Lab Sample ID: 551202768-0004 | | | |
| Sample Description: WEST MECHANICAL ROOM/PIPE WRAP | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 60% | 40% | None Detected | |
| Client Sample ID: AS05 | | | Lab Sample ID: 551202768-0005 | | | |
| Sample Description: WEST MECHANICAL ROOM/PIPE WRAP | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 60% | 40% | None Detected | |
| Client Sample ID: AS06 | | | Lab Sample ID: 551202768-0006 | | | |
| Sample Description: WEST MECHANICAL ROOM/PIPE WRAP | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 20% | 80% | None Detected | |
| Client Sample ID: AS07 | | | Lab Sample ID: 551202768-0007 | | | |
| Sample Description: WEST ELEVATOR SHAFT/SKIM PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray/White/Various | 0% | 100% | None Detected | |



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.emsl.com / torontolab@emsl.com

EMSL Canada Order 551202768
Customer ID: 55TROW78
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

| Client Sample ID: AS08 | | Lab Sample ID: 551202768-0008 | | | | |
|---|------------------|--------------------------------------|--------------|-------------|---------------|---------|
| Sample Description: WEST ELEVATOR SHAFT/SKIM PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray/White | 0% | 100% | None Detected | |
| Client Sample ID: AS09 | | Lab Sample ID: 551202768-0009 | | | | |
| Sample Description: WEST ELEVATOR SHAFT/SKIM PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray/White/Various | 0% | 100% | None Detected | |
| Client Sample ID: AS10 | | Lab Sample ID: 551202768-0010 | | | | |
| Sample Description: WEST ELEVATOR SHAFT/SKIM PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 0% | 100% | None Detected | |
| Client Sample ID: AS11 | | Lab Sample ID: 551202768-0011 | | | | |
| Sample Description: WEST ELEVATOR SHAFT/SKIM PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 0% | 100% | None Detected | |
| Client Sample ID: AS12 | | Lab Sample ID: 551202768-0012 | | | | |
| Sample Description: WEST ELEVATOR SHAFT/SKIM PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray/White/Various | 0% | 100% | None Detected | |
| Client Sample ID: AS13 | | Lab Sample ID: 551202768-0013 | | | | |
| Sample Description: WEST ELEVATOR SHAFT/SKIM PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 0% | 100% | None Detected | |
| Client Sample ID: AS20 | | Lab Sample ID: 551202768-0014 | | | | |
| Sample Description: 3RD FLOOR WEST ELEVATOR SHAFT/BASE PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray | 0% | 100% | None Detected | |
| Client Sample ID: AS21 | | Lab Sample ID: 551202768-0015 | | | | |
| Sample Description: 3RD FLOOR WEST ELEVATOR SHAFT/BASE PLASTER | | | | | | |
| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray | 0% | 100% | None Detected | |



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
Phone/Fax: 289-997-4602 / (289) 997-4607
<http://www.emsl.com / torontolab@emsl.com>

EMSL Canada Order 551202768
Customer ID: 55TROW78
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: AS22 **Lab Sample ID:** 551202768-0016
Sample Description: 3RD FLOOR WEST ELEVATOR SHAFT/BASE PLASTER

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|-------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray | 0% | 100% | None Detected | |

Client Sample ID: AS28 **Lab Sample ID:** 551202768-0017
Sample Description: CENTRAL ELEVATOR SHAFT/SKIM PLASTER

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|---------------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 0% | 100% | None Detected | |

Client Sample ID: AS29 **Lab Sample ID:** 551202768-0018
Sample Description: CENTRAL ELEVATOR SHAFT/SKIM PLASTER

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|---------------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 0% | 100% | None Detected | |

Client Sample ID: AS30 **Lab Sample ID:** 551202768-0019
Sample Description: CENTRAL ELEVATOR SHAFT/SKIM PLASTER

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|---------------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White/Various | 0% | 100% | None Detected | |

