

SPECIFICATION

Cobourg Search and Rescue Station

Department of Fisheries and Oceans Canada

Cobourg, Ontario

Issued for Tender

17 December 2020

PSPC Project No. R.084112.005

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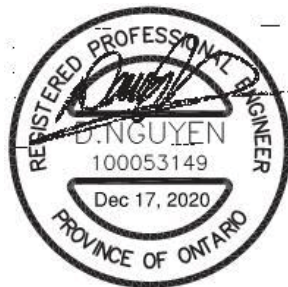


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Refer to next page for M&E seals.

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COBOURG SEARCH AND RESCUE STATION

114 DIVISION STREET

COBOURG (ONTARIO)

K9A 0B3

**PWGSC ONTARIO
REGION PROJECT
NUMBER R.084112.005**

DIVISIONS 10, 21, 22, 23, 26, 27 AND 28

**Issued for Tender
December 17, 2020**

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END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Cobourg Search and Rescue. New two storey, wood frame residence building and offices with an attached steel framed garage. Residence portion of the building is built to Passive House standards. Work includes a 12 m tall free standing antenna.
- .2 Demolition of existing Cobourg Search and Rescue buildings.
- .3 Contractor has full use of the premise.

1.2 PRECEDENCE

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

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises demolition of the existing Coast Guard Station and related outbuildings and general construction of a replacement Coast Guard Station, located at 114 Division Street, Cobourg, ON.

1.4 CONTRACT METHOD

- .1 Construct work under lump sum contract.

1.5 COST BREAKDOWN

- .1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating Contract Amount.
 - .1 For Section 02 85 00.01, 02 85 00.03, submit prices for each line item for the unit of measure specified.
- .2 Within 48 hours of acceptance of bid submit a list of subcontractors.

1.6 WORK SEQUENCE

- .1 Required stages:
 - .1 Installation of temporary Coast Guard Search & Rescue trailer including antenna install. Antenna install by Departmental Representative.
 - .2 Demolition of existing station.
 - .3 Construction of new station.
 - .4 Occupancy of new station
- .2 Maintain fire access/control.

1.7 CONTRACTOR USE OF PREMISES

- .1 Contractor shall limit use of premises for Work, for storage, and for access, to allow;

- .1 Departmental Representative occupancy of outbuilding on pier for storage.
- .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.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Scheduled preconstruction, and progress meetings.

1.2 DESCRIPTION

- .1 Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, under instructions of Departmental Representative.

1.3 PROJECT MEETINGS

- .1 Schedule and administer bi-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 and Departmental Representative.

1.5 CONSTRUCTION ORGANIZATION AND START-UP

- .1 Within 15 days after Award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of the 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 00.
 - .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 Record drawings in accordance with Section 01 78 00.
 - .9 Maintenance in accordance with Section 01 78 00.
 - .10 Commissioning in accordance with Section 01 91 00.
 - .11 Take-over procedures, acceptance, and warranties in accordance with Section 01 77 00 and 01 78 00.
 - .12 Monthly progress claims, administrative procedures, photographs, and holdbacks (GC).
 - .13 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00.
 - .14 Insurances and transcript of policies (GC).
- .5 Comply with Departmental Representative's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- .6 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.
- .7 Comply with instructions of Departmental Representative for use of temporary utilities and construction facilities.
- .8 Coordinate field engineering and layout work with Departmental Representative.

1.6 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.

1.7 SCHEDULES

- .1 Submit preliminary construction progress schedule in accordance with Section 01 32 00 and Commissioning Schedule in accordance with Section 01 91 00 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.

1.8 COMMISSIONING MEETINGS

- .1 Schedule separate commissioning meetings in accordance with Section 01 91 00.

1.9 SUBMITTALS

- .1 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 and 01 91 00 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.
- .2 Submit requests for payment for review, and for transmittal to Departmental Representative.
- .3 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
- .4 Process substitutions through Departmental Representative.
- .5 Process change orders through Departmental Representative.
- .6 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative.

1.10 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.

1.11 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 Departmental Representative-occupied areas.

- .4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

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 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 4 days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Unless directed otherwise by Departmental Representative, record minutes of meetings. Minutes shall be circulated to attending parties and affected parties not in attendance within 3 days after meeting.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 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.
 - .5 Site security in accordance with Sections 01 56 00.
 - .6 Health and safety in accordance with Section 01 35 29.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Departmental Representative provided products.
 - .9 Record drawings and specifications in accordance with Sections 01 33 00 and 01 78 00.

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

1.3 PROGRESS MEETINGS

- .1 During course of Work and 4 weeks prior to project completion, schedule progress meetings monthly.
- .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

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

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

1.2 REQUIREMENTS

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

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

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit to Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.
 - .1 Excavation completed within 20 working days of Award of Contract date.
 - .2 Substructure completed within 40 working days of Award of Contract date.
 - .3 Superstructure completed within 60 working days of Award of Contract date.
 - .4 Building closed-in and weatherproofed within 80 working days of Award of Contract date.
 - .5 Interior finishing and fitting, mechanical, and electrical work completed within 150 working days of Award of Contract date.
 - .6 Certificate of Substantial Performance within 160 working days of Award of Contract date.

1.5 MASTER PLAN

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

1.6 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.

- .4 Mobilization.
- .5 Excavation.
- .6 Backfill.
- .7 Building footings.
- .8 Slab on grade.
- .9 Structural Steel.
- .10 Siding and Roofing.
- .11 Interior Architecture (Walls, Floors and Ceiling).
- .12 Plumbing.
- .13 Lighting.
- .14 Electrical.
- .15 Piping.
- .16 Controls.
- .17 Heating, Ventilating, and Air Conditioning.
- .18 Millwork.
- .19 Fire Systems.
- .20 Testing and Commissioning.
- .21 Supplied equipment long delivery items.
- .22 Departmental Representative supplied equipment required dates.
 - .1 Antenna.
 - .2 Fridge.
 - .3 Dishwasher.
 - .4 Washer and dryer.
 - .5 Boot Dryer Rack.
 - .6 Microwave
 - .7 Range

1.7 PROJECT SCHEDULE REPORTING

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

1.8 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings 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.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

PWGSC Ontario	CONSTRUCTION PROGRESS	Section 01 32 16
Region Project	SCHEDULE - BAR (GANTT)	Page 4
Number R.084112.005	CHART	2020-12-17

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 files. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel, MS Project and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

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

- .9 After Departmental Representative's review, distribute copies.
- .10 Submit 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 copy of colour digital photography in jpg format, fine 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: 4 locations.
 - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly.
 - .1 Upon completion of: excavation, foundation, framing and services before concealment, of Work, and as directed by Departmental Representative.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workplace Safety and Insurance Board Experience Report.
- .2 Submit transcription of insurance immediately after Award of Contract.

1.7 FEES, PERMITS AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required. Note that a building permit is not 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 Safety Authority (ESA).

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA): Canada
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 National Building Code 2015 (NBC):
 - .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .3 National Fire Code 2015 (NFC):
 - .1 NFC 2015, 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.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit 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 operation found in work plan.
 - .3 Measures and controls to be implemented to address identified safety hazards and risks.
- .3 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Building Emergency Response requirements and procedures provided by Departmental Representative.
- .4 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

- .5 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.
- .6 Submit names of personnel and alternates responsible for site safety and health.
- .7 Submit records of Contractor's Health and Safety meetings when requested.
- .8 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly.
- .9 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .10 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .11 Submit copies of incident and accident reports.
- .12 Submit Safety Data Sheets (SDS).
- .13 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.

1.3 FILING OF NOTICE

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

1.4 WORK PERMIT

- .1 Obtain permits related to project prior to commencement of Work.
- .2 A building permit is not required for this project.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

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

1.7 REGULATORY REQUIREMENTS

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

1.8 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Silica in concrete.
 - .2 Mercury in fluorescent light tubes and thermostats.
 - .3 Asbestos in vermiculite insulation, vinyl composition tiles, and adhesives.
 - .4 Lead in paint, electrical equipment.
 - .5 Mould.

1.9 GENERAL REQUIREMENTS

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

1.10 COMPLIANCE REQUIREMENTS

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

1.11 RESPONSIBILITY

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

1.14 CORRECTION OF NON-COMPLIANCE

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

1.15 POWDER ACTUATED DEVICES

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

1.16 WORK STOPPAGE

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not used.

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HEALTH AND SAFETY
REQUIREMENTS

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PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.2 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005-92, Storm Water Management for Construction Activities, Chapter 3.
 - .2 EPA General Construction Permit (GCP) 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS SDS.
- .3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Departmental Representative.
- .4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring

- and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations and EPA 832/R-92-005, Chapter 3.
- .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
 - .1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
 - .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
 - .9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
 - .12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
 - .13 Waste Water Management Plan identifying methods and procedures for management and or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
 - .14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
 - .15 Pesticide treatment plan to be included and updated, as required.

1.4 FIRES

- .1 Fires and burning of rubbish on site are not permitted.

1.5 DRAINAGE

- .1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations, EPA 832/R-92-005, Chapter 3 US EPA

General Construction Permit.

- .2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.6 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Departmental Representative.
- .6 Refer to Arborist Report for tree protection.

1.7 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Use waterway beds for borrow material only after written receipt of approval from Departmental Representative.
- .3 Waterways to be kept free of excavated fill, waste material and debris.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Blasting is allowed only above water and 100 m minimum from indicated spawning beds.

1.8 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where indicated directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.9 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

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 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.

- .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .5 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.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2015, National Fire Code of Canada (NFC) 2015 and Ontario Building Code (OBC) 2012, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply as directed by the Departmental Representative.
- .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 and CSA B651-18.

1.5 ACCESSIBLE DESIGN

- .1 Comply with CSA B651-18, 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.
- .2 Conduct concrete floor moisture testing using Calcium Chloride moisture tests.
 - .1 Submit test results to Departmental Representative for approval prior to installing any flooring. Conduct one test per 100 m2 of area being covered.

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 ABBREVIATIONS AND ACRONYMS

- .1 The abbreviations and acronyms are commonly found in the Project Manual and represent the associated organizations or terms.

1.2 MATERIALS, EQUIPMENT AND METHODS

- .1 A:
- .1 AB: anchor bolt.
 - .2 AC: acoustic.
 - .3 AC PAN: acoustic panel.
 - .4 ACU: acoustic unit ceiling.
 - .5 AFF: above finished floor.
 - .6 AC PLAS: acoustic plaster.
 - .7 ACT: acoustic tile.
 - .8 ACR CU LVR: acrylic cube louvre.
 - .9 ADH: adhesive.
 - .10 ADJ: adjustable.
 - .11 A/C: air conditioner.
 - .12 AHU: air handling unit.
 - .13 AL: aluminum.
 - .14 ANOD: anodized.
 - .15 APPROX: approximate.
 - .16 ARCH: architecture.
 - .17 ARCH BLK: architectural block.
 - .18 AVB: air vapour barrier.
- .2 B:
- .1 B: base.
 - .2 BEAST: benthic assessment of sediment.
 - .3 BH: bore hole.
 - .4 BHP: brake horse power.
 - .5 BL: bottom layer.
 - .6 BLK: block.
 - .7 BLKD: bulkhead.
 - .8 BM: beam.
 - .9 BOT: bottom.
 - .10 BMP: best management practice.
 - .11 B PL: base plate.
 - .12 BRG: bearing.
 - .13 BRK: brick.
 - .14 BSMT: basement.
 - .15 BTEX: benzene, toluene, ethylbenzene and xylenes.
 - .16 BUR: built-up roof.
- .3 C:
- .1 CAL: caliper.
 - .2 CANTIL: cantilever.
 - .3 CB: catch basin.
 - .4 CC: centre to centre.

- .5 CCN: contemplated change notice.
 - .6 CDF: controlled density fill.
 - .7 CEC: Canadian Electrical Code.
 - .8 CF: chair fabric.
 - .9 CHAN: channel.
 - .10 CHS: Canadian hydrographic service.
 - .11 CJ: construction joint.
 - .12 CL: centreline.
 - .13 CK: cork.
 - .14 CLG: ceiling.
 - .15 CLR: clear.
 - .16 COL: column.
 - .17 CONC: concrete.
 - .18 CONC BLK: concrete block.
 - .19 CONC BRK: concrete brick.
 - .20 CONT: continuous.
 - .21 CONT J: control joint.
 - .22 COMPL: complete.
 - .23 CM: centimetre. (Nursery stock).
 - .24 CP: circulating pump.
 - .25 CPL: cement plaster.
 - .26 CPM: critical path method.
 - .27 CPT: carpet.
 - .28 CPTT: carpet tile.
 - .29 CT: ceramic tile.
 - .30 CTE: connect to existing.
 - .31 CV: control valve.
 - .32 CVT: conductive vinyl tile.
 - .33 C/W: complete with.
- .4 D:
- .1 D: deep.
 - .2 dB: decibels.
 - .3 DB: dry-bulb.
 - .4 DD: dutch door.
 - .5 DEG: degree.
 - .6 DF: drinking fountain.
 - .7 DIA: diameter.
 - .8 DIM: dimension.
 - .9 DL: dead load.
 - .10 DMNT: demountable.
 - .11 DP: dampproofing.
 - .12 DR: door.
 - .13 DRP: drapery.
 - .14 DWL: dowel.
- .5 E:
- .1 EA: each.
 - .2 EC: epoxy coating.
 - .3 ECF: engineered containment facility.
 - .4 EE: each end.
 - .5 EF: each face (architectural/structural).
 - .6 EF: exhaust fan (mechanical/electrical).

- .7 EL: elevation.
 - .8 ELEC: electric.
 - .9 ELEV: elevator.
 - .10 EM: expanded metal.
 - .11 ENCL: enclosure.
 - .12 EQ: equal.
 - .13 ET: expansion tank.
 - .14 EXH: exhaust.
 - .15 EXIST: existing.
 - .16 EXPJ: expansion joint.
 - .17 EXP STRUCT: exposed structure.
 - .18 EXT: exterior.
 - .19 EW: each way.
 - .20 EWT: entering water temperature.
- .6 F:
- .1 FC: fuel contributed.
 - .2 FD: floor drain.
 - .3 FDN: foundation.
 - .4 FEAT W: feature wall.
 - .5 FEXT: fire extinguisher.
 - .6 FH: fire hose.
 - .7 FHC: fire hose cabinet.
 - .8 FHR: fire hose rack.
 - .9 FIN: finish.
 - .10 FIP: federal identity program.
 - .11 FL: floor.
 - .12 FLD: field.
 - .13 FLUOR: fluorescent.
 - .14 FR: frame.
 - .15 FRR: fire resistance rating.
 - .16 FTG: footing.
- .7 G:
- .1 GALV: galvanized steel.
 - .2 GB: grab bar.
 - .3 GBD: gypsum board.
 - .4 GC: General Conditions.
 - .5 GF: ground floor.
 - .6 GFCI: ground fault circuit interrupter.
 - .7 GL: glass or glazing.
 - .8 GL BLK: glass block.
 - .9 GPC: gypsum plaster ceiling.
 - .10 GPW: gypsum plaster wall.
 - .11 GT: glass tile.
- .8 H:
- .1 HB: hose bib.
 - .2 HC: hollow core.
 - .3 HCWD: hollow core wood door.
 - .4 HD: hand dryer.
 - .5 HDW: hardware.
 - .6 HDWD: hardwood.

- .7 HEX: heat exchanger.
 - .8 HM: hollow metal.
 - .9 HOR: horizontal.
 - .10 HOR EF: horizontal each face.
 - .11 HP: hydro pole.
 - .12 HPA: Hamilton Port Authority.
 - .13 HR: hour.
 - .14 HRV: heat recovery ventilator.
 - .15 HT: height.
 - .16 HTR: heater.
 - .17 HUM: humidifier.
 - .18 HWT: hot water tank.
 - .19 HYD: hydrant.
 - .20 HZ: Hertz frequency, cycles per second.
- .9 I:
- .1 ICF: insulated concrete formwork.
 - .2 ID: inside diameter.
 - .3 INS: insulation.
 - .4 INTLK: interlock.
 - .5 ITG: insulated translucent fiberglass sandwich panel wall system
- .10 J:
- .1 JT: joint.
- .11 K:
- .1 KPL: kick plate.
- .12 L:
- .1 LAT: leaving air temperature.
 - .2 LAV: lavatory.
 - .3 LDG: landing.
 - .4 LG: long.
 - .5 LINO: linoleum.
 - .6 LL: live load.
 - .7 LT: light.
 - .8 LWT: leaving water temperature.
- .13 M:
- .1 MAS: masonry.
 - .2 MAS FL: masonry flashing.
 - .3 MAX: maximum.
 - .4 MBG: metal bar grating.
 - .5 MCL: metal cube louvre
 - .6 MDF: medium density fibreboard
 - .7 MECH: mechanical.
 - .8 MET: metal.
 - .9 MET DK: metal deck.
 - .10 MET FL: metal flashing.
 - .11 MET GRID CLG: metal grid ceiling.
 - .12 MET GRTG: metal grating.
 - .13 MET LIN CLG: metal linear ceiling.
 - .14 MET T PTN: metal toilet partition.

- .15 MH: maintenance hole.
- .16 MIN: minimum.
- .17 MLP: metal lath and plaster.
- .18 MO: masonry opening.
- .19 MR: marble.
- .20 MT: metal threshold.
- .21 MWP: membrane waterproofing.

- .14 N:
 - .1 NBC: national building code.
 - .2 NC: normally closed.
 - .3 NF: near face.
 - .4 NFC: national fire code.
 - .5 NIC: not in contract.
 - .6 NO: number.
 - .7 NRC: noise reduction coefficient.
 - .8 NRP: non removable pin.
 - .9 NTS: not to scale.

- .15 O:
 - .1 OA: outside air.
 - .2 OBC: Ontario building code.
 - .3 OC: on centre.
 - .4 OD: outside diameter.
 - .5 OPNG: opening.
 - .6 OPR: operator
 - .7 OSB: oriented strand board
 - .8 OVHD: overhead.
 - .9 OWSJ: open web steel joist.

- .16 P:
 - .1 P: prefinished.
 - .2 PAH: polynuclear aromatic hydrocarbons.
 - .3 PARG: parging.
 - .4 PCC: precast concrete.
 - .5 PCT: porcelain ceramic tile.
 - .6 PED ACS FLG: pedestal access flooring.
 - .7 PF: panel fabric.
 - .8 PH: phase.
 - .9 PL: plate.
 - .10 PLAM: plastic laminate.
 - .11 PLAS: plaster.
 - .12 PLYWD: plywood.
 - .13 PR: pair.
 - .14 PREFAB: prefabricated.
 - .15 PREFIN: prefinished.
 - .16 PRESS: pressure.
 - .17 PRFL: profile.
 - .18 PRV: pressure regulating valve.
 - .19 PT: paint.
 - .20 PTD: paper towel dispenser.
 - .21 PTN: partition.
 - .22 PVC: polyvinyl cholide.

- .17 Q:
- .1 QTB: quarry tile base.
 - .2 QTF: quarry tile floor.
 - .3 QTR: quarry tile roof.
- .18 R:
- .1 R: radius.
 - .2 RA: return air.
 - .3 RAD: return air damper.
 - .4 RB: resilient base.
 - .5 RC: reinforced concrete.
 - .6 RCPT: receptacle.
 - .7 RD: roof drain.
 - .8 REINF: reinforced/reinforcing.
 - .9 REQD: required.
 - .10 REQT: requirement.
 - .11 RFT: rubber floor tile.
 - .12 RM: room.
 - .13 RO: rough opening.
 - .14 RP: radiant panel.
 - .15 RRS: recycled rubber sheet.
 - .16 RRT: recycled rubber tile.
 - .17 RSD: rolling steel door.
 - .18 RSF: rubber sheet flooring.
 - .19 RT: rubber tile.
 - .20 RTU: roof top unit.
 - .21 RWL: rain water leader.
- .19 S:
- .1 SA: supply air.
 - .2 SAN SEW: sanitary sewer.
 - .3 SCHED: schedule.
 - .4 SC: solid core.
 - .5 SCRN: screen.
 - .6 SCWD: solid core wood door.
 - .7 SD: smoke developed.
 - .8 SDT: static dissipative tile.
 - .9 SECT: section.
 - .10 SH: sill height.
 - .11 SIM: similar.
 - .12 SL: sliding.
 - .13 SLR: sealer.
 - .14 SPEC: specification.
 - .15 SS: stainless steel.
 - .16 STD: standard.
 - .17 STL: steel.
 - .18 STL BM: steel beam.
 - .19 STC: sound transmission class.
 - .20 STL FL DK: steel floor deck.
 - .21 STL PL: steel plate.
 - .22 STN: stone.
 - .23 STR: structure or structural.

- .24 ST SEW: storm sewer.
.25 S&U: stain and urethane.
.26 S&V: stain and varnish.
.27 SVT: solid vinyl tile.
- .20 T:
.1 T: top.
.2 T&B: top and bottom.
.3 TCB: turbidity control plan.
.4 TEL: telephone.
.5 TER: terrazzo.
.6 TERT: terrazzo tile.
.7 THKNS: thickness.
.8 THR: threshold.
.9 TMPD: tempered.
.10 TOPG: topping.
.11 TRANSV: transverse.
.12 TYP: typical.
- .21 U:
.1 U: urethane.
.2 U/C: undercut.
.3 UGRD: underground.
.4 UNO: unless noted otherwise.
.5 UOS: unless otherwise specified.
.6 U/S: underside.
.7 UR: urinal.
- .22 V:
.1 V: volt.
.2 VCF: vinyl coated fabric.
.3 VCT: vinyl composition tile.
.4 VEL: velocity.
.5 VERT: vertical.
.6 VERT B: vertical blinds.
.7 VERT EF: vertical each face.
.8 VSF: vinyl sheet flooring.
.9 VPT: vinyl plank flooring.
.10 VT: vinyl tile.
.11 VWC: vinyl wall covering.
- .23 W:
.1 WB: wet-bulb.
.2 WC: water closet.
.3 W-C: wall connectors.
.4 WD: wood.
.5 WDV: wood veneer.
.6 WG: water gauge.
.7 WH: wall hydrant.
.8 WHMIS: workplace hazardous materials information system.
.9 WP: waterproofing.
.10 WR: washroom.
.11 WSIB: workplace safety and insurance board.

- .12 WT: weight.
- .13 WTP: water treatment plant.

1.3 STANDARDS ORGANIZATIONS

- .1 Standards writing organizations:
 - .1 AA - Aluminum Association.
 - .2 ACPA - American Concrete Pipe Association.
 - .3 ANSI - American National Standards Institute.
 - .4 ASHRAE - American Society of Heating and Refrigerating and Air-Conditioning Engineers.
 - .5 ASTM - American Society for Testing and Materials.
 - .6 AWMAC/WI - Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute.
 - .7 AWPA - American Wood Preservers' Association.
 - .8 AWWA - American Water Works Association.
 - .9 BHMA - Builders Hardware Manufacturers Association.
 - .10 CCDC - Canadian Construction Documents Committee.
 - .11 CCMPA - Canadian Concrete Masonry Producers Association.
 - .12 CGSB - Canadian General Standards Board.
 - .13 CNTA - Canadian Nursery Trades Association.
 - .14 CPCA - Canadian Painting Contractors Association.
 - .15 CRCA - Canadian Roofing Contractors Association.
 - .16 CSA - Canadian Standards Association.
 - .17 CSC - Construction Specifications Canada.
 - .18 CSDMA - Canadian Steel Door Manufacturers Association.
 - .19 CSI - Construction Specifications Institute.
 - .20 CSSBI - Canadian Sheet Steel Building Institute.
 - .21 CRCA - Canadian Roofing Contractors Association.
 - .22 DHI - Door and Hardware Insitute.
 - .23 EEMAC - Electrical and Electronic Manufacturer's Association of Canada.
 - .24 ESA - Electrical Safety Authority.
 - .25 FCC - Fire Commissioner of Canada.
 - .26 FSC - Forest Stewardship Council.
 - .27 GANA - Glass Association of North America.
 - .28 HMMA - Hollow Metal Manufacturers Association.
 - .29 IEEE - Institute of Electrical and Electronics Engineers Inc.
 - .30 ISO - International Organization for Standardization.
 - .31 IWFA - International Window Film Association.
 - .32 LEED - LEED Canada, Leadership in Energy and Environmental Design.
 - .33 MPI - Master Painters Insitute.
 - .34 NAAMM - National Association of Architectural Metal Manufacturers.
 - .35 NCPI - National Clay Pipe Institute.
 - .36 NEMA - National Electrical Manufacturers Association.
 - .37 NFPA - National Fire Protection Association.
 - .38 OPSD - Ontario Provincial Standard Drawings.
 - .39 OPSS - Ontario Provincial Standard Specifications.
 - .40 PPI - Plasctics Pipe Institute.
 - .41 SDI - Steel Door Intitute.
 - .42 SCAQMD - South Coast Air Quality Management District.
 - .43 TIA - Telecommunications Industry Association.
 - .44 TIAC - Thermal Insulation Association of Canada.

- .45 TTMAC - Terrazzo Tile and Marble Association of Canada.
- .46 UL - Underwriters Laboratories.
- .47 ULC - Underwriters Laboratories of Canada.
- .48 US EPA - United States Environmental Protection Agency.
- .49 WH - Warnock Hersey.

1.4 FEDERAL GOVERNMENT DEPARTMENTS AND AGENCIES

- .1 Departments, agencies and crown corporations.
 - .1 CEAA - Canadian Environmental Assessment Agency.
 - .2 CSC - Correctional Service Canada.
 - .3 CRA - Canada Revenue Agency.
 - .4 DND - Department of National Defence.
 - .5 ECCC - Environment and Climate Change Canada.
 - .6 FHBRO - Federal Heritage Buildings Review Office.
 - .7 HC - Health Canada.
 - .8 HCD - Heritage Conservation Directorate.
 - .9 LC - Labour Canada.
 - .10 PC - Parks Canada.
 - .11 PSPC - Public Service Procurement Canada.
 - .12 PWGSC - Public Works and Government Services Canada.
 - .13 RCMP - Royal Canadian Mounted Police.
 - .14 TBS - Treasury Board Secretariat.
 - .15 TC - Transport Canada.

1.5 PROVINCIAL GOVERNMENT DEPARTMENTS AND AGENCIES

- .1 MECP - Ontario Ministry of Environment and Conservation and Parks.
- .2 MOL - Ontario Ministry of Labour.
- .3 MTO and MOT - Ontario Ministry of Transportation.
- .4 TSSA - Technical Standards and Safety Authority.

1.6 INTERNATIONAL GOVERNMENT DEPARTMENTS AND AGENCIES

- .1 DOHMH - New York City Department of Health and Mental Hygiene, USA.
- .2 GSA - Government Services Administration, USA.

1.7 UNITS OF MEASURE METRIC

- .1 The following abbreviations of units of measure are commonly found in the Project Manual:
 - .1 C: Celsius.
 - .2 cm: centimetre.
 - .3 kg: kilogram.
 - .4 kg/m³: kilogram per cubic metre.
 - .5 kN: kilonewton.
 - .6 kPa: kilopascals.

- .7 kw: kilowatts.
- .8 l/s: litre per second.
- .9 m: metre.
- .10 m³: cubic metre.
- .11 mg/kg: milligrams per kilogram.
- .12 mg/L: milligrams per litre.
- .13 mm: millimetres.
- .14 MPa: megapascal.
- .15 NTU: nephelometric turbidity unit.
- .16 ppm: parts per million.
- .17 ug/L: micrograms per litre.
- .18 ug/m³: micrograms per cubic metre.

1.8 UNITS OF MEASURE IMPERIAL

- .1 The following abbreviations of units of measure are commonly found in the Project Manual:

- .1 BTU: British thermal units.
- .2 CFM: cubic feet per minute.
- .3 F: Fahrenheit.
- .4 ft: foot/feet.
- .5 FPI: fins per inch.
- .6 FPM: feet per minute.
- .7 ga: gauge.
- .8 gpm: gallons per minute.
- .9 in: inches.
- .10 lbs: pounds.
- .11 NTU: nephelometric turbidity unit.
- .12 psi: pounds-force per square inch.
- .13 PSIG: PSI gauge.
- .14 ppm: parts per million.
- .15 RPM: revolutions per minute.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 91 00 - Commissioning - General Requirements.

1.3 INSPECTION

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

1.4 INDEPENDENT INSPECTION AGENCIES

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

- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

1.5 ACCESS TO WORK

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

1.6 PROCEDURES

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

1.7 REJECTED WORK

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

1.8 REPORTS

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

1.9 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.

1.10 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 or as specified in specific Section.
- .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 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.11 MILL TESTS

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

1.12 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 00.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Temporary utilities.

1.2 RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.
- .2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 833-R-06-004, May 2007, Developing Your Storm water Pollution Prevention Plan - A Guide for Construction Sites.

1.4 SUBMITTALS

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

1.5 INSTALLATION AND REMOVAL

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

1.6 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.7 WATER SUPPLY

- .1 Departmental Representative will provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.
- .3 Departmental Representative will pay for utility charges at prevailing rates.

1.8 TEMPORARY HEATING AND VENTILATION

- .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 when available. Be responsible for damage to heating system if use is permitted.
- .7 On completion of Work for which permanent heating system is used, replace filters.
- .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.

1.9 TEMPORARY POWER AND LIGHT

- .1 Departmental Representative will pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 120 volts 15 amps.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract.

1.10 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary data hook up necessary for own use and use of Departmental Representative.

1.11 FIRE PROTECTION

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office and sheds.
- .3 Parking.
- .4 Project identification.
- .5 Temporary Coast Guard Search & Rescue trailer
- .6 Temporary sea can storage container for Coast Guard equipment. Supplied by Departmental Representative.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA 0121-17, Douglas Fir Plywood.
 - .3 CSA Z797-09(R2014), 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.

1.3 SUBMITTALS

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

1.4 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 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.

1.5 SCAFFOLDING

- .1 Scaffolding in accordance with CSA Z797.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, and temporary stairs as required.

1.6 HOISTING

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

1.7 SITE STORAGE/LOADING

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

1.8 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.
- .3 Build and maintain temporary roads where indicated or directed by Departmental Representative and provide snow removal during period of Work.
- .4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.9 SECURITY

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

1.10 CONSTRUCTION OFFICES

- .1 Provide office heated to 20°C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.11 TEMPORARY OPERATIONS COAST GUARD SEARCH & RESCUE TRAILER

- .1 Provide 3.66 m wide x 18.3 m long raised trailer, heated / cooled to 20°C, lighted 750 lx and ventilated, to accommodate temporary office for the operations of the Coast Guard Search & Rescue. Trailer needs to be in placed between March and December during construction period.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Temporary operations trailer for 8 lockers (Departmental Representative provided), two 3.6 m X 3 m office, lunchroom, and 2 piece washroom (toilet and sink).
- .4 Provide on demand water pump.
- .5 Portable water and sewage tanks; minimum 750 Litre capacity each.
- .6 Electrical hook-up/disconnects by Contractor. Electrical cord and cord ends by Contractor.
- .7 Trailer to have a quantity of 10 - 110 volt power outlets.
- .8 Telecom data hook-ups/disconnects are by Shared Services Canada. Provide rough in for a quantity of at least 3 phone and 4 data outlets.
- .9 Water hauling and sewage services are by Contractor.
- .10 The following furniture is to be provided:
 - .1 Two (2) Desk Package (Swivel Chair and 765 mm wide X 1830 mm long Desk.
 - .2 2440mm long folding table.
 - .3 Four (4) Sled Chairs.
 - .4 Three (3) waste bins and one (1) recycling bin.
- .11 Location of trailer as per Drawings.

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.13 SANITARY FACILITIES

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

1.14 CONSTRUCTION SIGNAGE

- .1 No signs or advertisements, other than warning signs, are permitted on site.

1.15 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .3 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
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Dust control: adequate to ensure safe operation at all times.
- .11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative .
- .12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .13 Provide snow removal during period of Work.
- .14 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.16 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.

- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 Section 01 52 00 - Construction Facilities.

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
 - .2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA):
 - .1 CSA O121-17, Douglas Fir Plywood.

1.4 INSTALLATION AND REMOVAL

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

1.5 HOARDING

- .1 Erect temporary site enclosure using modular freestanding fencing: galvanized, minimum 1.8 m high, chain link or welded steel mesh, pipe rail. Provide two lockable truck entrance gates 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.

1.6 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.7 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.8 DUST TIGHT SCREENS

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

1.9 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.10 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.11 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.12 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.13 PROTECTION OF BUILDING FINISHES

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

PART 2 - PRODUCTS

2.1 NOT USED

PWGSC Ontario
Region Project
Number R.084112.005

TEMPORARY BARRIERS
AND ENCLOSURES

Section 01 56 00
Page 3
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.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.

1.3 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 <https://www.library.mto.gov.on.ca/SydneyPLUS/TechPubs/Portal/tp/opsViews.aspx?lang=en-US>.

1.4 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.

1.5 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.

1.6 METRIC SIZED MATERIALS

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

1.7 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 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 and 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.

1.8 TRANSPORTATION

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

1.9 MANUFACTURER'S INSTRUCTIONS

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

Time.

1.10 QUALITY OF WORK

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

1.11 CO-ORDINATION

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

1.12 CONCEALMENT

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

1.13 REMEDIAL WORK

- .1 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.

1.14 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.

1.15 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

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

1.16 FASTENINGS - EQUIPMENT

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

1.17 PROTECTION OF WORK IN PROGRESS

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

1.18 EXISTING UTILITIES

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

PWGSC Ontario
Region Project
Number R.084112.005

COMMON PRODUCT
REQUIREMENTS

Section 01 61 00
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2020-12-17

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Field engineering survey services to measure and stake site.
- .2 Survey services to establish and confirm inverts for Work.
- .3 Recording of subsurface conditions found.

1.2 REFERENCES

- .1 Departmental Representative's identification of existing survey control points and property limits.

1.3 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

1.4 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Departmental Representative.
- .4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.5 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.

- .6 Stake batter boards for foundations.
- .7 Establish foundation column locations and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

1.6 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.7 LOCATION OF EQUIPMENT AND FIXTURES

- .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.

1.8 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.9 SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

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Number R.084112.005

EXAMINATION AND
PREPARATION

Section 01 71 00
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PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Departmental Representative or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Departmental Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 MATERIALS

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

1.3 PREPARATION

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

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.

- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Remove samples of installed Work for testing
- .6 Provide openings in non-structural elements of Work for penetrations of 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, sleeves, ducts, conduit, 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.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse, recycling composting and anaerobic digestion in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 PROJECT CLEANLINESS

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

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools,

- construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
 - .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
 - .4 Remove waste products and debris other than that caused by Owner or other Contractors.
 - .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
 - .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
 - .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
 - .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
 - .9 Clean lighting reflectors, lenses, and other lighting surfaces.
 - .10 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.
 - .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
 - .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
 - .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
 - .14 Remove dirt and other disfiguration from exterior surfaces.
 - .15 Clean and sweep roofs, gutters, areaways, and sunken wells.
 - .16 Sweep and wash clean paved areas.
 - .17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
 - .18 Clean roofs, downspouts, and drainage systems.
 - .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Target for this project is 95% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Brick and portland cement concrete.
 - .2 Corrugated cardboard.
 - .3 Wood, not including painted or treated wood or laminated wood.
 - .4 Gypsum board, unpainted.
 - .5 Steel.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
 - .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested.
- .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, Conservation and Parks, 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 or 1-888-501-9637.
 - .2 Fax: 416-960-8053.
 - .3 Email: rco@rco.on.ca.
 - .4 Internet: <http://www.rco.on.ca/>.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

Province	Address	General Inquiries	Fax
Ontario	Ministry of Environment, Conversation and Parks 135 St Clair Avenue West Toronto, ON M4V 1P5 Environment and Climate Change Canada Toronto, ON	(416) 323-4321 (800) 565-4923 (416) 734-4494	(416) 323-4682

END OF SECTION

PART 1 - GENERAL

1.1 INSPECTION AND DECLARATION

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

1.2 CLEANING

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

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 91 00 - Commissioning - General Requirements.
- .2 Section 01 79 00 - Demonstration and Training.

1.3 SUBMISSION

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

1.4 FORMAT

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

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names,
 - .2 Addresses, and telephone numbers of Contractor with name of responsible parties;
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.
- .6 Training: Refer to Section 01 79 00 and 01 91 00.

1.6 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Amendments and addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 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. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.
- .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".

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured 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.

1.8 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.

1.9 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 00.
- .15 Additional requirements: As specified in individual specification sections.

1.10 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.

1.11 SPARE PARTS

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

1.13 SPECIAL TOOLS

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

1.14 STORAGE, HANDLING AND PROTECTION

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

1.15 WARRANTIES AND BONDS

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Substantial Performance is determined.

- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 23 08 00 - Mechanical Commissioning.

1.3 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.

1.4 QUALITY CONTROL

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

1.5 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with Section 01 91 00.
- .2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 00 and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.6 PREPARATION

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

1.7 DEMONSTRATION AND INSTRUCTIONS

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

1.8 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 Section - Heating Plant: 1 hour of instruction.
 - .2 Section - Cooling and Ventilation System: 1 hour of instruction.
 - .3 Section - Control System: 1 hour of instruction.
 - .4 Section - Plumbing System: 1 hour of instruction.
 - .5 Section - Electrical System: 1 hour of instruction.
 - .6 Section - Overhead Doors: 1 hour of instruction.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Includes general requirements for commissioning facilities and facility systems.

1.2 RELATED SECTIONS

- .1 Section 23 33 14 - Dampers-Balancing.
- .2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.3 QUALITY ASSURANCE

- .1 Co-operate with system Commissioning Administrator under provisions specified in Section 01 45 00.
- .2 Comply with applicable procedures and standards of the certification sponsoring association.
- .3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.4 REFERENCES

- .1 Associated Air Balance Council (AABC): National Standards For Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems, 2002.
- .2 ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for the Commissioning Process.
- .3 ASHRAE Guideline 4-2008(RA 2013), Preparation of Operating and Maintenance Documentation for Building System.
- .4 NEBB Procedural Standards for Building Systems Commissioning (1999).
- .5 NETA Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems 2009.

1.5 SUBMITTALS

- .1 Within 15 working days of Award of Contract, submit name of Contractor personnel proposed to perform services who has managerial responsibilities for coordination of all commissioning activities.
- .2 Submit 3 preliminary specimen copies of each type of startup checklist, product information and performance verification report forms proposed for use.

- .3 Submit completed report forms within 3 days after completion of each testing to Consultant for review and verification.
- .4 Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms for functional performance verification.
- .5 Submit post-commissioning reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.6 REPORT FORMS

- .1 Contractor personnel having managerial responsibility] shall make reports.
- .2 Report forms shall include:
 - .1 Startup Checklists.
 - .2 Product Information (PI) Report forms.
 - .3 Performance Verification (PV) Report forms.
- .3 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.
- .4 Submit signed form to Departmental Representative for review, approval and signature.
- .5 Identify each instrument used for testing, adjusting and balancing and its latest date of calibration.

1.7 CONTRACTOR'S RESPONSIBILITIES

- .1 Prepare each system for testing and balancing.
- .2 Cooperate with testing organization and provide access to equipment and systems.
- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .4 Notify testing organization and Departmental Representative 7 days prior to time project will be ready for testing, adjusting, and balancing.
- .5 Accurately record data for each step.
- .6 Report to Departmental Representative any deficiencies or defects noted during performance of services.
- .7 Correct deficiencies identified in accordance with Departmental Representative's written instructions.

1.8 PREPARATION

- .1 Provide instruments required for testing, adjusting, and balancing operations.

- .2 Make instruments available to Departmental Representative to facilitate spot checks during testing and functional performance verification.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.
- .5 Verify lighting is turned on when lighting is included in cooling load.
- .6 Verify equipment such as computers, laboratory and electronic equipment are in full operation when these equipment are included in cooling load.

1.9 EXECUTION

- .1 Test equipment, balance distribution systems, and adjust devices for HVAC systems.
- .2 Test hydronic systems, adjust and record liquid flow at each piece of equipment.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION



**Designated Substances and
Hazardous Building Materials
Abatement Specifications**

Search and Research Station (SAR)
Cobourg, Ontario

March 11, 2020

Prepared for:

Public Works and Government Services
Canada
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Appendices

Appendix A – “*Designated Substances and Hazardous Building Materials Assessment – SAR Station, Search and Rescue Station (SAR), Cobourg, Ontario*”, prepared by Stantec Consulting Ltd. and dated February 21, 2020.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Refer to the following assessment report bound into this specification, for information pertaining to designated substances and hazardous building materials that have been identified and may require disturbance as part of the project:
 - .1 *Designated Substances and Hazardous Building Materials Assessment – SAR Station, Search and Rescue Station (SAR), Cobourg, Ontario*, prepared by Stantec Consulting Ltd. and dated February 21, 2020.

1.2 REFERENCE STANDARDS

- .1 Canadian Environmental Protection Act, 1999 (CEPA 1999):
 - .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149)
- .2 Department of Justice Canada (Jus):
 - .1 Transportation of Dangerous Goods Act, 1992 (TDG Act) 1992, (c. 34)
 - .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286)
- .3 Green Seal Environmental Standards (GS):
 - .1 GS-11-2015, Edition 3.2, Paints and Coatings
 - .2 GS-36-2013, Edition 2.1, Commercial Adhesives
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS):
 - .1 WHMIS Safety Data Sheets (SDS)
- .5 National Research Council Canada (NRC):
 - .1 National Fire Code of Canada 2015 (NFC)
- .6 Government of Ontario:
 - .1 Regulation 347/90 of the Revised Regulations of Ontario, amended to Ontario Regulation 461/05 and 217/08, General – Waste Management, under the Environmental Protection Act
 - .2 R.R.O. 1990, Reg. 833: Control of Exposure to Biological or Chemical Agents under the Occupational Health and Safety Act (OHSA)
 - .3 Ontario Regulation 278/05 Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations, under the Occupational Health and Safety Act
 - .4 Ontario Regulation 490/09 Designated Substances, made under the Occupational Health and Safety Act
 - .5 Environmental Protection Act (EPA), Part VI, the Ozone Depleting Substances – General Regulation (R.R.O. 1990, Regulation 356 amended to Ontario Regulation. 351/93)
 - .6 Refrigerants Regulation, O. Reg. 189/94 amended to Ontario Regulation 519/97.
 - .7 Canadian Environmental Protection Act (CEPA), Ozone-Depleting Substances Regulations, 1998 SOR/99-7

- .8 RRO. 1990, Reg. 362: Waste Management: PCBs under the Environmental Protection Act
- .7 Government of Canada:
 - .1 The Canada Labour Code, Part II, Canada Occupational Health and Safety Regulations
 - .2 The Federal PCB Regulations (SOR/2008-273)
 - .3 The Federal Halocarbons Regulation (July 2003) (SOR/2003-289)
 - .4 The Public Services and Procurement Canada Asbestos Management Standard
 - .5 The Public Services and Procurement Canada Asbestos Management Directive
 - .6 Canada Occupational Health and Safety Regulations (COHSR)
 - .7 National Joint Council (NJC) Occupational Health and Safety Directive (OHS Directive)
 - .8 Surface Coating Materials Regulations (SOR/206-193)
 - .9 Technical Guideline to Asbestos Exposure Management Programs
- .8 Canadian Construction Association:
 - .1 Standard Construction Document CCA 82 “Mould Guidelines for the Canadian Construction Industry” (2004 – further referred to herein as “CCA 82”)
- .9 Environmental Abatement Council of Ontario Mould Abatement Guidelines, Edition 3, dated 2015
- .10 Environmental Abatement Council of Ontario (EACO) Lead Guideline for Construction, Maintenance or Repair, dated October 2014
- .11 Environmental Abatement Council of Ontario (EACO) Vermiculite Guideline, dated January 2015

1.3 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into environment.
- .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.
- .5 Hazardous Building Material: component of a building or structure that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when altered, disturbed or removed during maintenance, renovation or demolition.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit two copies of WHMIS Safety Data Sheets (SDS) to the Public works and Government Services Canada (PWSGC) Representative for each hazardous material required prior to bringing hazardous material on site.
 - .3 Submit hazardous materials management plan to the Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.
 - .4 Hazardous waste classification: identify waste codes applicable to each hazardous waste material based on applicable federal and provincial acts, regulations, and guidelines. Waste profiles, analyses, and classification submitted to contract offices for review and approval.
 - .5 Low-Emitting Materials: submit listing of adhesives and sealants, paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.
 - .6 Spill response: establish spill response procedures. Comply with applicable requirements according to classification of waste material. Designate an emergency coordinator and emergency contacts for comprehensive emergency response and incident mitigation.
 - .7 Record keeping: contractor is responsible for maintaining adequate records of handling, storing, and shipping of hazardous materials.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance 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 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
 - .1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.
- .4 Storage and Handling Requirements:
 - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada (NFC) requirements.

- .4 Keep no more than 45 litres of flammable and/or combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
- .5 Transfer of flammable and combustible liquids is prohibited within buildings.
- .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
- .7 Solvents or cleaning agents: non-flammable or have flash point above 38 degrees C.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

- .11 When hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with Departmental Representative.
 - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Only trained personnel handle offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
- .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.6 EXISTING CONDITIONS

- .1 Reports and information pertaining to designated substances and hazardous building materials present within the building that may be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.
 - .1 Notify Departmental Representative of suspected hazardous building material discovered during the project and not apparent from drawings, specifications, or reports pertaining to the project. Do not disturb such material pending instructions from the Departmental Representative.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Description:
 - .1 Bring on site only quantities of hazardous material required to perform work associated with the project.
 - .2 Maintain WHMIS Safety Data Sheets (SDS) in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.
 - .3 Sustainability Characteristics:
 - .1 Adhesives and Sealants: maximum VOC limit to SCAQMD Rule 1168.
 - .2 Coatings, Primers, Paints in accordance with manufacturer's recommendations for surface conditions:
 - .1 Primer: maximum VOC limit to SCAQMD Rule 1113
 - .2 Paints: maximum VOC limit to SCAQMD Rule 1113
 - .3 Coatings: maximum VOC limit to SCAQMD Rule 1113
 - .4 Spill Response Materials: provide spill response materials which can be used for absorbing/shoveling and containing hazardous materials.
 - .5 Provide personal protective equipment.

PART 3 EXECUTION

3.1 DESIGNATED SUBSTANCES AND HAZARDOUS BUILDING MATERIALS

- .1 The intent is to provide information in these documents that indicates the likely extent and presence of designated substances and hazardous building materials that are to be to handle, alter, remove and/or dispose of.
- .2 Abatement shall be conducted to handle, alter, remove and/or dispose of designated substances and hazardous building materials as identified in the Assessment Report in accordance with applicable regulations, guidelines, standards and/or best practices for such work, to the extent that such identified designated substances and hazardous building materials will be impacted (handled, altered, damaged, removed) by the work associated with the project.
- .3 Contractor is responsible for reviewing plans, specifications and reports such that they understand the locations and amounts of hazardous building materials that will be impacted by their work, and such that appropriate plans and budgets can be included in their overall bids.
- .4 Should the work areas be expanded, or work must occur outside of the areas noted, the Contractor is to notify the Departmental Representative as additional assessment and abatement work may be required prior to disturbance of the building material.
- .5 Should additional materials be identified that require abatement, the Contractor is to comply with the requirements of the applicable sections of the specifications.
- .6 Contractor to quantify and clarify all materials to be removed at the site. Quantities stated in these documents are estimates only.
- .7 Read this section in conjunction with all other sections so as to comply with the General Conditions of the contract.
- .8 Provide adequate workforce to complete all work specified in this section within the specified time frame.
- .9 All work to be carried out at Cobourg Search and Rescue Station, 114 Division Street South in Cobourg, Ontario.
- .10 Project work must be completed on acceptable dates and timelines provided by the project coordinator.
- .11 Contractor to provide notice to the client in writing no less than 10 days prior to starting abatement work.