Client Sample ID: AS31 **Lab Sample ID:** 551202768-0020
Sample Description: CENTRAL ELEVATOR SHAFT/FIREPROOFING

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|-------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |

Client Sample ID: AS32 **Lab Sample ID:** 551202768-0021
Sample Description: CENTRAL ELEVATOR SHAFT/FIREPROOFING

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|-------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 0% | 100% | None Detected | |

Client Sample ID: AS33 **Lab Sample ID:** 551202768-0022
Sample Description: CENTRAL ELEVATOR SHAFT/FIREPROOFING

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|-------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |

Client Sample ID: AS34 **Lab Sample ID:** 551202768-0023
Sample Description: CENTRAL ELEVATOR SHAFT/FIREPROOFING

| TEST | Analyzed | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------|-------|--------------|-------------|---------------|---------|
| | Date | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
Phone/Fax: 289-997-4602 / (289) 997-4607
http://www.emsl.com / torontolab@emsl.com

EMSL Canada Order 551202768
Customer ID: 55TROW78
Customer PO:
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: AS40 Lab Sample ID: 551202768-0024

Sample Description: FREIGHT ELEVATOR SHAFT/FIREPROOFING

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|-------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |

Client Sample ID: AS41

Lab Sample ID: 551202768-0025

Sample Description: FREIGHT ELEVATOR SHAFT/FIREPROOFING

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|-------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 0% | 100% | None Detected | |

Client Sample ID: AS42

Lab Sample ID: 551202768-0026

Sample Description: FREIGHT ELEVATOR SHAFT/FIREPROOFING

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|-------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | White | 90% | 10% | None Detected | |

Client Sample ID: AS50

Lab Sample ID: 551202768-0027

Sample Description: EAST ELEVATOR SHAFT/SKIM PLASTER

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|--------------------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray/White/Various | 0% | 100% | None Detected | |

Client Sample ID: AS51

Lab Sample ID: 551202768-0028

Sample Description: EAST ELEVATOR SHAFT/SKIM PLASTER

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|--------------------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray/White/Various | 0% | 100% | None Detected | |

Client Sample ID: AS52

Lab Sample ID: 551202768-0029

Sample Description: EAST ELEVATOR SHAFT/SKIM PLASTER

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|-------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | | 0% | 100% | None Detected | |

Client Sample ID: AS53

Lab Sample ID: 551202768-0030

Sample Description: EAST ELEVATOR SHAFT/BASE PLASTER

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|-------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray | 0% | 100% | None Detected | |

Client Sample ID: AS54

Lab Sample ID: 551202768-0031

Sample Description: EAST ELEVATOR SHAFT/BASE PLASTER

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|-------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Gray | 0% | 100% | None Detected | |



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
Phone/Fax: 289-997-4602 / (289) 997-4607
<http://www.emsl.com> / torontolab@emsl.com

EMSL Canada Order 551202768
Customer ID: 55TROW78
Customer PO:
Project ID:

Attn: Bob Jowett
exp Services Inc
561 Bryne Drive
Unit D
Barrie, ON L4N 9Y3

Phone: (703) 734-6222
Fax: (703) 734-6224
Collected:
Received: 6/22/2012
Analyzed: 6/25/2012

Proj: 1 FRONT STREET

Client Sample ID: AS55

Lab Sample ID: 551202768-0032

Sample Description: EAST ELEVATOR SHAFT/BASE PLASTER

| TEST | Analyzed Date | Color | Non-Asbestos | | Asbestos | Comment |
|------|------------------|-----------|--------------|-------------|---------------|---------|
| | | | Fibrous | Non-Fibrous | | |
| PLM | 06/25/2012 | Tan/White | 0% | 100% | None Detected | |



EMSL Canada Inc.