3.2 SCOPE OF PROJECT DESIGN:

- .1 Scope of abatement activities for designated substances and hazardous building materials is summarized below. Procedures for abatement activities for asbestos, lead, and mould are specified elsewhere in the specification package.

.2 Scope of work for the removal of Asbestos-Containing Materials is as follows:

Asbestos-Containing Material	Building/Room	Approx. Quantity	Minimum Abatement Procedures
Vinyl Floor tiles - beige	House - first floor, bedroom 1	16 m ²	Type 1
	House - first floor, bedroom 2	16 m ²	Type 1
	House - first floor, bedroom 3	16 m ²	Type 1
	House - first floor, hallway	10 m ²	Type 1
	House - first floor, living room	25 m ²	Type 1
	Total		83 m ²
Exterior window glazing compound- black	House addition - first floor, kitchen exterior	6 m (1 window)	Type 1
	House - first floor, laundry room exterior	6 m (1 window)	Type 1
	Office - exterior	55 m (7 windows)	Type 1
	Total		67 m (9 windows)
Vermiculite	House – Attic addition	75 m ²	Type 3
	House – Attic original construction	150 m ²	Type 3
	Total		225 m ²

- .1 The Contractor shall design an abatement plan, including any phasing or staging, so that all asbestos-containing materials are removed in accordance with all applicable regulations. This plan will be submitted to the Departmental Representative for review and approval before any work is completed. All work to be read in conjunction with other sections. The following are the anticipated minimum requirements for abatement:
- .1 The abatement of asbestos-containing materials is to be completed and the Contractor is to coordinate the schedule with the Departmental Representative.
 - .2 Work shall not commence on any phase of the project that involves the potential disturbance of asbestos until receiving permission to proceed from the Departmental Representative and inspection requirements are discussed.
 - .3 Contractor to quantify and clarify all materials to be removed at the site. No allowances will be made for extras for materials that are noted. For locations where material needs to be removed, read this in conjunction with all tender drawings and documents.

- .3 Scope of work for the removal of lead-containing materials is as follows:
 - .1 Prior to removal from the site and disposal, white colored paint from the house door frames and exterior wood siding, Office building interior wood siding and pier building doors and walls and brown coloured paint on house interior door frames should be subject to toxicity characteristic leaching procedure (TCLP) to determine the toxicity of with respect to lead prior to disposal in accordance with R.,R.O. 1990, Regulation 347 General – Waste Management, as amended (R.R.O., 1990, Reg. 347) under the Environmental Protection act (EPA). If TCLP testing is not completed, contractor to assume paint to be disposed of as lead waste.
- .4 Scope of work for the removal of Polychlorinated Biphenyls (PCBs) materials is as follows:
 - .1 Per the Assessment Report, PCBs may be in the ballasts of twelve light fixtures observed as an aggregate for the house and office. As the ballasts were energized, they could not be inspected at the time of the assessment for health and safety reasons.
 - .2 Per the Assessment Report, caulking suspected of containing PCBs were identified by laboratory analysis to be below the method detection limit.
 - .3 Should a material suspected to contain PCBs become uncovered during renovation activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present.
- .5 Water staining was observed on the ceiling (2 m²) of the washroom 2 in the house and on the ceiling tiles (4 ceiling tiles) in office 1 of the office. Mould abatement activities are not required
 - .1 Water staining was observed on the ceiling (2 m²) of the washroom 2 in the house and on the ceiling tiles (4 ceiling tiles) in office 1 of the office.
 - .2 Mould was not observed to be present on suspect materials collected for laboratory analysis.
- .6 Scope of work for the removal of mercury is based on the following:
 - .1 Per the Assessment report, mercury is likely to be present in 18 fluorescent light tubes observed in the house (6 fluorescent light tubes), Office (6 fluorescent light tubes) and Workshop (6 fluorescent light tubes).
 - .2 Prior to removal from the site and disposal, white colored paint from the house door frames and exterior wood siding, Office building interior wood siding and pier building doors and walls and brown coloured paint on house interior door frames should be subject to toxicity characteristic leaching procedure (TCLP) to determine the toxicity of with respect to mercury prior to disposal in accordance with R.,R.O. 1990, Regulation 347 General – Waste Management, as amended (R.R.O., 1990, Reg. 347) under the Environmental Protection act (EPA). If TCLP testing is not completed, contractor to assume paint to be disposed of as mercury waste.
- .7 Scope of work for the removal of Removal of ozone-depleting substances (ODSs) is based on the following:
 - .1 Removal and disposal of one (1) Lennox HVAC unit on the exterior of the house in accordance with applicable federal and provincial acts, regulations and guidelines.

- .8 Silica:
 - .1 When silica-containing materials are to be disturbed and/or removed (e.g., demolition of concrete slabs, masonry or concrete units, removal of gypsum board/plaster walls, impacts to stucco-like wall or ceiling coatings, etc.), ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by ON OH&S Reg. (Cristobalite and Quartz – each 0.025 mg/m³). This would include, but not be limited to, the following:
 - .1 Providing workers with respiratory protection.
 - .2 Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions.
 - .3 Providing workers with facilities to properly wash prior to exiting the work area.
- .9 Removal of urea formaldehyde foam insulation (UFFI) is not required based on the following:
 - .1 Per the Assessment Report, UFFI was not identified in building materials that are anticipated to be impacted by the renovation project.
- .10 Prior to demolition, the following Fuel Oil, Waste Oil and Stored chemicals are to be removed from the site following handling and disposal in accordance with applicable regulations:
 - .1 Two fire extinguishers (House)
 - .2 One fire extinguisher (Office)
 - .3 Eight fire extinguishers (Pier)
 - .4 One Compressor (Pier)
 - .5 One chemical cabinet containing motor oil, paints, insecticide and lubricants (Pier)
 - .6 Four unlabeled drums (Pier)
 - .7 Eight fire extinguishers (Pier)
 - .8 One Compressor (Pier)

3.3 CLEANING

- .1 Progress Cleaning: leave work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Hazardous waste burned for energy recovery.
- .4 Lead-acid battery recycling.
- .5 Hazardous wastes with economically recoverable precious metals.

3.4 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
- .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
- .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
- .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
- .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal
 - .2 Hazardous waste burned for energy recovery
 - .3 Lead-acid battery recycling
 - .4 Hazardous wastes with economically recoverable precious metals

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following work:
 - .1 Removal of asbestos-containing exterior window glazing compound – black on house
 - .2 Removal of asbestos-containing exterior window glazing compound – black on office
 - .3 Removal of asbestos-containing vinyl floor tiles – beige
- .2 Refer to section 02 81 00 for the abatement project scope locations.
- .3 To be read in conjunction with all other Sections of the Specifications and general conditions of the contract.
- .4 Contractor to quantify and clarify all materials to be removed at the site. No allowances will be made for extras for materials that are noted.
- .5 All vacuums used on site must have HEPA integrity test (D.O.P.) completed on site prior to use. Only units documented as passing the test will be allowed to be used on site. Documentation must be provided to the Consultant showing test information.
- .6 Electricity and water service to be made available by the Owner. Contractor to provide adequate lighting to the satisfaction of the Public Services and Procurement Canada Representative.
- .7 Ground fault panels must be used for all electrical devices used in the work areas. A licensed electrician must connect and disconnect the ground fault panel.
 - .1 The contractor is to provide the following:
 - .1 Designated sanitary facilities for workers and Authorized Visitors.
 - .2 Designated washroom facilities for workers and Authorized Visitors.
 - .3 Temporary facilities including connections to electrical, water and drainage point sources.
 - .4 Any special facilities and supplies required by the specification and any relevant or applicable guidelines, codes, or regulations.
 - .5 All and any other materials, equipment and tools required to complete the work.
 - .6 In addition, the Contractor shall maintain an adequate supply of protective clothing and equipment as described herein for use by Authorized Visitors, the Departmental Representatives who may need to enter the work area.
 - .7 Departmental Representative are to receive a written work schedule at least 10 days in advance of the start of the work.

1.2 SECTION INCLUDES

- .1 Requirements and procedures for asbestos abatement of non-friable asbestos-containing materials.

1.3 RELATED REQUIREMENTS

- .1 Refer to the following Assessment Report bound into this specification, for information pertaining to designated substances and hazardous building materials that have been identified that and may require disturbance during the project:
 - .1 *Designated Substances and Hazardous Building Materials Assessment – SAR Station, Search and Rescue Station (SAR), Cobourg, Ontario*, prepared by Stantec Consulting Ltd. and dated February 21, 2020.

1.4 REFERENCE STANDARDS

- .1 Refer to part 3.2 of Section 02 81 00 for applicable reference standards.

1.5 DEFINITIONS

- .1 Amended Water: water with nonionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.
- .2 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.
- .3 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.
- .4 Authorized Visitors: designated representatives, and representatives of regulatory agencies.
- .5 Competent worker: 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.
- .6 Contractor: Asbestos Abatement Contractor with accredited workers and supervisors and the proper insurance for performing asbestos abatement.
- .7 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) HEPA-filter leak test.
- .8 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .9 HEPA Integrity Test: A testing method used to determine the integrity of the vacuums and negative air units, testing for HEPA-filter leaks.

- .10 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.
- .11 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .12 Occupied Area: any area of the building or work site that is outside Asbestos work area.
- .13 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.
- .14 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.
- .15 Owner: Public works and Government Services Canada.
- .16 Consultant: Stantec Consulting Ltd.

1.6 SUBMITTALS

- .1 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.
- .2 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
- .3 Submit proof of Contractor's Asbestos Liability Insurance.
- .4 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.
- .5 Submit proof that all asbestos workers and/or supervisors 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.
- .6 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.
- .7 Submit Worker's Compensation Board status and transcription of insurance.
- .8 Submit documentation including test results, fire and flammability data, and WHMIS Safety Data Sheets (SDS) for chemicals or materials including but not limited to following:
 - .1 Encapsulants
 - .2 Amended water
 - .3 Slow drying sealer

1.7 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 Safety Requirements: worker protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Minimum Precautions Work Area include:
 - .1 Air purifying half-mask respirator with 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.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .7 Visitor Protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
 - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .2 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mils bags or leak proof drums. Label containers with appropriate warning labels.
- .3 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

1.9 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this project are bound into this specification.
- .2 Notify the Consultant and Owner of material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by the Consultant.

1.10 SCHEDULING

- .1 Hours of Work: Project work must be completed on acceptable dates and timelines provided by the project coordinator.

1.11 PERSONNEL TRAINING

- .1 Before beginning work associated with the project, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, personal hygiene and work practices, and use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes the 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.
- .3 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.
- .4 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.
- .5 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.
- .6 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.
- .7 Tape: fibreglass-reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

PART 3 EXECUTION

3.1 SCOPE OF WORK

- .1 Comply with the requirements of this section when performing Minimum Work procedures described above in Section 1.1 Summary for the removal of the asbestos-containing materials described in Section 3.2.1 in Asbestos-Containing Materials (section 028210).
- .2 Contractor to quantify all materials prior to submitting bids.

3.2 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.3 PREPARATION

- .1 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.

3.4 PROCEDURES

- .1 Asbestos-containing building materials to be removed without the use of power tools.
- .2 Window frames and glass containing glazing materials are to be removed and wrapped in poly sheeting. The windows are to then have an asbestos label affixed and be placed in a lined disposal bin.
- .3 Remove asbestos-containing vinyl floor tile – beige.
- .4 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.
- .5 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.

- .6 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.

3.5 Final 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.

3.6 INSPECTION

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviation from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, 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 by Contractor for additional labour or materials required to provide specified performance level.
- .3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Departmental Representative may order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.7 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples on daily basis outside of Asbestos Work Area enclosure in accordance with Provincial/Territorial Occupational Health and Safety Regulations and PWGSC requirements.
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

- .2 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.
- .3 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that
- .2 During course of Work, Departmental Representative to measure fibre content of air outside work areas by means air samples analyzed by Phase Contrast Microscopy (PCM).
 - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .3 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Representative will perform air monitoring within Asbestos Work Area by aggressive methods.
 - .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
 - .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
 - .3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
 - .1 Removal of asbestos-containing vermiculite insulation
 - .2 Removal or disturbance of asbestos-containing vinyl floor tiles – beige
- .2 Refer to section 02 81 00 for the abatement project scope locations.
- .3 To be read in conjunction with all other Sections of the Specifications and general conditions of the contract.
- .4 Contractor to quantify and clarify all materials to be removed at the site. No allowances will be made for extras for materials that are noted.
- .5 All vacuums used on site must have HEPA integrity test (D.O.P.) completed on site prior to use. Only units documented as passing the test will be allowed to be used on site. Documentation must be provided to the Consultant showing test information.
- .6 Electricity and water service to be made available by the Owner. Contractor to provide adequate lighting to the satisfaction of the Public Services and Procurement Canada Representative.
- .7 Ground fault panels must be used for all electrical devices used in the work areas. A licensed electrician must connect and disconnect the ground fault panel.
 - .1 The contractor is to provide the following:
 - .1 Designated sanitary facilities for workers and Authorized Visitors.
 - .2 Designated washroom facilities for workers and Authorized Visitors.
 - .3 Temporary facilities including connections to electrical, water and drainage point sources.
 - .4 Any special facilities and supplies required by the specification and any relevant or applicable guidelines, codes, or regulations.
 - .5 All and any other materials, equipment and tools required to complete the work.
 - .6 In addition, the Contractor shall maintain an adequate supply of protective clothing and equipment as described herein for use by Authorized Visitors, the Departmental Representatives who may need to enter the work area.
 - .7 Departmental Representative are to receive a written work schedule at least 10 days in advance of the start of the work.

1.2 SECTION INCLUDES

- .8 Requirements and procedures for asbestos abatement of asbestos-containing materials.

1.3 RELATED REQUIREMENTS

- .9 Refer to the following Assessment Report bound into this specification, for information pertaining to designated substances and hazardous building materials that have been identified that and may require disturbance during the Work:
 - .1 Report title *Designated Substances and Hazardous Building Materials Assessment – SAR Station, Search and Rescue Station (SAR), Cobourg, Ontario* prepared by Stantec Consulting Ltd. and dated February 21, 2020.

1.2 REFERENCE STANDARDS

- .1 Refer to part 3.2 of Section 02 81 00 for applicable reference standards.

1.3 DEFINITIONS

- .1 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.
- .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: designated representatives, and representatives of regulatory agencies.
- .6 Competent worker: 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 Contractor: Asbestos Abatement Contractor with accredited workers and supervisors and the proper insurance for performing asbestos abatement.
- .8 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 weight bottom edge to ensure proper closing.
 - .3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.

- .9 DOP Test: testing method used to determine integrity of Negative Pressure units and vacuums using dioctyl phthalate (DOP) HEPA-filter leak test.
- .10 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .11 Glove Bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
- .12 HEPA Integrity Test: A testing method used to determine the integrity of the vacuums and negative air units, testing for HEPA-filter leaks.
- .13 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.
- .14 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.
- .15 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .16 Occupied Area: any area of the building or work site that is outside Asbestos work area.
- .17 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.
- .18 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.
- .19 Owner: Public works and Government Services Canada.
- .20 Consultant: Stantec Consulting Ltd.

1.4 SUBMITTALS

- .1 Obtain from appropriate agency and submit to Departmental Representative necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material being dumped, and proper methods of disposal. Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.
 - .1 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person on hazards of asbestos exposure, good personal hygiene, entry and exit from

Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing. Submit proof of attendance in form of certificate.

- .2 Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.
- .3 Submit layout of proposed enclosures and decontamination facilities to Departmental Representative for review.
- .4 Submit documentation including test results for sealer proposed for use.
- .5 Submit Provincial/Territorial and/or local requirements for Notice of Project form.
- .6 Submit proof of Contractor's Asbestos Liability Insurance.
- .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.
- .8 Submit Worker's Compensation Board status and transcription of insurance.
- .9 Submit documentation including test results, fire and flammability data, and WHMIS Safety Data Sheets (SDS) for chemicals or materials including but not limited to following:
 - .1 Encapsulants
 - .2 Amended water
 - .3 Slow drying sealer
- .2 Where required, submit proof that any scaffolding has been inspected and has been approved for use by a licensed Engineer in Ontario, in accordance with the OHS Act.
- .3 Submit proof to the Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Comply with all requirements of the Ontario OHS Act.
 - .1 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
 - .1 Air purifying half-mask respirator with 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 to 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. It includes suitable footwear, and it to be repaired or replaced if torn.

Requirements for each worker:

- .1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos 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 then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated work suits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos 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 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.

- .4 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 must not use this system as means to leave or enter work area.
- .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
- .3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.
- .4 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
- .5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .6 Visitor Protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
 - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .2 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mils bags or leak proof drums. Label containers with appropriate warning labels.
- .3 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 ACMs to be handled, removed, or otherwise disturbed and disposed of during this project are bound into this specification.
- .2 Notify the Departmental Representative of material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by the Departmental Representative.

1.8 SCHEDULING

- .1 Hours of Work: Project work must be completed on acceptable dates and timelines provided by the project coordinator.

1.9 PERSONNEL TRAINING

- .1 Before beginning Work, provided 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, at minimum:
 - .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 competent, qualified person.
- .4 Supervisory personnel to complete required training.

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 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .3 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.
- .4 Waste Containers: contain waste in two separate containers.
- .5 Inner container: 0.15 mm thick sealable polyethylene waste bag.
- .6 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.
- .7 Labelling requirements: affix pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site.
- .8 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.
- .9 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.

PART 3 EXECUTION

3.1 SCOPE OF WORK

- .1 Comply with the requirements of this section when performing maximum precautions procedures described above in Section 1.1 Summary for the removal of the asbestos-containing materials described in Section 3 in Designated Substances and Hazardous Materials (section 02 82 10).
- .2 Contractor to quantify all materials prior to submitting bids.

3.2 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.3 PREPARATION

- .1 Before beginning Work, at each access to Asbestos Work Area, 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: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.
 - .2 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Conduct smoke tests to ensure that duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.
 - .3 Preclean moveable furniture and carpeting within proposed work areas using HEPA vacuum and remove from work areas to temporary location.
 - .4 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.
 - .1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.
 - .2 Do not use compressed air to clean up or remove dust from any surface.
 - .3 Pre-clean moveable objects within proposed work areas using HEPA vacuum and remove such objects from work areas and dispose of as clean waste, as directed by the Departmental Representative or cover with poly.
 - .4 Preclean moveable furniture and carpeting within proposed work areas using HEPA vacuum and remove from work areas to temporary location.

- .5 The spread of dust from the work area to be prevented by:
 - .1 Using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls.
 - .2 Using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.
- .6 Cover floor and wall surfaces, where abatement of those surfaces is not required, with FR polyethylene sheeting sealed with tape. Use two layers of rip-proof polyethylene on floors and walls. Enclosure construction techniques and setup to minimize impact to adjacent building materials and finishes.
- .7 Seal off all openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
- .8 Isolate and protect all lights, alarms, heat sensors and smoke detectors, security devices.
- .9 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Fire Commissioner of Canada and Provincial Fire Marshall. The emergency exits within the enclosure should be marked as exits.
- .10 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 0.02 inches of water, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used.
- .11 Implement maximum precaution operations for sealing/isolating/protecting materials if ceiling tiles need to be disturbed.
- .12 Build airlocks at entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.
- .13 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Departmental Representative. Use localized water spraying during fixture removal to reduce fibre dispersal.
- .14 Where application of water is required for wetting asbestos containing materials, shut off electrical power, 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.

- .5 Before removing suspended ceilings, remove friable material on upper surfaces using HEPA vacuum equipment.
 - .1 Remove and clean surfaces of ceiling panels using HEPA vacuum, wrap clean panels in 0.10 mm thick polyethylene, and store in building as directed by Departmental Representative.
 - .2 Clean "T" grid suspension system, disconnect, wrap in 0.10 mm thick polyethylene, and store in building as directed by Departmental Representative.
- .6 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.
 - .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
 - .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.
- .7 Pipe Insulation Removal Using Glove Bag:
 - .1 A glove bag not to be used to remove insulation from a pipe, duct or similar structure if:
 - .2 It may not be possible to maintain a proper seal for any reason including, without limitation:
 - .1 The condition of the insulation.
 - .2 The temperature of the pipe, duct or similar structure.
 - .3 The bag could become damaged for any reason including, without limitation.
 - .1 The type of jacketing.
 - .2 The temperature of the pipe, duct or similar structure.
 - .4 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestos containing contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.
 - .5 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.
 - .6 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.
 - .7 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.
 - .8 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.

- .9 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.
- .10 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.
- .8 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .9 Worker Decontamination Enclosure System:
 - .1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:
 - .1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work areas, with two curtained doorways, one to Shower Room and one to work areas. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.
 - .2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Drains to common sewers are before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.
 - .3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. 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.
- .10 Container and Equipment Decontamination Enclosure System:
 - .1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.
 - .1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.
 - .2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste

- containers and equipment. Pump wastewater through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.
- .3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.
 - .4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.
- .11 Construction of Decontamination Enclosures:
- .1 Build suitable framing for enclosures, and line with polyethylene sheeting sealed with tape. Use two layers of FR polyethylene on floors.
 - .2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
 - .3 The waste decontamination enclosure shall be constructed in addition to the worker decontamination enclosure.
- .12 Separation of Work Areas from Occupied Areas:
- .1 Separate parts of building required to remain in use from parts of building used for asbestos abatement by means of airtight barrier system constructed as follows:
 - .1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create airtight barrier.
 - .2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.
- .13 Maintenance of Enclosures:
- .1 Maintain enclosures in tidy condition.
 - .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
 - .3 Visually inspect enclosures at beginning of each working period.
 - .4 Use smoke methods to test effectiveness of barriers when directed by Departmental Representative.
- .14 Do not begin Asbestos Abatement work until:
- .1 Arrangements have been made for disposal of waste.
 - .2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of wastewater.
 - .3 Work areas, decontamination enclosures and parts of building required to remain in use are effectively segregated.
 - .4 Tools, equipment, and materials waste containers are on hand.

- .5 Arrangements have been made for building security.
- .6 Warning signs are displayed where access to contaminated areas is possible.
- .7 Notifications have been completed and other preparatory steps have been taken.
- .8 Pre-contamination visual inspection has been completed by the Consultant, and authorization to proceed with abatement work is granted.

3.4 PROCEDURES

- .1 Before removing asbestos:
 - .1 Prepare site.
 - .2 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.
- .2 Remove saturated asbestos-containing vermiculite in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate 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 that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 All waste bins brought and stored on site must be covered and locked at all times when in use on the property. Location of bins must be approved by the client.
- .5 After completion of stripping work, wire brushed and wet sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.
- .6 After wire brushing and wet sponging to remove visible asbestos, wet clean entire work area including equipment and access room, and equipment used in process. After 24-hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of work area. Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.
- .7 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

- .8 Cleanup:
 - .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
 - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
 - .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
 - .4 Seal and remove double bagged waste 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 guidelines and regulations for asbestos disposal are followed.
 - .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.5 FINAL CLEANUP

- .1 Following cleaning specified in the Asbestos Work Areas above, and when air sampling shows that asbestos levels inside the enclosure do not exceed 0.010 fibres/cc as determined by the NIOSH 7400A at 400-500X magnification phase contrast illumination, as described in O. Reg. 278/05, proceed with the removal of the polyethylene sheeting.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.
- .5 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.
- .6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.
- .7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of in authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

3.6 INSPECTION

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviation from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, 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 by Contractor for additional labour or materials required to provide specified performance level.
- .3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Departmental Representative may order Work shutdown.
 - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.7 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples on daily basis outside of Asbestos Work Area enclosure in accordance with Provincial/Territorial Occupational Health and Safety Regulations and PWGSC requirements.
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
 - .2 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.
 - .3 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that
- .2 During course of Work, Departmental Representative to measure fibre content of air outside work areas by means air samples analyzed by Phase Contrast Microscopy (PCM).
 - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .3 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Representative will perform air monitoring within Asbestos Work Area by aggressive methods.
 - .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
 - .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
 - .3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Comply with requirements of this Section when performing following Work:
 - .1 Prior to removal from the site and disposal, The following materials containing lead should be subject to toxicity characteristic leaching procedure (TCLP) to determine the toxicity of with respect to lead prior to disposal in accordance with R.,R.O. 1990, Regulation 347 General – Waste Management, as amended (R.R.O., 1990, Reg. 347) under the Environmental Protection act (EPA). If TCLP testing is not completed, contractor to assume paint to be disposed of as lead waste:
 - House**
 - White coloured paint
 - Brown coloured paint
 - Office**
 - White coloured paint
 - Pier**
 - White coloured paint
 - .2 Contractor to quantify and clarify all materials to be removed at the site. No allowances will be made for extras for materials that are noted. The summary of occurrences of asbestos-containing materials is provided in the Stantec Consulting Ltd. report entitled *Designated Substances and Hazardous Building Materials Assessment – SAR Station, Search and Rescue Station (SAR), Cobourg, Ontario*, prepared by Stantec Consulting Ltd. and dated February 21, 2020.

1.2 REFERENCE STANDARDS

- .1 Refer to part 3.2 of Section 02 81 00 for applicable reference standards.

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: Public Works and Government Services Canada (PWGSC) Representative.
- .3 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. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.
- .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

- .5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic metre of air (50 ug/m³) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic metre of air for removal of lead-containing paint by methods noted in paragraph 1.1.
- .6 Competent person: Departmental Representative capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.
- .7 Lead dust: wipe sampling on vertical surfaces 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.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of lead-containing paint waste in accordance with requirements of authority having jurisdiction.
- .2 Provide proof of Contractor's Environmental Liability Insurance.
- .3 Quality Control:
 - .1 Provide Departmental Representative necessary permits for transportation and disposal of lead-containing paint waste and proof that lead-containing paint waste has been received and properly disposed of.
 - .2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial, Territorial and local requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
 - .1 Safety Requirements: worker and visitor protection.
 - .1 Protective equipment and clothing to be worn by workers and visitors in work Area include:
 - .1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.
 - .2 Half mask respirator: half-mask particulate respirator with P100 series filter.
 - .2 Eating, drinking, chewing, and smoking are not permitted in work area.
 - .3 Ensure workers wash hands and face when leaving work area.

- .4 Visitor Protection:
 - .1 Provide approved respirators to Authorized Visitors to work areas.
 - .2 Instruct Authorized Visitors on procedures to be followed in entering and exiting work area.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .2 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm bags or leak proof drums. Label containers with appropriate warning labels.
- .3 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-containing paint to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification.
- .2 Notify Departmental Representative of lead-containing 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 two days before beginning Work on this Project notify following in writing:
 - .1 Provincial Ministry of Labour.
 - .2 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: Project work must be completed on acceptable dates and timelines provided by the project coordinator.

1.9 PERSONNEL TRAINING

- .1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Proper 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 competent, qualified person.
- .4 Supervisory personnel to complete required training.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Polyethylene 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .3 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 lead paint residue.
- .4 Lead waste containers: Type acceptable to dump operator with tightly fitting covers and 0.15 mm thickness 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 One Supervisor for every ten workers is required.
- .2 Supervisor must remain within work area during disturbance, removal, or handling of lead-containing paints.

3.2 PREPARATION

- .1 Remove and store items to be salvaged or reused.
 - .1 Protect and wrap items and transport and store in area specified by Departmental Representative.
- .2 Work Area:
 - .1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
 - .2 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.
 - .3 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.
 - .4 Seal off openings with polyethylene sheeting and seal with tape.
 - .5 Protect floor surfaces covered from wall to wall with polyethylene sheets.
 - .6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.
 - .7 Where water application is required for wetting lead-containing materials, provide temporary water supply appropriately sized for application of water as required.
 - .8 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 cables and equipment.
- .3 Do not start work until:
 - .1 Arrangements have been made for disposal of waste.
 - .2 Tools, equipment, and materials waste containers are on site.
 - .3 Arrangements have been made for building security.
 - .4 Notifications have been completed and preparatory steps have been taken.

3.3 LEAD ABATEMENT

- .1 Removal of with lead-containing coatings with the use of non-powered hand tools other than manual scraping and sanding in the following areas:
 - .1 White coloured paint on exterior wood finishing (trim, etc.) – House
 - .2 White coloured paint on interior wood finishing (trim, etc.) and plaster ceilings – House

- .3 Brown coloured paint on interior door frames, shelves, and walls of Bedroom 2 – House
 - .4 White coloured paint on wood siding in locker room – Office Building
 - .5 White coloured paint on wood siding beneath exterior vinyl siding – Office building
 - .6 White coloured paint on interior and exterior doors and door frames – Pier Building
 - .7 White coloured paint on interior wood board walls and ceiling – Pier Building
- .2 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .3 After completion of stripping work, wire brush and wet sponge surface from which lead-containing paint has been removed to remove visible material. During this work keep surfaces wet.
- .4 After wire brushing and wet sponging to remove visible lead-containing paint, and after encapsulating lead-containing material impossible to remove, wet clean entire work area, and equipment used in process. After inspection by Departmental Representative, apply continuous coat of slow drying sealer to surfaces of work area. Do not disturb work area for [8] hours no entry, activity, ventilation, or disturbance during this period.

3.4 INSPECTION

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, 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 by Contractor for additional labour or materials required to provide specified performance level.

3.5 FINAL CLEANUP

- .1 Following cleaning and when lead wipe surfaces sampling are 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 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

3.6 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.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 02 82 10 Designated Substances and Hazardous Materials.
- .2 02 82 00.01 Asbestos Abatement - Minimum Precautions.
- .3 02 82 00.03 Asbestos Abatement - Maximum Precautions.
- .4 02 83 10 Lead Management.

1.2 REFERENCES

- .1 Definitions:
 - .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
 - .2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
 - .3 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
 - .4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .2 Reference Standards:
 - .1 CSA International
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
 - .2 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
 - .3 U.S. Environmental Protection Agency (EPA)
 - .1 EPA CFR 86.098-10, Emission standards for 1998 and later model year Otto-cycle heavy-duty engines and vehicles.
 - .2 EPA CFR 86.098-11, Emission standards for 1998 and later model year diesel heavy-duty engines and vehicles.

- .3 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 to:
 - .1 Verify project requirements.
 - .2 Verify existing site conditions adjacent to demolition work.
 - .3 Co-ordination with other construction subtrades.
 - .2 Hold project meetings every bi-weekly.
 - .3 Ensure key personnel attend.
 - .4 WMC must provide written report on status of waste diversion activity at each meeting.
 - .5 Departmental Representative will provide written notification of change to meeting schedule established upon contract award [24] hours prior to scheduled meeting.
- .2 Scheduling:
 - .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
 - .1 In event of unforeseen delay notify Departmental Representative in writing.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 and Section 01 74 20.
- .2 WMC is responsible for fulfilment of reporting requirements.
- .3 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 20 and indicate:
 - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tippage.
 - .5 Name and address of haulers, waste facilities and waste receiving organizations.
- .4 Submit copies of certified weigh bills from authorized disposal sites and reuse and recycling facilities for material removed from site on a monthly basis.
 - .1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in Waste Reduction Workplan.
- .5 Shop Drawings:
 - .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures

- and underpinning.
- .2 Submit demolition drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Ensure Work is performed in compliance with CEPA, CEAA, TDGA and applicable Provincial/Territorial and Municipal regulations.

1.6 SITE CONDITIONS

- .1 Environmental protection:
 - .1 Ensure Work is done in accordance with Section 01 35 43.
 - .2 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .3 Fires and burning of waste or materials is not permitted on site.
 - .4 Do not bury rubbish waste materials.
 - .5 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout project.
 - .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
 - .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.
 - .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
 - .9 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
 - .10 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

1.7 EXISTING CONDITIONS

- .1 If material resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify Departmental Representative immediately. Proceed only after receipt of written instructions have been received from Departmental Representative.
- .2 Structures to be demolished are based on their condition on date that bid is accepted.
 - .1 Remove, protect and store salvaged items as directed by Departmental Representative. Salvage items as identified by Departmental Representative. Deliver to Departmental Representative as directed.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Equipment and heavy machinery:
 - .1 On-road vehicles to: CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations and CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .2 Off-road vehicles to: EPA CFR 86.098-10 and EPA CFR 86.098-11.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to: specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .2 Protection of in-place conditions:
 - .1 Work in accordance with Section 01 35 43.
 - .2 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grade and properties to remain.
 - .1 Provide bracing, shoring and underpinning as required.
 - .2 Repair damage caused by demolition as directed by Departmental Representative.
 - .3 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
- .3 Surface Preparation:
 - .1 Disconnect and re-route electrical and telephone service lines entering buildings to be demolished.
 - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
 - .2 Disconnect and cap designated mechanical services.
 - .1 Natural gas supply lines: remove in accordance with gas company requirements.
 - .2 Sewer and water lines: remove and dispose of as indicated.
 - .3 Other underground services: remove and dispose of as indicated.
 - .3 Do not disrupt active or energized utilities designated to remain undisturbed.

3.2 DEMOLITION

- .1 Do demolition work in accordance with Section 01 56 00.
- .2 Blasting operations not permitted during demolition.
- .3 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.
- .4 Prior to start of Work remove contaminated or hazardous materials listed as hazardous from site and dispose of at designated disposal facilities in safe manner and in accordance with TDGA and other applicable requirements and Section 02 82 10.
- .5 Crush concrete generated due to demolition of foundations to size suitable for recycling
- .6 At end of each day's work, leave Work in safe and stable condition.
- .7 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
- .8 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
- .9 Use natural lighting to do Work where possible.
 - .1 Shut off lighting except those required for security purposes at end of each day.
- .10 Removals include furniture within existing buildings to be demolished.

3.3 ANTENNA DEMOLITION

- .1 Remove existing antenna and supporting structure.
 - .1 Dispose of existing antenna and supporting structure.
- .2 Protection:
 - .1 Implement effective controls to catch/collect all tower debris during demolition, specifically paint.
 - .2 Implement effective controls to prevent injury to workers, property, and local traffic.
- .3 Preparation:
 - .1 Erect warning signs and barricades.
 - .2 Ensure all environmental protection/mitigation measures are in place.
 - .3 Ensure all items identified for salvage have been removed and stored.
- .4 Demolition:
 - .1 Remove and dispose of existing antenna
 - .2 Ensure that demolition does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

- .3 Ensure demolition is undertaken safely. If at any period during demolition the safety of the Contractor's staff cannot be maintained take preventative measures, stop work and immediately notify Departmental Representative.
- .5 Disposal:
 - .1 All material is to be disposed of off-site and a licensed disposal/recycling facility.

3.4 CLEANING

- .1 Develop Construction Waste Management Plan related to Work of this Section.
- .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 Divert excess materials from landfill to site approved Departmental Representative.
- .4 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .5 Supply separate, clearly marked disposal bins for categories of waste material.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A1060/A1060M-16b, Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .2 ASTM A1064/A1064M-18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .3 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
 - .4 ASTM D1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .3 CSA International
 - .1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .3 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Shop Drawings:
 - .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and necessary details of reinforcing.
 - .2 Submit drawings showing formwork and falsework design to: CSA A23.1/A23.2.
 - .3 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Provide testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .4 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.3 QUALITY ASSURANCE

- .1 Provide to Departmental Representative, 4 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

.1 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by the Departmental Representative.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
 - .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 DESIGN CRITERIA

- .1 Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

2.2 MATERIALS

- .1 Cement: to CSA A3001, Type GU.
- .2 Blended hydraulic cement: Type GUb to CSA A3001.
- .3 Water: to CSA A23.1/A23.2.
- .4 Reinforcing bars: to CSA G30.18, Grade 400, minimum 30% recycled content.
- .5 Welded steel wire fabric: to ASTM A1060/A1060M or ASTM A1064/A1064M, flat sheets only, minimum 30% recycled content.
- .6 Premoulded joint filler:
 - .1 Bituminous impregnated fibreboard: to ASTM D1751.
- .7 Joint sealer/filler: grey to CAN/CGSB-19.24, Type 1, Class B.
- .8 Sealer: proprietary poly-siloxane resin blend.
- .9 Other concrete materials: to CSA A23.1/A23.2.

2.3 MIXES

- .1 Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: As indicated on structural construction drawings.
 - .2 Compressive strength at 28 days: As indicated on structural construction drawings, 25 MPa minimum.
 - .3 Aggregate size 20 mm maximum.
 - .4 Air content category: 1.
 - .5 Slump: to CAN/CSA-A23.1

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Provide Departmental Representative 24 hours notice before each concrete pour.
- .2 Place concrete reinforcing in accordance with CSA 23.1/A23.2.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.
- .4 Protect previous Work from staining.
- .5 Clean and remove stains prior to application of concrete finishes.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in.
 - .2 Sleeves and openings greater than 100 mm x 100 mm not indicated, must be reviewed by Departmental Representative.

3.3 FINISHES

- .1 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA A23.1/A23.2.
- .2 Interior floor slabs requiring smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CSA A23.1/A23.2 to Table 21 Class B Flat to produce hard, smooth, dense trowelled surface free from blemishes.

- .3 Floor slabs to receive mortar bed for ceramic or quarry tile: screed to correct grade to provide broomed texture.
- .4 Equipment pads: provide smooth trowelled surface.
- .5 Pavements, walks, curbs and exposed site concrete:
 - .1 Screed to plane surfaces and use magnesium floats.
 - .2 Provide round edges and joint spacings using standard tools.
 - .3 Trowel smooth to provide lightly brushed non-slip finish.

3.4 CONTROL JOINTS

- .1 Cut control joints in slabs on grade at locations indicated, to CSA A23.1/A23.2 and install specified joint sealer/filler.

3.5 EXPANSION AND ISOLATION JOINTS

- .1 Install premoulded joint filler in expansion and isolation joints full depth of slab flush with finished surface to CSA A23.1/A23.2.

3.6 CURING

- .1 Use curing compounds compatible with applied finish on concrete surfaces free of bonding agents and to CSA A23.1/A23.2.

3.7 SEALING APPLICATION

- .1 After curing is complete, apply poly-siloxane resin blend sealer at 4 m²/L.

3.8 SITE TOLERANCES

- .1 Concrete floor slab finishing tolerance to CSA A23.1/A23.2.

3.9 FIELD QUALITY CONTROL

- .1 Concrete testing: to CSA A23.1/A23.2 by testing laboratory designated and paid for by Departmental Representative.

3.10 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate cleaning area for tools to limit water use and runoff.
- .4 Cleaning of concrete equipment to be done in accordance with Section 01 35 43.
- .5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 05 21 00 - Steel Joist Framing.
- .2 Section 05 31 00 - Steel Decking.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A193/A193M-19, Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
 - .4 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .5 ASTM F3125/F3125M-19, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
 - .1 CISC/CPMA 1-73b, Quick-Drying One-Coat Paint for Use on Structural Steel.
 - .2 CISC/CPMA 2-75, Quick-Drying Primer for use on Structural Steel.
- .4 Canadian Standards Association (CSA)
 - .1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16-14, Design of Steel Structures.
 - .3 CSA S136-16 Package, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - .4 CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W55.3-08(R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .7 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
- .5 Master Painters Institute
 - .1 MPI-INT 5.1-2020, Structural Steel and Metal Fabrications.
 - .2 MPI-EXT 5.1-2020, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC)
 - .1 SSPC SP 6/NACE No. 3-06, Joint Surface Preparation Standard: Commercial Blast Cleaning.

1.3 DESIGN REQUIREMENTS

- .1 Design details and connections in accordance with requirements of CSA S16 to resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Ontario, Canada for non standard connections.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00.
- .2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.
- .3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the province of Ontario, Canada.

1.5 QUALITY ASSURANCE

- .1 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials 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 for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility

approved by Departmental Representative.

- .5 Divert unused paint material from landfill to official hazardous material collections site approved by Departmental Representative.
- .6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Structural steel: to CSA G40.20/G40.21 Grade as indicated, minimum 30% recycled content.
- .2 Anchor bolts: to CSA G40.20/G40.21, Grade 300W, minimum 30% recycled content.
- .4 Bolts, nuts and washers: to ASTM A307, minimum 30% recycled content.
- .5 Welding materials: to CSA W49 and certified by Canadian Welding Bureau.
- .6 Shop paint primer: to CISC/CPMA 2 with surface to SSPC SP-6, Ecologo certified.
- .7 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A123/A123M, minimum zinc coating of 600 g/m², Coating Grade 85.
- .8 Shear studs: to CSA W59, Appendix H.

2.2 FABRICATION

- .1 Fabricate structural steel in accordance with CSA S16 and in accordance with reviewed shop drawings.
- .2 Install shear studs in accordance with CSA W59.
- .3 Continuously seal members by continuous welds. Grind smooth.

2.3 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CSA S16 except where members to be encased in concrete.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface according to SSPC-SP-6.
- .3 Apply one coat of primer in shop to steel surfaces to achieve minimum dry film thickness of 15 to 20 mils (0.381 to 0.508 mm), except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connections.
 - .3 Surfaces and edges to be field welded.

- .4 Faying surfaces of friction-type connections.
- .5 Below grade surfaces in contact with soil.

- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Structural steel work: in accordance with CSA S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 01 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 MARKING

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.3 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CSA S16 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Departmental Representative.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.

- .3 Submit test reports to Departmental Representative within 3 weeks of completion of inspection.
- .4 Test shear studs in accordance with CSA W59.

3.5 FIELD PAINTING

- .1 Touch up damaged surfaces and surfaces without shop coat with primer to SSPC-SP-6/NACE No. 3 except as specified otherwise. Apply in accordance with CAN/CGSB-85.10.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 05 12 23 Structural Steel for Buildings.
- .2 Section 05 55 00 Metal Fabrications.
- .3 Section 09 91 13 Exterior Painting.
- .4 Section 09 91 23 Interior Painting.

1.2. SUMMARY

- .1 This section includes requirements regarding the appearance, surface preparation and integration of Architecturally Exposed Structural Steel (AESS) only.
- .2 For technical requirements, refer to the other sections of Division 5 Structural Steel.
- .3 This section applies to any structural steel members noted as AESS.
- .4 Section 05 12 23 AESS is Category AESS 3.
- .5 Section 05 55 00 AESS is Category AESS 4.

1.3 REFERENCES

- .1 Canadian Institute for Steel Construction
 - .1 CISC Code of Standard Practice - Eighth Edition.
- .2 CSA International
 - .1 CSA S16:19, Design of Steel Structures.
 - .2 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
- .3 ASTM International
 - .1 ASTM A780/A780M-09(2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

1.3. SUBMITTALS

- .1 Submit each item below according to the Section 01 33 00.
 - .1 Shop Drawings detailing fabrication of AESS components:
 - .1 Provide erection drawings clearly indicating which members are considered as AESS members and their Category;
 - .2 Include details that clearly identify all of the requirements listed in sections 2.3 ``Fabrication`` and 3.3 ``Erection`` of this specification. Provide connections for AESS consistent with concepts, if shown on the Structural Design Documents;

- .3 Indicate welds by standard CWB symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein;
- .4 Indicate type, finish of bolts. Indicate which side of the connection bolt heads should be placed;
- .5 Indicate any special tolerances and erection requirements.

1.4. QUALITY ASSURANCE

- .1 Comply with applicable provisions of the following specifications and documents:
 - .1 CISC Code of Standard Practice for Structural Steel.
- .2 Visual samples when specified may include any of the following:
 - .1 3-D rendering of specified element;
 - .2 Physical sample of surface preparation and welds;
 - .3 First off inspection: First element fabricated for use in finished structure subject to alterations for subsequent pieces.
 - .4 Mockups: As specified in Structural Design Document. Mockups are either scaled or full-scale. Mockups are to demonstrate aesthetic effects as well as qualities of materials and execution:
 - .1 Mockups may have finished surface (including surface preparation and paint system);
 - .2 Departmental Representative's approval of mockups is required before starting fabrication of final units;
 - .3 Mockups are retained until project is completed;
 - .4 Approved full-scale mockups may become part of the completed work.

1.5. DELIVERY, STORAGE, AND HANDLING

- .1 Ensure that all items are properly prepared, handled and/or packaged for storage and shipping to prevent damage to product.
- .2 Erect finished pieces using softened slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 General: Meet requirements of Section 05 12 23.
- .2 Specialty bolts: all nuts and bolts are custom fabricated stainless steel with square heads. Do not emboss grade on bolt heads.

2.2 FABRICATION

- .1 Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Departmental Representative.
- .2 Fabricate AESS with surface quality consistent with the AESS Category and visual samples if applicable.

2.3 SHOP CONNECTIONS

- .1 Bolted Connections: Make in accordance with Section 05 12 23. Provide bolt type and finish as specified and place bolt heads as indicated on the approved shop drawings.
- .2 Welded Connections: Comply with CSA W59 and Section 05 12 23. Appearance and quality of welds shall be consistent with the Category and visual samples if applicable. Assemble and weld built-up sections by methods that will maintain alignment of members to the tolerance of this Subsection.

2.4 ARCHITECTURAL REVIEW

- .1 The Departmental Representative shall review the AESS steel in place and determine acceptability based on the Category and visual samples (if applicable). The Fabricator/Erector will advise the Departmental Representative the schedule of the AESS Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 The erector shall check all AESS members upon delivery for twist, kinks, gouges or other imperfections, which might result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

3.2 PREPARATION

- .1 Provide connections for temporary shoring, bracing and supports only where noted on the approved shop erection drawings. Temporary connections shown shall be made at locations not exposed to view in the final structure or as approved by the Departmental Representative.
- .2 Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the AESS through the process of erection.

3.3 ERECTION

- .1 Set AESS accurately in locations and to elevations indicated, and according to CSA S16.
- .2 In addition to the special care used to handle and erect AESS, employ the proper erection techniques to meet the requirements of the specified AESS Category:

1. AESS Erection tolerances: Erection tolerances shall meet the requirements of standard frame tolerances for structural steel per CSA S16;
2. Bolt Head Placement: All bolt heads shall be placed as indicated on the structural design document. Where not noted, the bolt heads in a given connection shall be placed to one side;
3. Removal of field connection aids: Run-out tabs, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure. Welds at run-out tabs shall be removed to match adjacent surfaces and ground smooth. Holes for erection bolts shall be plug welded and ground smooth where specified;
4. Filling of connection access holes: Filling shall be executed with proper procedures to match architectural profile, where specified;
5. Field Welding: Weld profile, quality, and finish shall be consistent with Category and visual samples, if applicable, approved prior to fabrication.

3.4 FIELD CONNECTIONS

- .1 Bolted Connections: Make in accordance with Section 05 12 23. Provide bolt type and finish as specified and place bolt heads as indicated on the approved shop drawings.
- .2 Welded Connections: Comply with CSA W59 and Section 05 12 23. Appearance and quality of welds shall be consistent with the Category and visual samples if applicable. Assemble and weld built-up sections by methods that will maintain alignment of members to the tolerance of this Subsection.
3. Assemble and weld built-up sections by methods that will maintain alignment of axes. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances.