10 Falconer Drive, Unit #3 Mississauga, ON L5N 3L8
Phone/Fax: 289-997-4602 / (289) 997-4607
<http://www.emsl.com> / torontolab@emsl.com

EMSL Canada Order 551202768
Customer ID: 55TROW78
Customer PO:
Project ID:

Attn: Bob Jowett
exp Services Inc
561 Bryne Drive
Unit D
Barrie, ON L4N 9Y3
Proj: 1 FRONT STREET

Phone: (703) 734-6222
Fax: (703) 734-6224
Collected:
Received: 6/22/2012
Analyzed: 6/25/2012

The samples in this report were submitted for asbestos bulk analysis. The reference number for these samples is the Order ID above. Please use this reference number when calling about these samples.

Sample Receipt Date: 06/22/2012

Sample Receipt Time: 10:29 am

Analysis Completed Date: 06/25/2012

Analysis Completed Time: 5:45 pm

Analyst(s):

Lisa Podzyhun PLM (21)

Matthew Davis PLM (11)

Reviewed and approved by:

Kevin Pang
or Other Approved Signatory

None Detected = <0.5%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

**EMSL Canada Inc.**

10 Falconer Drive, Unit #3, Mississauga, ON L5N 3L8

Phone/Fax: 289-997-4602 / (289) 997-4607

<http://www.emsl.com>torontolab@emsl.com

EMSL Canada Or 551202774

CustomerID: 55TROW78

CustomerPO:

ProjectID:

Attn: **Bob Jowett**
exp Services Inc
561 Bryne Drive
Unit D
Barrie, ON L4N 9Y3

Phone: (703) 734-6222
Fax: (703) 734-6224
Received: 06/22/12 10:29 AM
Collected: 6/19/2012

Project: 1 FRONT STREET

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B*/7000B)

| <i>Client Sample Description</i> | <i>Lab ID</i> | <i>Collected</i> | <i>Analyzed</i> | <i>Lead Concentration</i> |
|----------------------------------|---------------|------------------|-----------------|---------------------------|
| PB-01 | 0001 | 6/19/2012 | 6/25/2012 | 0.33 % wt |
| Site: EAST ELEVATOR SHAFT | | | | |

Kevin Pang
or other approved signatory

Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. The QC data associated with these results included in this report meet the method QC requirements, unless specifically indicated otherwise. Unless noted, results in this report are not blank corrected. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. * slight modifications to methods applied. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

**Appendix C –
Asbestos Location & Quantity Table (Asbestos only)**

| East Elevator Mechanical Room | Type of Material | Asbestos Content | Approximate Quantity | Type of Removal |
|--------------------------------------|-------------------------|-------------------------|-----------------------------|--|
| Elevator hoists (2) | Brake shoes | Suspect ACM | 20 sq. ft. | Type 1 or Type 2. (Depends on the Method of Removal) |

| Central Elevator Mechanical Room | Type of Material | Asbestos Content | Approximate Quantity | Type of Removal |
|---|-------------------------|-------------------------|-----------------------------|--|
| Elevator hoists (3) | Brake shoes | Suspect ACM | 20 sq. ft. | Type 1 or Type 2. (Depends on the Method of Removal) |

| West Elevator Mechanical Room | Type of Material | Asbestos Content | Approximate Quantity | Type of Removal |
|--------------------------------------|-------------------------|-------------------------|-----------------------------|--|
| Elevator hoists (2) | Brake shoes | Suspect ACM | 20 sq. ft. | Type 1 or Type 2. (Depends on the Method of Removal) |

| Freight Elevator Mechanical Room | Type of Material | Asbestos Content | Approximate Quantity | Type of Removal |
|---|-------------------------|-------------------------|-----------------------------|--|
| Elevator hoist | Brake shoes | Suspect ACM | 20 sq. ft. | Type 1 or Type 2. (Depends on the Method of Removal) |

List of Distribution

Report Distributed To:

SNC Lavalin O & M
1 Front Street West,
Toronto, Ontario
M5J 2X5

Attention: Mr. David Wiebe
David.Wiebe@snclavalinom.com