3.5 ARCHITECTURAL REVIEW

- .1 The Departmental Representative shall review the AESS steel in place and determine acceptability based on the Category and visual samples (if applicable). The Fabricator/Erector will advise the Departmental Representative of the schedule of the AESS Work.

3.6 ADJUSTING AND CLEANING

- .1 Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touchup work shall be done in accordance with manufacturer's instructions.
- .2 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .2 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA)
 - .1 CISC/CPMA 2-75-1975, Quick-Drying, Primer for Use on Structural Steel.
 - .2 CISC/CPMA 1-73a-1975, Quick-Drying, One-Coat Paint for Use on Structural Steel.
- .3 CSA International
 - .1 CSA G40.20-13(R2018)/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16:19, Design of Steel Structures.
 - .3 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
 - .4 CSA W55.3-08(R2013), Certificate of Companies for Resistance Welding of Steel and Aluminum.
 - .5 CSA W59-18, Welded Steel Construction (Metal Arc Welding), Metric.
- .4 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - 2020.

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 steel joist framing 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 Indicate on erection drawings, relevant details such as joist mark, depth, spacing, bridging lines, bearing, anchorage and details.
 - .3 Indicate particulars, on shop drawings, relative to joist geometry, framed openings, splicing details, bearing and anchorage. Include member size, properties, specified and factored member loads, and stresses under various loadings, deflection and camber.

1.3 QUALITY ASSURANCE

- .1 Submit 3 copies of mill test reports at least 4 weeks prior to fabrication of steel joists and accessories. Reports to show:
 - .1 Chemical and physical properties.
 - .2 Other details of steel to be incorporated into work.
 - .3 Certification by qualified metallurgists confirming that tests

conform to requirements of CSA G40.20/G40.21

1.4 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- .1 Design steel joists and bridging to carry loads indicated in joist schedule shown on drawings to CSA S16.
- .2 Design joists and anchorages for uplift forces as indicated.
- .3 Ensure joists are manufactured to consider load effects due to fabrication, erection and handling.

2.2 MATERIALS

- .1 Open web steel joists: to CSA S16.
- .2 Structural steel: to CSA G40.20/G40.21.
- .3 Welding materials: to CSA W59.
- .4 Shop paint primer: to CISC/CPMA-2.

2.3 FABRICATION

- .1 Fabricate steel joists and accessories as indicated in accordance with CSA S16 and in accordance with reviewed shop drawings.
- .2 Weld in accordance with CSA W59.
- .3 Provide chord extensions where indicated.
- .4 Provide diagonal or horizontal bridgings and anchorages as indicated.

2.4 SHOP PAINTING

- .1 Clean, prepare and shop prime surfaces of steel joists to CSA S16, SSPC SP-6.
- .2 Clean members of loose mill scale, rust, oil, dirt and other foreign matter. Prepare surfaces to SSPC SP1 brush blast.
- .3 Apply one coat of CISC/CPMA 2 primer to steel surfaces to achieve dry film thickness of .065 mm to .080 mm maximum except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connectors and steel decks.
 - .3 Surfaces and edges to be field welded.
 - .4 Faying surfaces of friction-type connections.
 - .5 Below grade surfaces in contact with soil.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint bolts, nuts, sharp edges and corners before prime coat is dry.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for steel joist framing 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 Do structural steel work: to CSA S16.
- .2 Do welding: in accordance with CSA W59.
- .3 Ensure installers are certified to CSA W47.1 for fusion welding or CSA W55.3 for resistance welding.
- .4 Submit certification that welded joints are qualified by Canadian Welding Bureau.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative.
- .2 Testing laboratory will inspect representative joists for integrity, accuracy of fabrication and soundness of welds. Testing laboratory will also monitor test loading of joists used by manufacturer to verify design and check representative field connections. Departmental Representative will determine extent of and identify all inspections.
- .3 Submit test report to Departmental Representative within 5 days after completion of inspection.
- .4 Departmental Representative will pay costs of tests as specified in Section 01 29 83.

3.4 ERECTION

- .1 Erect steel joists and bridging as indicated to CSA S16 and in accordance with reviewed erection drawings.
- .2 Complete installation of bridging and anchorages before placing construction loads on joists.
- .3 Field cutting or altering joists or bridging that are not shown on shop drawings: to approval of Departmental Representative.
- .4 Clean and touch up shop primer to bolts, welds, burned or scratched surfaces at completion of erection.

3.5 FIELD PAINTING

- .1 Touch up all damaged surfaces and surfaces without shop coat with CISC/CPMA-2 in accordance with manufacturers' recommendations.

3.6 CLEANING

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

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.

- .2 Repair damage to adjacent materials caused by steel joist framing installation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 05 12 23 - Structural Steel.
- .2 Section 05 21 00 - Steel Joist Framing.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55%Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.79-16, Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
 - .2 CSA S16:19, Design of Steel Structures.
 - .3 CSA S136-16 PACKAGE, North American Specification for the Design of Cold Formed Steel Structural Members.
 - .4 CSA W47.1:19 Certification of Companies for Fusion Welding of Steel Structures.
 - .5 CSA W55.3-08(R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .6 CSA W59-18, Welded Steel Construction, (Metal Arc Welding).
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 10M-13, Standard for Steel Roof Deck.
 - .2 CSSBI 12M-15, Standard for Composite Steel Deck.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings erection and shoring drawings in accordance with Section 01 33 00.
- .2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.
- .4 Indicate details of temporary shoring of steel deck, such as location, time and duration of placement and removal of shoring for concrete fill decks.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Divert unused metal 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 location where it will pose health or environmental hazard.
- .5 Dispose of unused caulking material at official hazardous material collections site approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, minimum 30% recycled content, with ZF75 coating, for interior surfaces not exposed to weather, unpainted finish, 0.76 mm minimum base steel thickness.
- .2 Closures: in accordance with manufacturer's recommendations.
- .3 Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.76 mm, minimum 30% recycled content. Metallic coating same as deck material.
- .4 Primer: zinc rich, ready mix to CAN/CGSB-1.181, Ecologo certified.

2.2 TYPES OF DECKING

- .3 Composite steel deck: 0.76 mm minimum base steel thickness, 38 mm deep profile, non-cellular embossed fluted profile, interlocking side laps.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Structural steel work: in accordance with CSA S16.
- .2 Welding: in accordance with CSA W59, except where specified otherwise.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

- .1 Erect steel deck as indicated and in accordance with CSA S16 and in accordance

- with approved erection drawings.
- .2 Lap ends: to 50 mm minimum.
 - .3 Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.
 - .4 Prior to concrete placement, steel deck to be free of soil, debris, standing water, loose mil scale and other foreign matter.
 - .5 Temporary shoring, if required, to be designed to support construction loads, wet concrete and other construction equipment. Do not remove temporary shoring until concrete attains 75% of its specified 28 day compression strength.
 - .6 Place and support reinforcing steel as indicated.

3.3 CLOSURES

- .1 Install closures in accordance with approved details.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

- .1 No reinforcement required for openings cut in deck which are smaller than 150 mm square.
- .2 For deck openings with any one dimension greater than 150 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

- .1 Install connections in accordance with CSSBI and manufacturer recommendations as indicated.

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 06 16 43 - Exterior Gypsum Sheathing.
- .2 Section 07 61 00 - Sheet Metal Roofing

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 CSA International
 - .1 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel Structures.
 - .2 CSA W55.3-08 (R2018), Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .3 CSA W59-18, Welded Steel Construction (Metal Arc Welding) Metric .
 - .4 CSA S136:19, Package, North American Specification for the Design of Cold Formed Steel Structural Members.
 - .5 CSA S136S1:19, Supplement 1 to S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI Fact Sheet #3 2006, Care and Maintenance of Prefinished Sheet Steel Building Products.
 - .2 CSSBI Technical Bulletin Vol. 7, No. 2 September 2011, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.
 - .3 CSSBI S5-2011, Guide Specification for Wind Bearing Steel Studs.
- .5 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - 2020.

1.3 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 structural metal studs 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 Ontario.
 - .2 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
 - .3 Indicate locations, dimensions, openings and requirements of related work.
 - .4 Indicate welds by welding symbols as defined in CSA W59.
- .4 Certificates: prior to beginning Work, submit: 2 certified copies of mill reports covering material properties.

1.4 DESIGN CRITERIA

- .1 Design shall be based on Limit States Design principles using factored loads and resistances.
- .2 Loads and load factors shall be in accordance with the National Building Code of Canada. For wind load calculations the reference velocity pressure, q , shall be based on a 1 in 50 probability of being exceeded in any one year.
- .3 Resistances and resistance factors shall be determined in accordance with the National Building Code of Canada and CSA S136 and CSA S136S1.
- .4 Stud depths are shown on the drawings. Adjust stud material thickness and spacing as required by the design criteria. Use greater or lesser stud depths only if approved in writing by the DEPARTMENTAL Representative.
- .5 Unless otherwise noted, space wall studs at 400 mm on centre mm maximum. Use lesser stud spacing if required by the design criteria.
- .6 Space wall studs at 300 mm on centre maximum for exterior walls of Rooms 102C, 103A, 103B and 103C. Make provision for Protection Material to be installed on exterior face of studs.
- .7 For studs, conform to the design thicknesses as follows. Use greater stud thicknesses if required by the design criteria.

Stud Depth (mm)	Minimum Base Steel Thickness Exclusive of Coating (mm)	Design Thickness Exclusive of Coating (mm)
92	0.836	0.879
102	0.836	0.879
152	0.836	0.879
203	1.087	1.146

- .8 The minimum thickness for bridging channel shall be 1.087 mm. Use greater bridging channel design thickness if required by the design criteria.

- .9 The minimum thickness for clip angles shall be 1.367 mm. Use greater clip angle thickness if required by the design criteria.
- .10 Maximum flexural deflections under specified wind loads shall be limited to L/360.
- .11 Design connections to accommodate vertical deflection movement of the structure, frame shortening and vertical tolerances without imposing axial loads onto the framing. Leave minimum gap of 12mm. Larger gaps may be required to accommodate structural movement.
- .12 Limit free play in connections perpendicular to the plane of the framing to ± 0.5 mm relative to the building structure.
- .13 Design components and assemblies to accommodate specified erection tolerances of the structure.
- .14 Design bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Collateral sheathing may be used to help restrain member rotation and translation perpendicular to minor axis . Do not rely on collateral sheathing to help restrain member rotation and translation perpendicular to minor axis . Provide bridging at 1524 mm on centre maximum. Space bridging at equal intervals over the span length.
- .15 Design anchorage and splice details for bridging.
- .16 Design for local loading due to anchorage of cladding and interior wall mounted fixtures where shown.
- .17 Connections between wind bearing steel stud members shall be by bolts, welding or sheet metal screws.
- .18 Provide head, sill and jamb members and connections to frame openings larger than 100 mm in any dimension.
- .19 Anchor top and bottom track to the structure at a maximum spacing of 813 mm on centre. Closer spacing may be required to satisfy structural requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

- .4 installation in accordance with CSSBI Sheet Steel Facts #3.
- .4 Handle and protect galvanized materials from damage to zinc coating.
- .5 Replace defective or damaged materials with new.
- .4 Waste Management and Disposal: Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Steel: to CSA S136 and CSA S136S1, fabricated from ASTM A653/A653M, Grade 340 steel.
- .2 Zinc coated steel sheet: quality to ASTM A653/A653M, with Z275 designation coating.
- .3 Aluminum-zinc alloy coated steel sheet: quality to ASTM A792/A792M, with AZM180 designation coating.
- .4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .5 Screws: pan head or low profile head , self-drilling, self-tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008 mm, length to suit.
- .6 Anchors: concrete expansion anchors or other suitable drilled type fasteners.
- .7 Bolts, nuts, washers: hot dipped galvanized to ASTM A123/A123M, 600 g/m² zinc coating, Coating Grade 85.
- .8 Touch up primer: zinc rich, to CAN/CGSB-1.181.

2.2 STEEL STUD DESIGNATIONS

- .1 Colour code: to CSSBI Technical Bulletin Vol.7, No. 2.

2.3 METAL FRAMING

- .1 Steel studs: to CSA S136 and CSA S136S1, fabricated from metallic coated steel.
- .2 Stud tracks: fabricated from same material and finish as steel studs.
 - .1 Bottom track: single piece.
 - .2 Top track: single piece.
- .3 Bridging: fabricated from same material and finish as studs, 38 x 12 mm.
- .4 Angle clips: fabricated from same material and finish as studs, 38 x 38 mm x depth of steel stud.
- .5 Tension straps and accessories: as recommended by manufacturer.

2.4 SOURCE QUALITY CONTROL

- .1 Ensure mill reports covering material properties are reviewed by Departmental Representative.

2.5 ACCESSORIES

- .1 Thermally broken Z-Girts, size as per drawings, engineered to meet structural requirements.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 GENERAL

- .1 Weld in accordance with CSA W59.
- .2 Certification of companies: to CSA W47.1 for fusion welding and CSA W55.3 for resistance welding.
- .3 Do structural metal stud framing work to CSSBI S5.

3.3 ERECTION

- .1 Erect components to requirements of reviewed shop drawings.
- .2 Anchor tracks securely to structure at 800 mm on centre maximum, unless lesser spacing prescribed on shop drawings.
- .3 Erect studs plumb, aligned and securely attached with 2 screws minimum or welded in accordance with manufacturer's recommendations.
- .4 Seat studs into bottom tracks and single piece top track.
- .5 Install studs at not more than 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .6 Brace steel studs with horizontal internal bridging at 1500 mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.
- .7 Frame openings in stud walls to adequately carry loads by use of

additional framing members and bracing as detailed on shop drawings.

- .8 Touch up welds with coat of zinc rich primer.

3.4 ERECTION TOLERANCES

- .1 Plumb: not to exceed 1/500th of member length.
- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: not more than +/- 3 mm from design spacing.
- .4 Gap between end of stud and track web: not more than 4 mm.

3.5 CUTOUTS

- .1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to centre Spacing (mm)
92	40 maximum	105 maximum	600 minimum
102	40 maximum	105 maximum	600 minimum
152	65 maximum	115 maximum	600 minimum

- .2 Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

3.6 CLEANING

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

3.7 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .4 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .5 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .6 ASTM A924/A924M-19, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - .7 ASTM B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- .2 CSA International
 - .1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16:19, Design of Steel Structures.
 - .3 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.
 - .4 CSA W59:19, Welded Steel Construction (Metal Arc Welding).
- .3 Environmental Choice Program
 - .1 CCD-047-98(R2005), Architectural Surface Coatings.
 - .2 CCD-048-98(R2006), Surface Coatings - Recycled Water-borne.
- .4 Green Seal Environmental Standards (GS)
 - .1 GS-11-2015, Edition 3.2, Paints and Coatings.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .6 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - 2020.

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 sections, plates, pipe, tubing and bolts and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS SDS.
 - .1 For finishes, coatings, primers, and paints applied on site:

indicate VOC concentration in g/L.

- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.3 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certifications: submit 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.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W, minimum 30% recycled content.
- .2 Steel pipe: to ASTM A53/A53M, minimum 30% recycled content.
- .3 Welding materials: to CSA W59.
- .4 Welding electrodes: to CSA W48 Series.
- .5 Bolts and anchor bolts: to ASTM A307.
- .6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m², Coating Grade 85, to ASTM A123/A123M.
- .2 Shop coat primer: MPI- INT 5.1A and EXT 5.1A in accordance with chemical component limits and restrictions requirements and VOC limits of GS-11.
- .3 Zinc primer: zinc rich, ready mix to MPI-INT 5.2C and EXT 5.2C in accordance with chemical component limits and restrictions requirements and VOC limits of GS-11.

2.4 ISOLATION COATING

- .1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.5 SHOP PAINTING

- .1 Primer: VOC limit 250 g/L maximum to GS-11.
- .2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
- .4 Clean surfaces to be field welded; do not paint.

2.6 ENTRANCE FLOOR GRILLES

- .1 Materials:
 - .1 Aluminum: ASTM B221M, extruded.
 - .2 Floor grilles: 915 mm wide x 915 mm long x 38 mm deep extruded AA 6101-T6 aluminum alloy tread rails joined mechanically by extruded AA 6101-T6 aluminum alloy key lock bars. Clear anodized finish.

- .3 Process with pan: Framing members shall be fabricated of AA 6063-T5 aluminum alloy, coped at corners and assembled with stainless steel screws, complete with 1.5 mm aluminum waterproof pan secured to bottom surface of frame. Where drain provisions are provided by mechanical, provide drain and stainless steel strainer. Surfaces in contact with cementitious materials shall receive one shop coat of isolation coating. Aluminum finish shall be clear anodized. Coordinate drain location with the mechanical work.
- .5 Bituminous paint: To provide dielectric separation and which will dry to be tack-free and able to withstand high temperatures.
- .6 Provide accessories required for complete installation.
- .7 Verify site dimensions and conditions prior to fabrication; fabricate to suit.
- .8 Ensure work is square, true, straight, level and accurate to required size and shape with joints closely fitted and properly secured.
- .9 Fabrications shall be free of distortion and/or defects detrimental to appearance or performance.
- .10 Splices in units wider than 3660 mm shall not be positioned in the middle of door openings.

2.7 EXTERIOR FENCE

- .1 Supply and install a total steel fence system. The system shall include all components (i.e., pickets, rails, posts, gates, hardware and concrete footers) required.
- .2 Material:
 - .1 Steel material for fence framework (i.e. tubular pickets, rails and posts), when galvanized prior to forming, shall conform to the requirements of ASTM A924/A924M, with a minimum yield strength of 310 MPa. The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 276 g/m², Coating Designation Z180.
 - .2 Material for fence pickets shall be 19 mm square x 1.14 mm (17 Ga.) tubing. The cross-sectional shape of the rails shall be 38 mm square and a minimum thickness of 1.63 mm (14 Ga.). Picket holes in the rail shall be spaced 120 mm O.C. Picket retaining rods shall be 3.2 mm diameter galvanized steel. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections. Fence posts and gate posts to be 100 mm square and 1.63 mm (14 Ga.) including standard flat cap.
- .3 Fabrication:
 - .1 Pickets, rails and posts shall be pre-cut to specified lengths.

- ForeRunner rails shall be pre-punched to accept pickets.
- .2 Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the ForeRunner rails. Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.
 - .3 The manufactured galvanized framework to be powder coated. The base coat shall be a thermosetting epoxy powder coating (gray in colour) with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The colour shall be Black.
 - .4 Completed panels shall be capable of supporting a 181 kg (400 lb.) load (applied at midspan) without permanent deformation. Panels without rings shall be biasable to a 12.5% change in grade.
 - .5 Swing gates shall be fabricated using 38 mm x 1.63 mm (14 Ga.) Forerunner double channel rail, 45 mm sq. x 1.63 mm (14 Ga.) gate ends, and 19 mm sq. x 1.14 mm (17 Ga.) pickets. Gates that exceed 1830 mm in width will have a 38 mm sq. x 1.63 mm (14 Ga.) intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.
 - .6 Concrete mixes and materials: to Section 03 30 00
 - .1 Nominal coarse aggregate size: 20-5.
 - .2 Compressive strength: 20 MPa minimum at 28 days.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications 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 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CSA S16.
- .7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:
 - .1 Primer: maximum VOC limit 250 g/L to GS-11.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
 - .1 Primer: maximum VOC limit 250 g/L to GS-11.

3.3 PIPE RAILINGS

- .1 Install pipe railings as indicated.

3.4 ENTRANCE FLOOR GRILLE INSTALLATION

- .1 Installation:
 - .1 Provide drainage pans, perimeter frames, intermediate supports and setting instructions for casting into concrete; provide supervision as required.
 - .2 Install grilles square, true, straight and level in accordance with manufacturer's instructions. Ensure floor grille units are free of rattle, deflection and bounce.
 - .3 Floor grille and frame assemblies shall be recessed flush with top of adjacent floor finish. Ensure accurate fit in recessed pans without gaps.

3.5 EXTERIOR FENCE INSTALLATION

- .1 Preparation: All new installation shall be laid out by the Contractor in accordance with the construction plans.
- .2 Fence Installation: Fence post shall be spaced at 2400 mm O.C., plus or minus 13 mm. For installations that must be raked to follow sloping grades,

the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 1500 mm. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by Departmental Representative, analysis to be sufficient in strength for the intended application.

- .3 Fence Installation Maintenance: When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces;
 - .1 Remove all metal shavings from cut area.
 - .2 Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
 - .3 Apply 2 coats of custom finish paint matching fence colour. Spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray.

- .4 Gate Installation: Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.6 POWDER COATED SHEET METAL

- .1 Provide concealed fasteners, types as required for specific usage.

3.7 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.

3.8 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Interior metal stairs and mezzanine guard.

1.2 RELATED REQUIREMENTS

- .1 Section 09 91 23 - Interior Painting.

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM F3125/F3125M-19 Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength CSA Group (CSA).
- .2 CSA Group (CSA)
 - .1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-18, Welded Steel Construction (Metal Arc Welding).
- .3 National Association of Architectural Metal Manufacturers' (NAAMM)
 - .1 NAAMM AMP 510-92, Metal Stairs Manual.

1.4 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 stairs 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 Indicate construction details, sizes of steel sections and thickness of steel sheet.

1.5 QUALITY ASSURANCE

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

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

1.6 DELIVERY, STORAGE AND HANDLING

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

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.
 - .2 Detail and fabricate stairs to NAAMM AMP 510.

2.2 MATERIALS

- .1 Steel sections: to CSA G40.20/G40.21 Grade 300W.
- .2 Steel plate: to CSA G40.20/G40.21, Grade 260W.
- .3 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black.
- .4 Steel tubing: to CSA G40.20/G40.21, Grade 350W, sizes and dimensions as indicated.
- .5 Welding materials: to CSA W59.
- .6 Bolts: to ASTM F3125/F3125M.
- .7 High strength bolts: to ASTM F3125/F3125M.
- .8 Detectable warning indicators: extruded aluminum 6063 alloy, T6 hardness, mill finish with contrasting-coloured epoxy abrasive inserts, complete with trim and appropriate anchors, 6 mm deep.
 - .1 Detectable warning indicator type 1: 51 mm wide.
 - .2 Detectable warning indicator type 2: 152 mm wide.
- .9 Slip-resistant nosing: extruded aluminum 6063 alloy, T6 hardness, mill finish with contrasting-coloured epoxy abrasive inserts, 6 mm deep with 13 mm lip at nosing, complete with trim and appropriate anchors.

- .1 Slip-resistant nosing type 1: 152 mm wide.
- .2 Slip-resistant nosing type 2: 51 mm wide.
- .10 Aluminum framing for detectable warning indicators and slip-resistant nosings: extruded aluminum angle, 6063 alloy, T6 hardness, mill finish.

2.3 STEEL PAN STAIRS

- .1 Fabricate stairs with open riser steel pan construction.
- .2 Form treads from 3 mm thick steel plate. Secure treads to L 35 x 35 x 5 horizontal welded to stringers and concealed from view.
- .3 Form stringers from C 310 x 31 minimum.
- .4 Provide clip angles for fastening of furring channels, where applied finish is indicated for underside of stairs and landings.
- .5 Close ends of stringers where exposed.
- .6 Provide slip-resistant nosing set flush with surface of concrete fill.
- .7 Provide concrete infill.

2.4 FABRICATION

- .1 Fabricate in accordance with NAAMM AMP 510.
- .2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
- .3 Accurately form connections with exposed faces flush:
 - .1 Make mitres and joints tight.
 - .2 Make risers of equal height.
- .4 Grind or file exposed welds and steel sections smooth.
- .5 Shop fabricate stairs in sections as large and complete as practicable.

2.5 BALUSTRADES AND GUARDRAILS

- .1 Construct balusters and handrails from steel angles and channels.
- .2 Cap and weld exposed ends of balusters and handrails.
- .3 Terminate at abutting wall with end flange.

2.6 FINISHES

- .1 Interior Finish - Zinc primer: zinc rich, ready mix to MPI-INT 5.2C in accordance with chemical component limits and restrictions requirements and VOC limits of GS-11. Final finish to Section 09 91 23.

2.7 SHOP PAINTING

- .1 Clean surfaces in accordance with SSPC Systems and Specifications.
- .2 Apply one coat of shop primer except interior surfaces of pans.
- .3 Apply two coats of primer of different colours to parts inaccessible after final assembly.
- .4 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7 degrees C.
- .5 Do not paint surfaces to be field welded.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal stairs and ladders 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 OF STAIRS

- .1 Install in accordance with NAAMM AMP 510.
- .2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.
- .3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .4 Do welding work in accordance with CSA W59 unless specified otherwise.
- .5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

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 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.4 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA International
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CAN/CSA O80 Series-15, Wood Preservation.
 - .3 CAN/CSA O80.27-1.1-15, This Standard covers the fire-retardant treatment of Douglas Fir, hardwood, softwood, and Poplar plywood by pressure processes.
 - .4 CSA O121-17, Douglas Fir Plywood.
 - .5 CAN/CSA-O141-05(R2019), Softwood Lumber.
 - .6 CSA O151-17, Canadian Softwood Plywood.
 - .7 CSA O325-16, Construction Sheathing.
 - .8 CAN/CSA-Z809-16, Sustainable Forest Management.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM D5055-19, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists
- .3 Forest Stewardship Council (FSC)
 - .1 FSC-STD-CAN-1-2018 EN V1-0, FSC National Forest Stewardship Standard of Canada.
 - .2 FSC-STD-20-002-2009, Structure and Content of Forest Stewardship Standards V3-0.
 - .3 FSC Accredited Certified Bodies.
- .4 Green Seal Environmental Standards (GS)
 - .1 GS-11-2015, Edition 3.2, Paints and Coatings.
- .5 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber GR-2017.
- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
- .7 National Building Code of Canada (NBC) 2015.

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 rough carpentry work and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Low-Emitting Materials:
 - .1 Submit listing of paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.
 - .2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.3 QUALITY ASSURANCE

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.
- .4 Sustainable Standards Certification:
 - .1 Certified Wood: submit listing of wood products and materials used in accordance with FSC-STD-CAN-1-2018 EN V1-0, CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.

1.4 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Lumber: unless specified otherwise, softwood, S4S, S-DRY, B and Better Clear, in accordance with following standards:
 - .1 CAN/CSA-0141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.
- .3 Panel Materials: CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
 - .1 Douglas fir plywood (DFP): to CSA 0121, standard construction. Urea-formaldehyde free.
 - .2 Canadian softwood plywood (CSP): to CSA 0151, standard construction. Urea-formaldehyde free.
 - .3 Plywood, OSB and wood based composite panels: to CSA 0325. Urea-formaldehyde free.
- .4 I joist plywood: Douglas Fir to CSA 0121, HEM-FIR, SHG Sheathing Grade, face grain perpendicular to lumber. All plies including core: douglas fir to Table A-1.
 - .1 Wood I-joists in accordance with Prefabricated Wood I-Joists ASTM D5055.

2.2 ACCESSORIES

- .1 Fasteners: to ASTM A123/A123M for exterior work.
- .2 Nails, spikes and staples: to CSA B111.
- .3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plug, recommended for purpose by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for rough carpentry 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 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and 1 minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat material as indicated as follows:
 - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.

3.3 INSTALLATION

- .1 Comply with requirements of NBC, supplemented by the following paragraphs.
- .2 Install furring and blocking as required to space-out and support casework, cabinets, stair railings, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7 Install sleepers as indicated.
- .8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.
- .9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .10 Countersink bolts where necessary to provide clearance for other work.

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.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA International
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O86:19, Engineering Design in Wood.
 - .3 CAN/CSA-Z809-16, Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC)
 - .1 FSC-STD-CAN-1-2018 EN V1-0, FSC National Forest Stewardship Standard of Canada.
 - .2 FSC-STD-20-002-2009, Structure and Content of Forest Stewardship Standards V3-0.
 - .3 FSC Accredited Certified Bodies.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .4 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber 2017.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.

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 wood decking and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS SDS.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Submit 2 - 300 x 300 mm samples of each type.
- .5 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
- .6 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 95% of construction wastes were recycled or salvaged.

.2 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood decking from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Wood decking: to NLGA standard Grading Rules for Canadian Lumber select grade Spruce 38 x 140 mm, predrilled at 750 mm on centre for lateral spiking, single tongue and groove and "Veed" one side. Kiln dry decking to 15% maximum moisture content. CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.

.2 Decking lengths: 1.8 to 6 m or longer with a minimum of 90% planks exceeding 3 m. Square end trimmed. For single spans shorter than 3 m use decking of same length as span.

.3 Nails: to CSA B111, stainless steel finish; sizes to CSA O86. Supply 200 mm spiral spikes for lateral nailing.

- .4 Splines: galvanized metal, as recommended by decking manufacturer.
 - .1 Adhesives and Sealants: VOC limit 140 g/L maximum to SCAQMD Rule 1168.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood decking 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 Do wood deck work to CSA O86 except where specified otherwise.
- .2 Install decking to CSA O86, joints to be parallel.
- .3 Supply minimum of 1 bearing support for each plank. Install sloping deck with tongues up.
- .4 Apply preservative to end cuts of pressure treated lumber.

3.3 FIELD QUALITY CONTROL

- .1 Testing:
 - .1 Testing moisture content of delivered material will be performed by testing laboratory designated by Departmental Representative.
 - .2 Departmental Representative will pay for costs of testing.
 - .3 Testing moisture content of delivered material will be by testing laboratory designated by Departmental Representative.

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 wood decking installation.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 05 41 00 - Wind Load Metal Stud Framing.
- .2 Section 07 27 05 - Air & Vapour Barrier

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - .2 ASTM C954-18, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .3 ASTM C1177/C1177M-17, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's product data and installation instructions.

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: Store materials off ground, in dry location and in accordance with manufacturer's recommendations.
- .4 Waste Management and Disposal: Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 PRODUCTS

2.1 WALL SHEATHING PANEL

- .1 Exterior gypsum sheathing with fiberglass facing and water resistant treated core to ASTM C1177/C1177M.
 - .1 Thickness: 16 mm.
 - .2 Panel Size: 610 mm X 1219 mm.

2.2 ACCESSORIES

- .1 Fasteners: Steel drill screws, in length recommended by sheathing

manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. For steel stud framing from 0.84 to 2.84 mm thick, attach sheathing with drill screws complying with ASTM C954.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Install gypsum sheathing in accordance with manufacturer's written instructions.
- .2 Cut boards at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
 - .1 Install gypsum sheathing boards with 9 mm setback where non-load-bearing construction abuts structural elements.
 - .2 Install boards with a 6 mm setback where they abut materials that might retain moisture, to prevent wicking.
- .3 Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- .4. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- .5 Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- .6 Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges, and stagger end joints of adjacent boards not less than one stud spacing. Screw-attach boards at perimeter and within field of board to each steel stud.
 - .1 Space fasteners approximately 200 mm oc and set back a minimum of 9 mm from edges and ends of boards.
 - .1 Decrease spacing between fasteners where required to comply with design wind loads, and as indicated in shop drawings submitted under Section 05 41 00.

- .7 Vertical Installation: Install board vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud.
 - .1 Space fasteners approximately 200 mm oc and set back a minimum of 9 mm from edges and ends of boards.
 - .2 Decrease spacing between fasteners where required to comply with design wind loads, and as indicated in shop drawings submitted under Section 05 41 00.

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.

3.4 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA O86:19, Engineering Design in Wood.
 - .2 CSA O141-05(R2019), Softwood Lumber.
 - .3 CSA S307-M1980(R2005), Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
 - .4 CSA S347:14(R2018), Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
 - .5 CAN/CSA-Z809-16, Sustainable Forest Management.
 - .6 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel.
- .2 National Building Code of Canada (NBCC)
 - .1 NBC 2015.
- .3 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber GR 2017.
- .4 Forestry Stewardship Council (FSC).
- .5 Sustainable Forestry Initiative (SFI).

1.2 DESIGN CRITERIA

- .1 Design trusses, bracing and bridging in accordance with CSA O86 for loads indicated and minimum uniform and minimum concentrated loadings stipulated in NBC commentary.
- .2 Limit live load deflection to 1/360th of span where gypsum board ceilings are hung directly from trusses.
- .3 Limit live load deflections to 1/240th of span unless otherwise specified or indicated.
- .4 Provide camber for trusses as indicated.

1.3 SOURCE QUALITY CONTROL

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

1.4 QUALIFICATION OF MANUFACTURERS

- .1 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

1.5 SHOP DRAWINGS

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

- .2 Each shop drawing submission shall bear signature and stamp of professional engineer registered or licensed in province of Ontario, Canada.
- .3 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.
- .4 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.

1.6 DELIVERY AND STORAGE

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.
- .2 Store trusses on job site in accordance with manufacturer's instructions. Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Lumber: SPF species, No. 1/No. 2 grade, softwood, with maximum moisture content of S-DRY graded and stamped at time of fabrication and to following standards:
 - .1 CSA O141.
 - .2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.
 - .3 CAN/CSA-Z809, SFI or Forest Stewardship Council (FSC) certified.
- .2 Fastenings: to CSA O86.

2.2 FABRICATION

- .1 Fabricate wood trusses in accordance with reviewed shop drawings.
- .2 Provide for design camber and roof slopes when positioning truss members.
- .3 Connect members using metal connector plates.

PART 3 - EXECUTION

3.1 ERECTION

- .1 Erect wood trusses in accordance with reviewed erection drawings.
- .2 Indicated lifting points to be used to hoist trusses into position.
- .3 Make adequate provisions for handling and erection stresses.
- .4 Exercise care to prevent out-of-plane bending of trusses.
- .5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.
- .6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.
- .7 Do not cut or remove any truss material without approval of Departmental Representative.
- .8 Remove chemical and other surface deposits on treated wood, in preparation for applied finishes.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A208.1-2016, Particleboard.
 - .2 ANSI A208.2-2016, Medium Density Fibreboard (MDF) for Interior Applications.
 - .3 ANSI/HPVA HP-1-2016, American National Standard for Hardwood and Decorative Plywood.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI).
 - .1 AWMAC/WI NAAWS North American Architectural Woodwork Standards, Edition 3.1-2017.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-M87, Hardboard.
- .4 CSA International
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O121-17, Douglas Fir Plywood.
 - .3 CSA O141-05(R2016), Softwood Lumber.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA O153-19, Poplar Plywood.
 - .6 CAN/CSA-Z809-16, Sustainable Forest Management.
- .5 Forest Stewardship Council (FSC)
 - .1 FSC-STD-CAN-1-2018 EN V1-0, FSC National Forest Stewardship Standard of Canada.
 - .2 FSC-STD-20-002-2009, Structure and Content of Forest Stewardship Standards V3-0.
 - .3 FSC Accredited Certified Bodies.
- .6 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber 2017.
- .7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.
- .8 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC-S105-16, Standard Specification for Fire Door Frames.
- .9 American Society for Testing and Materials (ASTM)
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for plywood, OSB, MDF and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS.

- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .3 Indicate materials, thicknesses, finishes and hardware.

- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.

- .5 Certifications: submit AWMAC GIS certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC Architectural Woodwork Standards and shall be subject to an inspection at the plant and/or site by an appointed AWMAC Certified Inspector.
 - .2 Inspection costs shall be included in the bid price for this project. Contact your local AWMAC Chapter for details of inspection costs.
 - .3 Shop drawings shall be submitted to the AWMAC Chapter office for review before work commences.
 - .4 Work that does not meet the AWMAC/WI NAAWS, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork contractor, to the approval of AWMAC, at no additional cost to the Departmental Representative.
 - .5 If the woodwork contractor is an AWMAC Manufacturer member in good standing, a two (2) year AWMAC Guarantee Certificate will be issued.
 - .6 The AWMAC Guarantee shall cover replacing, reworking and/or refinishing any deficient architectural woodwork due to faulty workmanship or defective materials supplied by the woodwork contractor, which may appear during a two (2) year period following the date of issuance.
 - .7 If the woodwork contractor is not an AWMAC Manufacturer member they shall provide the Departmental Representative with a two (2) year maintenance bond, in lieu of the AWMAC Guarantee Certificate, to the full value of the architectural woodwork contract.

- .6 Test and Evaluation Reports: submit certified test reports for composite wood from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

- .7 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling

and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 95% of construction wastes were recycled or salvaged.

.8 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants used in building, showing compliance with VOC and chemical component limits or restrictions requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.3 QUALITY ASSURANCE

- .1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).
- .2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.
- .3 Wood fire rated frames and panels: listed and labelled by an organization accredited by Standards Council of Canada to CAN/ULC-S104 and CAN/ULC-S105.

1.4 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Softwood lumber: S4S, S-DRY graded and stamped in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.

- .3 AWMAC/WI NAAWS North American Architectural Woodwork Standards grade, moisture content as specified.
- .4 Machine stress-rated lumber is acceptable.
- .5 Hardwood lumber: moisture content 15 % or less in accordance:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC/WI NAAWS North American Architectural Woodwork Standards premium grade, moisture content as specified.
- .2 Medium density fibreboard (MDF): to ANSI A208.2, density 640-800 kg/m³.

2.2 ACCESSORIES

- .1 Nails and staples: to CSA B111; galvanized to ASTM A123/A123M for exterior work, interior humid areas and for treated lumber; stainless steel finish elsewhere.
- .2 Wood screws: stainless steel, type and size to suit application.
- .3 Splines: wood.
- .4 Adhesive and Sealants: in accordance with Section 07 92 00.
 - .1 VOC limit 30 g/L maximum to SCAQMD Rule 1168.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

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

3.3 CONSTRUCTION

- .1 Fastening:

- .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
- .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
- .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
- .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Standing and running trim:
 - .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
 - .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
- .3 Window sills:
 - .1 Set frames with plumb sills and secure.
- .4 Stairs:
 - .1 Install stairs to location and details as indicated.
- .5 Handrails, wall rails and bumper rails.
 - .1 Install handrails, wall rails and bumper rails in locations indicated.
 - .2 Make joints hair line, dowelled and glued.
 - .3 Install support brackets as indicated.
 - .4 Install brackets at ends and at 1200 mm on centre minimum at intermediate spacings.
 - .5 Install metal backing plates between studs at bracket locations to ensure proper support for brackets and bolts or self-tapping screws.
 - .6 Secure using counter sunk screws plugged with matching wood plugs.

3.4 INSTALLATION OF STAIRS AND HANDRAILS

- .1 Stair and handrails:
 - .1 Treads and nosings: birch species, premium grade.
 - .2 Risers: birch species, premium grade.
 - .3 Handrail: birch species, premium grade.

3.5 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.

3.6 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM D2832-92(2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .2 ASTM D5116-17, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
 - .3 ASTM E1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI).
 - .1 AWMAC/WI NAAWS Edition 3.1-2017.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .4 CSA International
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O112.4 SERIES-M1977(R2006), Standards for Wood Adhesives.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O141-05(R2019), Softwood Lumber.
 - .5 CSA O151-17, Canadian Softwood Plywood.
 - .6 CSA O153-13(R2017), Poplar Plywood.
 - .7 CAN/CSA-Z809-16, Sustainable Forest Management.
- .5 Forest Stewardship Council (FSC)
 - .1 FSC-STD-CAN-1-2018 EN V1-0, FSC National Forest Stewardship Standard of Canada.
 - .2 FSC-STD-20-002, Structure and Content of Forest Stewardship Standards V3-0.
- .6 Green Seal Environmental Standards (GS)
 - .1 GS-11-2015, Edition 3.2, Paints and Coatings.
 - .2 GS-36-2013, Commercial Adhesives.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .8 International Organization for Standardization (ISO)
 - .1 ISO 14040-2006, Environmental Management-Life Cycle Assessment - Principles and Framework.
 - .2 ISO 14041-98, Environmental Management-Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis.
- .9 National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).
- .10 National Hardwood Lumber Association (NHLA)

- .1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.
- .11 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber GR 2017.
- .12 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.
- .13 Sustainable Forestry Initiative (SFI).

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 architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS SDS.
- .3 Shop Drawings:
 - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .1 Scales: profiles full size, details half full size.
 - .2 Indicate materials, thicknesses, finishes and hardware.
 - .3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.
- .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit duplicate samples of plywood: sample size 200 x 200 mm.
- .5 Certifications: submit AWMAC/WI GIS certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC/WI NAAWS and shall be subject to an inspection at the plant and/or site by an appointed AWMAC/WI Certified Inspector.
 - .2 Inspection costs shall be included in the bid price for this project. Contact your local AWMAC/WI Chapter for details of inspection costs.
 - .3 Shop drawings shall be submitted to the AWMAC/WI Chapter office for review before work commences.
 - .4 Work that does not meet the AWMAC/WI NAAWS, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork contractor, to the approval of AWMAC/WI, at no additional cost to the. Departmental Representative.
 - .5 If the woodwork contractor is an AWMAC/WI Manufacturer member in good standing, a two (2) year AWMAC/WI Guarantee Certificate will

be issued.

.6 The AWMAC/WI Guarantee shall cover replacing, reworking and/or refinishing any deficient architectural woodwork due to faulty workmanship or defective materials supplied by the woodwork contractor, which may appear during a two (2) year period following the date of issuance.

.7 If the woodwork contractor is not an AWMAC/WI Manufacturer member they shall provide the Departmental Representative with a two (2) year maintenance bond, in lieu of the AWMAC/WI Guarantee Certificate, to the full value of the architectural woodwork contract.

.6 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 95% of construction wastes were recycled or salvaged.

.2 Recycled Content:

.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

.3 Low-Emitting Materials:

.1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.3 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.3 Storage and Handling Requirements:

- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect architectural woodwork from nicks, scratches, and blemishes.
- .3 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 Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Softwood lumber: unless specified otherwise, S4S, S-DRY, B and Better Clear, in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC/WI NAAWS premium grade, moisture content as specified.
 - .4 CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: moisture content 12% or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC/WI NAAWS premium grade, moisture content as specified.
- .4 Douglas fir plywood (DFP): to CSA O121, standard construction.
 - .1 AWMAC/WI NAAWS premium grade.
 - .2 Vertical grain.
 - .3 Plywood resin to contain no added urea-formaldehyde.
- .5 Hardboard:
 - .1 To CAN/CGSB-11.3.
 - .2 Hardboard resin to contain no added urea-formaldehyde.
- .6 Birch plywood: to AWMAC Natural Select White
- .7 Nails and staples: to CSA B111.
- .8 Wood screws: stainless steel, type and size to suit application.
- .9 Splines: wood.
- .10 Sealant: To Section 07 92 10.

2.2 FABRICATION

- .1 Set nails and countersink screws apply stained plain wood filler to indentations, sand smooth and leave ready to receive finish.

- .2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .3 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .4 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's 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 Do architectural woodwork to AWMAC/WI NAAWS.
- .2 Install prefinished millwork at locations shown on drawings.
 - .1 Position accurately, level, plumb straight.
- .3 Fasten and anchor millwork securely.
 - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .4 Use draw bolts in countertop joints.
- .5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .6 Apply water resistant building paper bituminous coating over wood framing members in contact with masonry or cementitious construction.
- .7 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .8 At junction of solid surface countertop/back splash and adjacent wall

finish, apply small bead of sealant.

- .9 Fit hardware accurately and securely in accordance with manufacturer's written instructions. Refer to Section 08 70 05.

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.
 - .1 Clean millwork and cabinet work inside cupboards and drawers and outside surfaces.
 - .2 Remove excess glue from surfaces.
- .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 millwork and cabinet work from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 06 10 00 - Rough Carpentry.
- .2 Section 06 40 00 - Architectural Woodwork
- .3 Division 22 Plumbing

1.2 DEFINITION

- .1 Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.
 - .2 Submit two copies of WHMIS SDS - Safety Data Sheets in accordance with Section 01 33 00. Indicate VOC's for adhesives, solvents and cleaners.
 - .3 Indicate product description, fabrication information and compliance with specified performance requirements.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00. Minimum 150 x 150 sample in specified gloss.
 - .2 Submit duplicate samples of joints, edging, cutouts and post formed profiles.
 - .3 Cut sample and seam together for representation of inconspicuous seam.
 - .4 Indicate full range of colour and pattern variation.
 - .5 Approved samples will be retained as a standard for work.
- .3 Shop Drawings:
 - .1 Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components. Show full-size details, edge details, thermoforming requirements, attachments, etc.
 - .2 Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
 - .3 Show locations and sizes of cutouts and holes for plumbing fixtures, faucets and other items installed in solid surface.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Fabricator/installer qualifications:
 - .1 Provide copy of certification number.
- .6 Manufacturer certificates:
 - .1 Signed by manufacturers certifying that they comply with requirements.
- .7 Maintenance data:
 - .1 Submit manufacturer's care and maintenance data, including repair and

- cleaning instructions.
- .2 Maintenance kit for finishes shall be submitted.
- .3 Include in project closeout documents.

- .8 Closeout Submittals:
 - .1 Provide maintenance data for laminate work for incorporation into manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
 - .2 Fabricator/installer qualifications:
 - .1 Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.
 - .3 Applicable standards:
 - .1 Standards of the following, as referenced herein:
 - .1 American National Standards Institute (ANSI)
 - .2 American Society for Testing and Materials (ASTM)
 - .3 National Electrical Manufacturers Association (NEMA)
 - .4 NSF International
 - .4 Fire test response characteristics:
 - .1 Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 ASTM E84 or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - .1 Flame Spread Index: 25 or less.
 - .2 Smoke Developed Index: 450 or less.
 - .5 Deliver no components to project site until areas are ready for installation.
 - .6 Store components indoors prior to installation.
 - .7 Handle materials to prevent damage to finished surfaces.
 - .1 Provide protective coverings to prevent physical damage or staining following installation for duration of project.
 - .8 Sheets should be stored horizontally, with a cardboard or other protective sheet placed on top to protect the material from possible damage. The material should be protected from moisture, and should never be stored in contact with the floor or an outside wall. Optimum conditions for storage are approximately 75°F (24°C), and 45% to 55% relative humidity.
 - .9 Allow sheets to acclimate for at least 48 hours to ambient conditions prior to fabrication. Optimum conditions are approximately 75°F (24°C), and at a relative humidity of 45% to 55%. Provisions should be made for the circulation of air around the material.

1.5 MAINTENANCE

- .1 Provide maintenance requirements as specified by the manufacturer.

1.6 WARRANTY

- .1 Provide manufacturer's warranty against defects in materials.
 - .1 Warranty shall provide material and labor to repair or replace defective materials.
 - .2 Damage caused by physical or chemical abuse or damage from

excessive heat will not be warranted.

- .2 Manufacturer's warranty period:
 - .1 Ten years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Homogenous sheet composed of a blend of natural minerals and 100 percent acrylic resin (methyl methacrylate) complying with ANSI Z124.3 and ANSI Z124.6, Type 6.
 - .1 Physical Performance Characteristics:
 - .1 Flammability Test (flame spread and smoke developed):
 - .1 Test Procedure: CAN/ULC S102 (2018)
 - .2 Rating: Class A.
 - .2 Food Zone Use:
 - .1 Test Procedure: NSF 51.
 - .2 Rating: Pass.
 - .2 Use:
 - .1 Counter tops: 13 mm thick, unless otherwise shown on Drawings.
 - .1 Colour: from manufacturer's standard colour range.
 - .2 Finish: Semi-gloss.
 - .3 Double eased edge.
 - .4 100 mm backsplash.

2.2 FABRICATION

- .1 Shop assembly:
 - .1 Material, equipment, and workmanship should conform to the industry standard practices, conditions, procedures, and recommendations as specified by ANSI/NEMA.
 - .2 Sheets can be sawed, drilled, routed, and fabricated similarly to standard HPL. Carbide-tipped cutting tools are recommended.
 - .3 All inside corners of cutouts must be radiused as large as possible, 3.18mm minimum, to avoid stress cracking. The edges and corners should be routed, sanded, or filed smooth and free of chips or nicks.
- .2 Adhesives:
 - .1 Two component joint adhesive to bond solid surface panel to solid surface panel.
 - .2 Use 100 percent silicone sealant complying with ASTM C920 or neoprene-based panel adhesive to bond solid surface panel to other materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- 1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.

3.2 INSTALLATION

1. Install components plumb, level and rigid, scribed to adjacent finished, in accordance with approved shop drawings and product data.
 - .1 Provide product in the largest pieces available.
 - .2 Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - .3 Exposed joints/seams shall not be allowed.
 - .4 Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
 - .5 Cut and finish component edges with clean, sharp returns.
 - .6 Rout radii and contours to template.
 - .7 Anchor securely to base cabinets or other supports.
 - .8 Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in colour to match countertop.
 - .9 Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - .10 Install countertops with no more than 3 mm sag, bow or other variation from a straight line.

3.3 REPAIR

- .1 Repair or replace damaged work which cannot be repaired to Departmental Representative's satisfaction.

3.4 CLEANING AND PROTECTION

- .1 Keep components clean during installation.
- .2 Remove adhesives, sealants and other stains.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Below grade waterproofing.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D1970-19, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - .2 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
 - .3 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - .4 ASTM E154/E154M-08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.9Ma: Primer, Asphalt, Unfilled for Asphalt Roofing, Dampproofing and Waterproofing.
 - .2 CGSB 37-GP-11M-76(R1984), Application of Cutback Asphalt Plastic Cement.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for waterproofing membrane, primers, sealants and adhesives; and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS SDS.
 - .1 Indicate VOC's for primers, sealants and adhesives used during application and curing.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification.

.4 Materials used in this Section to be fully compatible and sourced and/or produced by one manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.

.3 Storage and Handling Requirements:

- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 When products must be stored for extended periods, keep out of direct sunlight.
- .3 Store materials at temperatures above 5 degrees C to facilitate handling.
- .4 Store and protect waterproofing materials from nicks, scratches, and blemishes.
- .5 Replace defective or damaged materials with new.
- .6 Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20, to the maximum extent economically possible.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

1.7 SITE CONDITIONS

.1 Ambient Conditions: temperature, relative humidity, moisture content.

- .1 Apply waterproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
- .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
- .3 Maintain air temperature and substrate temperature at waterproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
- .4 Do not apply waterproofing in wet weather or on frost or wet covered surfaces.

- .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
- .3 Ventilation:
 - .1 Ventilate enclosed spaces.
 - .2 Provide continuous ventilation during and after waterproofing application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of waterproofing installation.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Waterproofing membrane components and accessories to be obtained to ensure total system compatibility and integrity.
- .2 Self-adhered Waterproofing Membrane
 - .1 Primary sheet applied self-adhered waterproofing membrane: 1.5 mm SBS modified bitumen, self-adhering sheet membrane with a cross-laminated polyethylene film, and having the following physical properties:
 - .1 Thickness: 1.5 mm minimum;
 - .2 Flexibility: Pass @ -40 degrees C to ASTM D1970;
 - .3 Vapour permeance: 2.8 ng/Pa.s.m² to ASTM E96M;
 - .4 Tensile strength (membrane): 2.24 MPa to ASTM D412;
 - .5 Tensile strength (film): 34.5 MPa to ASTM D882;
 - .6 Elongation: 300% to ASTM D412; Die Cut C;
 - .7 Puncture resistance: 222 N min. to ASTM E154M.
 - .3 Primer
 - .1 Primer for self-adhering membranes: polymer emulsion based adhesive, quick setting, having the following physical properties:
 - .1 Weight: 1.03 kg/litre;
 - .2 Solids by weight: 53%;
 - .3 Water based, no solvent odours
 - .4 Drying time (initial set): 30 minutes at 50% RH and 21 degrees C;
 - .4 Liquid Membrane & Termination Sealant
 - .1 Termination Sealant: moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
 - .1 Compatible with sheet air barrier, under grade vapour barrier and waterproofing membranes and substrate. SWRI validated.
 - .2 Complies with ASTM C920, Type S, Grade NS, Class 25.
 - .3 Elongation: 450 - 550%.

- .4 Remains flexible with aging.
- .5 Seals construction joints up to 25 mm wide.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Verify that installation of perimeter foundation drainage system is complete.
 - .3 Verify that finish grade elevations are clearly marked.
 - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .5 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 Before applying waterproofing membrane:
 - .1 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar, frost or other contaminants. Fill spalled areas in substrate to provide an even plane.
 - .2 Seal exterior joints at structural slab joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.
 - .3 Use appropriate waterproofing membrane primer as recommended by manufacturer based on air and surface temperature at time of application.

3.3 APPLICATION

- .1 Foundation Wall Waterproofing: Install waterproofing system to all walls below grade, from bottom of wall to grade level, and in locations indicated on the drawings.
- .2 Do waterproofing in accordance with CAN/CGSB-37.9Ma.
- .3 Do sealing work in accordance with CGSB37-GP-11M.
- .4 Apply primer to CGSB primer standard.

3.4 INSTALLATION

- .1 Primer
 - .1 Apply primer for self-adhered membrane by roller or spray at rate recommended by manufacturer.

- .2 Allow minimum 30 minute open time. Primed surfaces not covered by waterproofing membrane during the same working day must be re-primed.
- .2 Structural Slab, Junctures, Cracks in Slab and Protrusions
 - .1 Coat penetrations, such as brackets, clips, braces, etc. that are set into the concrete with a 2.3 mm coating of liquid membrane to the height of the wearing course and around projections to ensure a complete seal prior to coating the entire area.
 - .2 To all cracks and cold joints less than 1.5 mm, apply a coat of liquid membrane at a minimum thickness of 1 mm extending 75 mm on either side of joint, embed a 152 mm wide strip of primary self-adhered waterproofing membrane over.
 - .3 To all cracks greater than 3 mm, fill void with non-shrink cementitious patching material and allow to cure dry. Prime area and install self-adhered waterproofing membrane, extend 75 mm on either side of crack. Overlap end joint of sheet a minimum 75 mm.
 - .4 At monolithic and non-monolithic wall/slab junctures, prime area, trowel-in fillet bead of liquid membrane to inside corners and install self-adhered waterproofing membrane sheet to the required height on the wall and at least 100 mm on the slab. Lap primary waterproofing membrane over a minimum of 50 mm.
 - .5 Horizontal to vertical inside corner transition areas are to be pre-treated with a liquid membrane fillet extending 20 mm vertically and horizontally from the corner. Apply a minimum 254 mm strip of self-adhered waterproofing membrane centred at the joint.
 - .6 All outside corners are to be pre-treated with a minimum 254 mm strip of waterproofing membrane centred at the joint.
 - .7 Where three or more planes come into contact, reinforce with cut sections of waterproofing membrane reinforcing sheet as per manufacturer's instructions.
- .3 Projections
 - .1 Extend waterproofing membrane tight to projection and seal with liquid membrane extending 75 mm along projection and 75 mm onto waterproofing membrane.
- .4 Waterproofing Membrane - Vertical Application
 - .1 Apply waterproofing membrane to prepared substrate in lengths of 1828 mm or less.
 - .2 Provide 75 mm laps at both sides and ends. Position for alignment and remove protective film. Press firmly into place. Promptly roll all laps with a counter top roller to effect seal. If more than one length is required on a vertical surface, apply in a shingle fashion.
 - .3 Terminate membrane using termination mastic or termination bar, reglet or counter flashing as indicated. Refer to manufacturers standard details.
 - .4 All laps within 30 mm of a 90 degrees change in plane are to be sealed with termination sealant.

3.5 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.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Do not leave installed waterproofing membrane and drainage board work exposed to sunlight for more than 30 days after installation; to cover, complete backfill operation or cover with protection board.
- .3 Prior to backfilling, inspect for tears and other damage; and repair.
- .4 Take care when backfilling to avoid damage to waterproofing system; replace materials damaged during backfilling.
- .5 Protect installed products until completion of project.
- .6 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 BSI:
 - .1 BS EN 13171:2012+A1:2015, Thermal insulation products for buildings. Factory made wood fibre (WF) products.
- .2 CAN/ULC-S102.2:2018, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
- .3 CAN/ULC-S114:2018, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
- .4 CAN/ULC-S701.1:2017, Standard for Thermal Insulation, Polystyrene Boards
- .5 CAN/ULC-S702.1:2014-AMD1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
- .6 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .7 ASTM C612-14(2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- .8 ASTM C1104/C1104M-19, Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation
- .9 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics
- .10 ASTM D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics
- .11 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
- .12 CGSB 71-GP-24M, Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

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 board insulation and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS. Indicate VOC's during application and curing.
- .3 Samples:
 - .1 Submit 100 x 100 mm x 40 mm sample of board insulation.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.3 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 INSULATION

- .1 Wood fibre insulation consisting of coniferous wood impregnated with paraffin.
 - .1 Tongue and groove construction, designed to serve as exterior wall sheathing.
 - .2 Bulk density: 175 kg/m³.
 - .3 Thermal conductivity to EN 13171: 0.043 W/(mK).
 - .4 Specific heat capacity: 2100 J/(kgK).
 - .5 Vapour diffusion resistance coefficient: 5 μ .
 - .6 Fire behaviour (EN 13501-1) Class E.
 - .7 Compressive stress at 10% compressive deformation: 70 kPa.
 - .8 Tensile strength perpendicular to plane of board: 5 kPa.
- .2 Structural Concrete Slab Insulation: expanded polystyrene (EPS) foam insulation to CAN/ULC-S701.1, Type 15, rigid, closed cell type, with integral high density skin.
 - .1 Thermal Resistance: long term aged RSI value of 0.81/25 mm to ASTM C518.
 - .2 Board Size: Minimum 1220 x 1220 mm x thickness as indicated on Drawings.
 - .3 Compressive Strength: to ASTM D1621, minimum compressive strength = 413 kPa @ 5% deformation or yield.
 - .4 Water Absorption: to ASTM D2842, 0.7% by volume maximum.
 - .5 Edges: Shiplapped.
 - .6 Water Vapour Permeance: to ASTM E96/E96M, 50 ng/Pa.s.m².
- .3 Semi-Rigid Insulation: mineral fibre board to CAN/ULC-S702.2, non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB.
 - .1 Board Size: 610 x 1220 mm, 75 mm thick or as noted on Drawings.
 - .2 Density: Outer Layer 100 kg/m³/Inner Layer 60 kg/m³ to ASTM C303.
 - .3 Fire performance:
 - .1 Non-combustibility: To CAN/ULC S114.

- .2 Surface Burning Characteristics: To CAN/ULC-S102.
 - .1 Flame spread: 0.
 - .2 Smoke developed: 0.
- .4 Thermal resistance: RSI value/25.4 mm at 24°C: 0.76 m²K/W to ASTM C518.
- .5 Water vapour permeance: 1555 ng/Pa.s.m²
- .6 Moisture asorption: 1% maximum to ASTM C1104/C1104M.
- .4 Extruded Polystyrene (XPS) Rigid Insulation: CAN/ULC-S701.
 - .1 Type: 4.
 - .2 Compressive strength: 207 kPa.
 - .3 Thickness: as indicated.
 - .4 Size: 600 mm x 2400 mm.
 - .5 Edges: square.
 - .6 Thermal resistance: RSI value/25.4 mm at 24°C: 0.88 m²K/W to ASTM C518.

2.3 ACCESSORIES

- .1 Proprietary fasteners compatible with wood fibre insulation panels.
- .2 Adhesive for Extruded Polystyrene Insulation: to CGSB 71-GP-24M, Type 1.
- .3 Semi-Rigid Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.

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 board insulation application in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .5 Offset both vertical and horizontal joints in multiple layer applications.
- .6 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

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.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 07 21 13 Board Insulation
- .3 Section 07 27 00 Air Tight Layer

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C739-17, Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .3 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
 - .1 CCMC Registry of Product Evaluations.
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S703-09(2015), Standard for Cellulose Fibre Insulation (CFI) for Buildings.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit proof of manufacturer's CCMC Listing and listing number to Departmental Representative.
- .2 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .3 Submit product data in accordance with Section 01 33 00.
- .4 Submit WHMIS SDS - Safety Data Sheets. Indicate VOC content.
- .5 Submit product data sheets for system materials. Include product characteristics, performance criteria, and limitations.

1.4 QUALITY
ASSURANCE

- .1 Provide 1 copy of Certification of Coverage and Application Chart in accordance with CAN/ULC-S702 to Departmental Representative, certified by Applicator's signature that the information is correct.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with

Section 01 35 29.

1.5 WASTE
MANAGEMENT AND
DISPOSAL

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

1.6 SITE
ENVIRONMENTAL
REQUIREMENTS

- .1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
- .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of insulation materials.
- .3 Ventilation:
.1 Ventilate area of work as required by use of approved portable supply and exhaust fans.
.2 Ventilate enclosed spaces in accordance with Section 01 51 00.
.3 Provide continuous ventilation during and after insulation application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of insulation installation.
- .4 Protection:
.1 Provide temporary enclosures to prevent dust from contaminating air beyond application area.
.2 Protect adjacent surfaces and equipment from damage by fall-out, and dust.

PART 2 - PRODUCTS

2.2 MATERIALS

- .1 Cellulose fibre insulation: to CAN/ULC-S703, pure cellulose fibres, chemically impregnated to resist mould, mildew and fire.

PART 3 - EXECUTION

3.1 INSPECTION

- .1 Ensure that wall cavity is not obstructed.
- .2 Ensure that the air tight layer has successfully passed the blower door test in accordance with Section 07 27 00 before commencing installation.

3.2 LOOSE FIBRE

- .1 Pneumatically place loose fibre insulation above

INSTALLATION

ceiling between joists and in walls between studding to provide minimum thermal resistance value RSI 10.8.

- .2 Pneumatically place loose fibre insulation in walls between studding to provide minimum thermal resistance value RSI 5.8.
- .3 Ensure wall and roof areas exposed to outside air are insulated.
- .4 Ensure unobstructed air circulation to eave vents.
- .5 Install baffles as indicated to prevent insulation from spilling over top of exterior wall and causing blockage of soffit vents, and to prevent displacement of insulation by wind entering vents.
- .6 Where openings in the air tight later are required to insulate the wall cavity, make good the opening by reinstalling matching 19mm OSB and seal with construction tape in accordance with Section 07 27 00.

3.3 CLEANING

- .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM E1643-18a Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
 - .2 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.2 SUBMITTALS

- .1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet and include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Limitations.
- .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS).
- .3 Quality assurance submittals:
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Laboratory Test Results: submit full set of actual test results as per paragraph 8.3 of ASTM E1745 (including all after conditioning permeance tests).
 - .3 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- .2 Store materials in a clean, dry area in accordance with manufacturer's instructions.
- .3 Stack membrane on smooth ground or wood platform to eliminate warping.
- .4 Protect materials during handling and application to prevent damage or contamination.
- .5 Ensure membrane is stamped with manufacturer's name, product name, and membrane thickness.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 Product not intended for uses subject to abuse or permanent exposure to the elements.
- .2 Do not apply on frozen ground.

PART 2 - PRODUCTS

2.1 SHEET VAPOUR BARRIER

- .1 Plastic Vapour Barrier: Vapour Barrier membrane must have the following properties:
 - .1 Permeance as tested after conditioning to ASTM E1745 paragraphs 7.1.2 - 7.1.5: less than 0.01 perms (gr/ft²/hr/in-Hg) / 0.57 ng/(Pa*s*m²).
 - .2 Strength: Class A, ASTM E1745.
 - .3 Minimum thickness: 0.38 mm (15 mils).

2.2 ACCESSORIES

- .1 Seam tape: high-density polyethylene film and a rubber-based, pressure-sensitive adhesive, specially designed to seal seams and penetration, approximate width 100 mm, by vapour barrier manufacturer.
- .2 Pipe Boots: Where slab penetrations occur, construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.
- .3 Vapour-Proofing Mastic: use mastic provided by vapour barrier manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine surfaces to receive membrane. Notify Departmental Representative if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

- .1 Prepare surfaces in accordance with manufacturer's instructions.
- .2 Level and tamp or roll aggregate.

3.3 INSTALLATION

- .1 Ensure services are installed and inspected prior to installation of vapour barrier.
- .2 Install in accordance with manufacturer's instructions and ASTM E1643.
- .3 Unroll vapour barrier over the entire area where the slab is to be poured.

- Unroll vapour barrier with the longest dimension parallel with the direction of the pour. Completely cover concrete placement area.
- .4 Lap vapour barrier over footings and seal to foundation walls.
 - .5 Overlap all joints 150 mm and seal with manufacturer's tape.
 - .6 Seal all penetrations (including but not limited to pipes, ducting, rebar) with manufacturer's pipe boot, or tape and mastic.
 - .7 No penetration of the vapour barrier is allowed except for reinforcing steel and permanent utilities.
 - .8 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed. Repair damaged areas by cutting patches of vapour barrier, overlapping damaged area 150mm. Clean all adhesion areas of dust, dirt and moisture. Tape all four sides with tape.
 - .9 Do not proceed until repair work has been inspected and approved by Departmental Representative.

3.4 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.
- .2 Dispose of waste in accordance with section 01 74 20.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 International Standards Organization (ISO):
 - .1 ISO 9972:2015, Thermal performance of buildings Determination of air permeability of buildings Fan pressurization method.
 - .2 ISO 13829:2000, Water Quality - Determination of the Genotoxicity of Water and Waste Water Using the Umu-Test
- .2 Canadian Standards Association Group (CSA):
 - .1 CSA O325-16 Construction Sheathing.
- .3 DIN18542 (2019), Sealing of outside wall joints with impregnated sealing tapes made of cellular plastics.

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.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
 - .1 Existing Substrate Condition: report deviations, as described in PART 3 -EXAMINATION in writing to Departmental Representative.
 - .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.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Testing agency: company specializing in performing work of this section with minimum 5 years' experience with testing of air tightness of building envelopes.
- .2 Mock-Up:
 - .1 Construct mock-up in accordance with Section 01 45 00.
 - .2 Construct typical exterior wall panel, 1 m long by 1 m wide, incorporating window and frame and sill, insulation, illustrating materials interface and seals.
 - .3 Locate where directed.
 - .4 Mock-up may remain as part of finished work.
 - .5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with air tight layer barrier Work.

- .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.

1.4 DELIVERY, STORAGE AND HANDLING

- .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 Avoid spillage: immediately notify Departmental Representative if spillage occurs and start clean up procedures.
- .4 Clean spills and leave area as it was prior to spill.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

1.6 AMBIENT CONDITIONS

- .1 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.7 SEQUENCING

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.8 WARRANTY

- .1 The 12 months warranty period prescribed in subsection GC3.13 of General Conditions is extended to 24 months.
- .1 Warranty: include coverage of installed sealant and sheet materials which:
 - .1 Fail to achieve air tight and watertight seal.
 - .2 Exhibit loss of adhesion or cohesion.
 - .3 Do not cure.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

- .1 19mm oriented strand board to CSA 0325.

2.2 PROPRIETARY SEALANT TAPE

- .1 Tape sealant in accordance with DIN 18542 designed for sealing construction joints.
 - .1 Flat joint tape for wood substrates, 50 mm wide
 - .2 Pre-formed angle tape for right angle joints between wood and concrete, 100 mm wide.
 - .3 Pre-formed angle tape for right angle joints between wood and wood, 100 mm wide.
 - .3 Pre-formed tape for sealing round penetrations.
- .2 Expanding foam tape in accordance with DIN 18542.

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 Verify that surfaces and conditions are ready to accept work of this section.
- .2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.
- .3 Report unsatisfactory conditions to Departmental Representative in writing.
- .4 Do not start work until deficiencies have been corrected.
 - .1 Beginning of Work implies acceptance of conditions.

3.3 PREPARATION

- .1 Remove loose or foreign matter, which might impair adhesion of materials.
- .2 Ensure substrates are free of surface moisture prior to application of self-adhesive tapes and primer.
- .3 Ensure metal closures are free of sharp edges and burrs.
- .4 Prime substrate surfaces to receive tape seals in accordance with manufacturer's instructions.

3.4 INSTALLATION

- .1 Install materials in accordance with manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

- .1 Field testing:
 - .1 When air tight layer is complete and windows installed, and prior to insulation being installed, provide blower door test in accordance with ISO 13829 by independent building envelope testing agency.
 - .2 Testing will be observed by the Departmental Representative.
 - .3 Maximum acceptable air leakage at 50 Pa is 0.3 air changes/hour under both positive and negative pressure.
 - .4 Locate and repair leaks until required air tightness is achieved.
 - .5 Repeat test at substantial performance.
 - .6 Locate and repair leaks until required air tightness is achieved.
 - .7 Building occupancy will not be permitted until required air tightness is successfully achieved.
 - .8 Provide written reports by testing agency.

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.

3.7 PROTECTION OF WORK

- .1 Protect finished work in accordance with Section 01 61 00.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished work is protected from climatic conditions.

3.8 SCHEDULES

- .1 Wall sheathing:
 - .1 Install 19 mm OSB sheathing to stud framing as indicated.
- .2 Wall sheathing joints:
 - .1 Prime joints in accordance with manufacturer's instructions.
 - .2 Apply tape and roll in accordance with manufacturer's instructions.
- .3 Window sheathing and slab junction:
 - .1 Prime joints in accordance with manufacturer's instructions.
 - .2 Apply pre-formed tape and roll in accordance with manufacturer's instructions.
- .4 Window and door seals:
 - .1 Install expanding foam tape in accordance with manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 ASTM International (ASTM):
 - .1 ASTM C920-18, Standard Specification for Elastomeric Joint Sealers.
 - .2 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .3 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheetin.
 - .4 ASTM D1970/D1970M-19, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - .5 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
 - .6 ASTM E154/E154M-08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Submit product data prior to ordering materials. Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit WHMIS SDS - Safety Data Sheets.
- .4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
 - .1 Existing Substrate Condition: report deviations, as described in PART 3 - EXAMINATION in writing to Departmental Representative.
 - .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 and cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Applicator: company specializing in installation of air/vapour barrier systems and approved by the material manufacturer.
- .2 Mock-Up:
 - .1 Construct mock-up in accordance with Section 01 45 00.
 - .2 Construct typical exterior wall panel, 2 m long by 2 m wide, incorporating window frame and sill, insulation, through wall flashing, building corner condition, junction with roof system and illustrating materials interface and

seals.

- .3 Locate where directed by Departmental Representative.
- .4 Mock-up may remain as part of finished work.
- .5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with air/vapour barrier work.

1.4 DELIVERY, STORAGE AND HANDLING

- .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.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

1.6 AMBIENT CONDITIONS

- .1 Maintain temperature and humidity recommended by materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- .1 Air/Vapour Barrier Membrane: self-adhering waterproofing membrane consisting of SBS rubberized asphalt compound, which is integrally laminated to a blue, tough, high-density cross-laminated polyethylene film, having the following physical properties:
 - .1 Nominal total thickness of 1.5 mm minimum.
 - .2 Flexibility: Pass @ -40 degrees C to ASTM D1970/D1970M.
 - .3 Vapour permeance: maximum 2.8 ng/Pa.s.m² (0.05 perms) to ASTM E96/E96M.
 - .4 Tensile strength (membrane): 2.24 MPa to ASTM D412.
 - .5 Tensile strength (film): 34.5 MPa to ASTM D882.
 - .6 Elongation: 300% to ASTM D412.
 - .7 Puncture resistance: 222 N minimum to ASTM E154/E154M.

2.2 PRIMERS

- .1 Primer for Air/Vapour Barrier Membrane: as recommended by manufacturer of air/vapour barrier membranes and as appropriate to application and substrate.

2.3 LIQUID MEMBRANE & TERMINATION SEALANT

- .1. Liquid Membrane and Termination Sealant for Air/Vapour Barrier Membrane: as recommended by manufacturer of air/vapour barrier membrane and as appropriate to application; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:

- .1 Compatible with sheet air barrier, roofing and waterproofing membranes and substrate.
- .2 Complies with ASTM C920, Type S, Grade NS, Class 25.
- .3 Elongation: 450 - 550%.
- .4 Remains flexible with aging.
- .5 Seals construction joints up to 25 mm wide.

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 GENERAL

- .1 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

3.3 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept work of this section.
- .2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.
- .3 Report unsatisfactory conditions to Departmental Representative in writing.
- .4 Do not start work until deficiencies have been corrected. Beginning of Work implies acceptance of conditions.

3.4 PREPARATION - AIR/VAPOUR BARRIER MEMBRANE

- .1 Remove loose or foreign matter, which might impair adhesion of materials.
- .2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions.
- .3 Ensure substrates are free of surface moisture prior to application of Air/Vapour Barrier Membrane Type 1 and primer.
- .4 Ensure metal closures are free of sharp edges and burrs.
- .5 For Air/Vapour Barrier Membrane Type 1, Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.5 INSTALLATION - AIR/VAPOUR BARRIER MEMBRANE

- .1 Install materials in accordance with manufacturer's instructions.
- .2 Install Air/Vapour Barrier Membrane primed substrate. Liquid Membrane and Termination Sealant to ensure complete seal. Position lap seals over firm bearing.
- .3 Lap Air/Vapour Barrier Membrane onto roof vapour minimum 150 mm. Seal with Liquid Membrane and Termination Sealant to ensure complete seal.
- .4 At perimeter of windows and door frames, provide strip of Air/Vapour Barrier Membrane to ensure air and vapour tight assembly. Install air/vapour barrier membrane over metal closure strip extending from pressure plate of frame, over full surface of metal closure strip and extend minimum 150 mm onto surface of air/vapour barrier of main wall surface. Caulk with Liquid Membrane and Termination Sealant to ensure complete seal.
- .5 Apply Liquid Membrane and Termination Sealant within recommended application temperature ranges.

3.6 CLEANING

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

3.7 PROTECTION OF WORK

- .1 Protect finished work in accordance with Section 01 61 00.
- .2 Do not permit adjacent work to damage work of this section.
- .3 Ensure finished work is protected from climatic conditions.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/Composite Panel Association (CPA)
 - .1 ANSI A135.6-12, Engineered Wood Siding.
- .2 ASTM International
 - .1 ASTM D5116-17, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.
 - .2 ASTM C1186-08(2016) - Standard Specification for Flat Fiber-Cement Sheets.
 - .3 ASTM D3359-17, Standard Test Methods for Rating Adhesion by Tape Test.
 - .4 ASTM E136-19a, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .5 CSA International
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .6 Environmental Choice Program (ECP)
 - .1 CCD-045-95, Sealants and Caulking Compounds.

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 siding and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS SDS. Indicate VOC's for caulking materials during application and curing.
- .3 Samples:
 - .1 Submit duplicate 300 mm long size of wall system, representative of materials, finishes and colours.

1.3 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00.

- .2 Supply mock up of Fibre Cement Siding, including:
 - .1 at window head, sill, jamb and fin
 - .2 outside corner
 - .3 inside corner

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect siding from nicks, scratches, and blemishes.
 - .3 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 Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Fibre cement lap siding:
 - .1 Fiber-cement Siding - complies with ASTM C1186 Type A Grade II.
 - .1 152mm width, 121mm exposure.
 - .2 Texture: smooth surface
 - .3 Finish: factory applied primer and topcoat.
 - .4 Colour selected by Departmental Representative from standard manufacturer's range. Use colour-matched edge coater to seal any cut ends.
- .2 Cement Board Fin: Non-asbestos fibre-cement fully compressed 25 mm thick flat trim boards to ASTM C1186 Grade II: Sizes vary - refer to drawings for sizes and locations. Two (2) fins per window. All trims smooth finish. Colour selected by Departmental Representative from standard manufacturer's range. Use colour-matched edge coater to seal any cut ends.
- .3 Cement Board Solid Trim: Non-asbestos fibre-cement fully compressed 13 mm thick flat trim boards to ASTM C1186 Grade II: Sizes vary - refer to drawings for sizes and locations. All trims smooth finish. Colour selected by Departmental Representative from standard manufacturer's range. Use colour-matched edge coater to seal any cut ends.
- .4 Coloured Cement Fibre Board Panel: Non-asbestos fibre-cement fully compressed 8 mm mm thick flat boards to ASTM C1186 Grade II: Panel 1220 mm X 2440 mm. Sizes vary - refer to drawings for sizes and locations. Smooth finish. Colour selected by Departmental Representative from standard manufacturer's range. Use colour-matched edge coater to seal any cut ends.

- .5 Fasteners: siding nails to CSA B111, stainless steel, sized as required by manufacturer.
- .6 Prefinished metal flashing in accordance with Section 07 62 00.
- .7 Wood vertical furring strips, in accordance with Section 06 10 00.
- .8 Joint Sealants: As per Section 07 92 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable 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 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install hardboard to manufacturers' written instructions.
- .2 Install sill flashings, wood starter strips, inside corner flashings, edgings and flashings over openings.
- .4 Fasten siding in straight, aligned lengths to furring at 400 mm on centre maximum using two nails at each fixing location. Intermediate butt joints are not permitted. Seal cut surfaces. Mitre ends at metal corner trims.
- .5 Maintain dimensions required by manufacturer for minimum distances from edge for holes and penetrations.
- .6 Installation to allow for thermal expansion of the siding.
- .7 Holes are to be drilled as per manufacturer's written instructions.
- .8 Siding to be aligned in straight, level and aligned manner, in consistent method allowing enough ventilation behind siding.

- .9 Install panels with joints centered over horizontal rails. All fasteners to be installed straight to the panel and in a consistent manner.
- .10 Do not install using damaged, warped or misaligned material.
- .11 Where siding fits into accessories, allow room for expansion.
- .12 Co-ordinate the location of, and provide clean cut-outs for, mechanical or electrical devices and outlets mounted on siding.
- .13 Finished installation shall be properly secured, free of rattles, distortions, waviness, and protrusions, damaged or chipped components.
- .14 Install wood strapping for horizontal siding over exterior insulation and air barrier at spacing to suit boards. Shim as required to achieve specified tolerances. Arrange furring to ensure free drainage of moisture to below.
- .15 Install head and sill flashings, edge trim, cap pieces and fillers.
- .16 Seal joints where indicated.
- .17 Located splices in horizontal boards at least 300 mm away from openings.

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 wood siding installation.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for sheet metal roofing.

1.2 RELATED SECTIONS

- .1 Section 07 92 10 - Joint Sealing.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A167-99(2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM B32-08(2014), Standard Specification for Solder Metal.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.(Withdrawn)

1.4 SUBMITTALS

- .1 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .2 Submit product data in accordance with Section 01 33 00.
- .3 Submit WHMIS SDS - Safety Data Sheets. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .4 Submit product data sheets for bitumen roofing felts insulation. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Limitations.
- .5 Submit shop drawings in accordance with Section 01 33 00.
- .6 Indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame.
- .7 Submit samples in accordance with Section 01 33 00.
- .8 Submit 300 x 300 mm samples of each sheet metal material.

1.5 QUALITY ASSURANCE

- .1 Submit mock-ups in accordance with Section 01 45 00.
- .2 Fabricate 600 x 600 mm sample roofing panel using identical project materials and methods to include typical seam.
- .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 sheet metal flashing work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may not remain as part of finished Work. Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- .1 Plain stainless steel sheet: to ASTM A167, Type 316L with, 0.476 mm minimum thickness. Finish #2b (Mill finish - matte).

2.2 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5.
- .3 Underlay:
 - .1 2 layers self-adhesive membrane composed of SBS modified bitumen and tri-laminated polyethylene.
 - .2 Thickness: 1.5mm.
 - .3 Underface: Silicone release film.
 - .4 Top face: Tri-laminate woven polyethylene.
 - .5 Tensile strength: 15.4 kN/m.
 - .6 Ultimate elongation: 25%.
 - .7 Tear resistance: 400N.
 - .8 Lap adhesion: 2000N/m.
 - .9 Water absorption: 0.1% max.
 - .10 Peel resistance: 3500 N/m.
 - .11 Water vapour permeance 0.49 ng/Pa*s*m2.
 - .12 Crack cycling at -32, 100 cycles: Unaffected.
 - .13 Resistance to hydraulic head: 114 m min.
- .4 Slip sheet: reinforced sisal paper or a heavy felt kraft paper.
- .5 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer.
- .6 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide.

Thickness same as sheet metal being secured.

- .7 Fasteners: concealed.
- .8 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .9 Solder: to ASTM B32.
- .10 Flux: rosin, cut muriatic acid, or commercial preparation suitable for materials to be soldered.
- .11 Sheet metal fascia: to profile as shown on drawings.
- .12 Sheet metal soffit: Perforated. Providing 0.005 m² of opening per 305 mm of length. Include soffit clips of matching material.
- .13 Ridge vent: Continuous rows of louvres on both sides. Vented. Providing 0.06 m² of opening per 3050 mm of length. Profile as per drawings.
- .14 As per Section 05 41 00, thermally broken Z-Girts, size as per drawings, engineered to meet structural requirements.
- .15 Downspout Splash Guard: 610 mm long x 400 mm wide x 100 mm high precast concrete. Colour to be chosen by Departmental Representative from manufacturer's standard colour range.

2.3 FABRICATION

- .1 Form individual pans in 3000 mm maximum lengths x 500 wide. Make allowances for expansion at joints.
- .2 Hem exposed edges on underside 12 mm, mitre and seal.
- .3 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .4 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.
- .5 Protect metals against oxidization by back painting with isolation coating where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Use concealed fastenings except where approved by Departmental Representative before installation.
- .2 Provide underlay under sheet metal roofing. Secure in place and lap joints 100 mm minimum.

- .3 Apply slip sheet over underlay to prevent bonding between sheet metal and underlayment. Secure with minimum anchorage and lap joints 50 mm minimum in direction of water flow.
- .4 Install sheet metal roof panels using cleats spaced at 600 mm on centre.
- .5 Secure cleats with two fasteners each and cover with cleat tabs.
- .6 Stagger transverse seams in adjacent panels.
- .7 Flash roof penetrations with material matching roof panels, and make watertight.
- .8 Form seams in direction of water-flow and make watertight.
- .9 Perform soldering with well heated coppers, heat seam thoroughly and sweat solder through its full width.
- .10 Clean and flux metals before soldering.
- .11 Follow sheet metal manufacturer's recommendations for soldering procedures.
- .12 As work progresses, neutralize excess flux with 5% to 10% washing soda solution, and thoroughly rinse. Leave work clean and free of stains.

3.2 STANDING SEAM ROOFING

- .1 Use stainless steel 600 mm wide by 2400 mm long sheets to make roofing with double-lock standing seams 530 mm on centre.
- .2 Fold lower end of each pan under 20 mm.
 - .1 Slit fold 25 mm away from corner to form tab where pan turns up to make standing seam.
 - .2 Fold upper end of each pan over 50 mm.
 - .3 Hook 20 mm fold on lower end of upper pan into 50 mm fold on upper end of underlying pan.
- .3 Apply sheet metal roofing beginning at eaves. Loose lock pans to edge strips at eaves.
- .4 Finish standing seams 25 mm high on flat surfaces. Bend up one side edge 40 mm and other 45 mm.
 - .1 Make first fold 6 mm wide single fold and second fold 12 mm wide, providing locked portion of standing seam with 5 plies in thickness.
 - .2 Fold lower ends of seams at eaves over at 45 degrees angle.
 - .3 Terminate standing seams at ridge and hips by turning down in tapered fold.

3.3 BUILT-IN GUTTERS

- .1 Form built-in box gutter lining with stainless steel conforming to profile

- of gutters.
- .2 Use 1000 mm long sheets if section profile of gutter exceeds 1000 mm. Use 2.4 m or 3 m long sheets if sectional profile is less than 1000 mm.
 - .3 Longitudinal joints not acceptable.
 - .4 Secure gutter lining to substrate with screws, washers and expansion shields spaced maximum 1200 mm on centre along centre of lining.
 - .5 At roof edges extend gutter lining under metal roofing 150 mm minimum and terminate in 20 mm folded edge secured by cleats. Hook lower end of roofing into lock strip to form 20 mm wide loose-lock seam.
 - .6 Provide matching stainless steel downspout.
 - .7 Provide splash guard on grade at bottom of each downspout.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A167-99(2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A240/A240M-19, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM B32-08(2014), Standard Specification for Solder Metal.
 - .4 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .2 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual 2012.
- .3 Canadian Standards Association (CSA International)
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, Standard/Specification for Windows, Doors, and Unit Skylights.
 - .2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies WHMIS SDS - Safety Data Sheets.
- .3 Shop Drawings:
 - .1 Shop drawings: submit drawings indicating proposed installation methods.
- .4 Quality assurance submittals: submit following in accordance with Section 01 45 00.
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, and installation sequence.

1.3 QUALITY ASSURANCE

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

- .1 Verify project requirements.
- .2 Review installation and substrate conditions.
- .3 Co-ordination with other building sub-trades.
- .4 Review manufacturer's installation instructions and warranty requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- .1 Plain stainless steel sheet: to ASTM A240/A240M, Type 316L.
- .2 Aluminum Sheet: ASTM B209M, alloy 3003-H14.

2.2 ALUMINUM WINDOW SILLS

- .1 Exterior aluminum cladding:
 - .1 Brake-formed sheet metal as detailed, minimum 1.2 mm thick, complete with join covers, jamb drip deflectors, chairs and anchors.
 - .2 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Fluoropolymer modified acrylic topcoat applied over primer: Colour from manufacturer's standard colour range.

2.3 ACCESSORIES

- .1 Underlay for metal flashing:
 - .1 2 layers self-adhesive membrane composed of SBS modified bitumen and tri-laminated polyethylene.
 - .2 Thickness: 1.5mm.
 - .3 Underface: Silicone release film.
 - .4 Top face: Tri-laminate woven polyethylene.
 - .5 Tensile strength: 15.4 kN/m.
 - .6 Ultimate elongation: 25%.
 - .7 Tear resistance: 400N.
 - .8 Lap adhesion: 2000N/m.
 - .9 Water absorption: 0.1% max.
 - .10 Peel resistance: 3500 N/m.
 - .11 Water vapour permeance: 0.49 ng/Pa*s*m2.
 - .12 Crack cycling at -32, 100 cycles: Unaffected.
 - .13 Resistance to hydraulic head: 114 m min.
- .2 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

- .3 Fasteners: of same material as sheet metal, to CSA B111, flat head roofing nails of length and thickness suitable for metal flashing application.
- .4 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .5 Solder: to ASTM B32.
- .6 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.

2.4 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work as indicated.
- .2 Form pieces in 2400 mm maximum lengths.
 - .1 Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm.
 - .1 Mitre and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 METAL FLASHINGS

- .1 Form flashings, copings and fascias to profiles indicated of 0.3 mm thick stainless steel sheet.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install sheet metal work as detailed.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal.
 - .1 Secure in place and lap joints 100 mm.
- .4 Lock end joints and solder.
- .5 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.

- .6 Install pans around items projecting through roof membrane, solder joints to provide water-tight connections.

3.3 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 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S115-2018, 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 2015, Division B, Parts 3.1.8 and 3.1.9.1, 9.10.9):
 - .1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company specializing in fire stopping installations with 5 years experience.
 - .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 firestopping. Individual disciplines shall NOT fire stop their own work.

1.5 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

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

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 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.

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 Partition Type P6 between Workshop 1.11 and Lockers 1.09/Engineer's Office 1.10.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.
- .2 Text to complete other various Sections containing sealant or caulking specifications.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .2 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .5 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each color where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00.
 - .1 Instructions to include installation instructions for each

product used.

1.4 QUALITY ASSURANCE/MOCK-UP

- .1 Construct mock-up in accordance with Section 01 45 00.
- .2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.
- .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 48 hours for inspection of mock-up by Departmental Representative before proceeding with sealant 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. Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 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 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

- .7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.
- .8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .9 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4°C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas

which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

- .3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Type 1: Silicones One Part.
 - .1 To CAN/CGSB-19.13 or ASTM C920, primerless, Type S, Grade NS, Class 25 50 100, SWRI validated.
- .2 Type 2: Acrylic Latex One Part.
 - .1 To CAN/CGSB-19.17.
- .3 Type 3: Acoustical Sealant.
 - .1 Single component, non-skinning, non-hardening synthetic rubber sealant.
 - .2 To CAN/CGSB-19.21 M87 or ASTM C920.
- .4 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded open or closed cell foam backer rod.
 - .2 Size: oversize 30 to 50%.
 - .2 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

- .1 Windows: Sealant type: 1.
- .2 Concrete formwork: Sealant type: 2.
- .3 Perimeter of interior frames: Sealant type: 2.
- .4 Plumbing fixtures and adjacent surfaces: Sealant type: 2.
- .5 Millwork and adjacent surfaces: Sealant type: 2.
- .6 Acoustical partitions: Sealant type: 3.

2.4 JOINT CLEANER

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

PART 3 - EXECUTION

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .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.

3.3 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.

3.4 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 For windows, mask edges of joint to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .3 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.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 07 27 00 - Air Tight Layer
- .2 Section 08 50 00 - Windows

1.2 REFERENCES

- .1 Deutsches Institut für Normung, (DIN)
 - .1 DIN 18542:2009, Sealing of outside wall joints with impregnated sealing tapes made of cellular plastics - Impregnated sealing tapes - Requirements and testing.
 - .2 DIN EN 12667:2001 Thermal Performance of Building Materials and Products - Determination of Thermal Resistance by Means of Guarded Hot Plate and Heat Flow Meter Methods - Products of High and Medium Thermal Resistance; English Version Of DIN 12667.
 - .3 DIN 4102-1:1998 Fire behaviour of building materials and building components - Part 1: Building materials; concepts, requirements and tests.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM E330/E330M-14: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .2 ASTM E331-00(2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Manufacturer's product data to describe:
 - .1 Physical properties and performance characteristics
 - .2 Dimensions
- .3 Submit samples in accordance with Section 01 33 00.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Submit manufacturer's instructions in accordance with Section 01 33 00.
 - .1 Instructions to include installation instructions for each product used.

1.4 QUALITY ASSURANCE/MOCK-UPS

- .1 Construct mock-up in accordance with Section 01 45 00.
- .2 Construct mock-up to show location, size, shape, depth and adhesion of joints complete with back-up material, primer, caulking and sealant. Allow for four mock-ups on different substrates.
- .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 sealant 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 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 Place materials defined as hazardous or toxic in designated containers.
- .5 Unused material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .6 Divert unused material from landfill to official hazardous material collections site approved by Departmental Representative.

1.7 SITE CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of compressible foam tape when

ambient and substrate temperature conditions are outside limits permitted by tape manufacturer.

- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of compressible foam tape where joint widths are greater or less than those allowed by tape manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of compressible foam tape until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

- .1 Pre-compressed, self-expanding joint sealing tape based on polyurethane soft foam with acrylate dispersion impregnation, accessory agents and filling agents with the following properties:
 - .1 Resistance to wind loading: 3.6 kN/m² uniform load deflection and 9kN/ m² uniform load structural in accordance with ASTM E330/E330M.
 - .2 Air tightness: 0.00004 m³s at .075 kN/m² and 0.00015 m³s at 0.3 kN/m².
 - .3 Resistance to water penetration: ≥1050 Pa when tested in accordance with ASTM E331.
 - .4 Compatibility with adjoining materials: No corrosion, staining or discolouration when tested in accordance with DIN 18542
 - .5 Thermal conductance: $\lambda = 0.0412$ W/mK when tested in accordance with DIN 12667.

PART 3 - EXECUTION

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of tape.
- .2 Ensure joint surfaces are dry and frost free.
- .3 Prepare surfaces in accordance with manufacturer's directions.

3.3 APPLICATION

- .1 Install in accordance with manufacturer's written instructions.
- .2 Tape to be sealed to window frame and wood stud rough opening.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C473-19, Standard Test Methods for Physical Testing of Gypsum Panel Products.
 - .2 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C636/C636M-19, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
 - .4 ASTM C665-17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
 - .5 ASTM C754-18, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
 - .6 ASTM C840-19b, Standard Specification for Application and Finishing of Gypsum Board.
 - .7 ASTM C1002-18, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .8 ASTM C1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .9 ASTM C1177/C1177M-17, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .10 ASTM C1288-17, Standard Specification for Fiber-Cement Interior Substrate Sheets.
 - .11 ASTM C1325-19, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.
 - .12 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
 - .13 ASTM D2394-17, Standard Test Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring.
- .2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2016, Adhesives and Sealants Applications.

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 board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 95% of construction wastes were recycled or salvaged.
 - .2 Low-Emitting Materials:
 - .1 Submit listing of adhesives and sealants and paints and coatings

used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.3 DESIGN REQUIREMENTS

- .1 Partition assembly to be as per the Drawings.

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 gypsum board assemblies materials level off ground, indoors in dry locatio] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
 - .3 Protect from weather, elements and damage from construction operations.
 - .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
 - .5 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

- .1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Standard board: to ASTM C1396/C1396M, minimum 96% recycled content, 13 and 15.9 mm thick, 15.9 mm thick fire-rated, 1200 mm wide x maximum practical length, ends square cut, edges squared.
- .2 Gypsum exterior sheathing board: to ASTM C1177/C1177M, regular, 16 mm thick, 1200 mm wide x maximum practical length.
- .3 Cement board for shower walls: cementitious, water durable, board; surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; to

ANSI A118.9, ASTM C1288 and ASTM C1325, 13 mm thick, edges tapered, 1200 mm wide x maximum practical length. Compressive strength: Not less than 15.51 MPa when tested in accordance with ASTM D2394. Water absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C473.

- .4 Metal furring runners, hangers, tie wires, inserts, anchors.
- .5 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .6 Steel drill screws: to ASTM C1002.
- .7 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .8 Sealants: in accordance with Section 07 92 00.
 - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
 - .2 Acoustic sealant: in accordance with Section 07 92 00.
- .9 Joint compound: to ASTM C475/C475M, asbestos-free.
- .10 Joint tape: to ASTM C475/C475M.
 - .1 Paper tape for standard gypsum board.
 - .2 Glass mesh tape for cement board.
- .11 Acoustical insulation: batt and blanket mineral fibre to ASTM C665, Type 1 Compliant, non-combustible, thickness as noted on drawings.
- .12 Concealed suspension system for gypsum board ceiling:
 - .1 Heavy duty system to ASTM C636/C636M.
 - .2 Basic materials for suspension system: G40 double-web tee, hot-dipped galvanized steel.
 - .3 Suspension system: non fire rated, two directional concealed tee bar grid.
 - .4 Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.
 - .6 Hanger wire: galvanized soft annealed steel wire, 2.67 mm (12 gauge) diameter.
 - .7 Hanger inserts: purpose made.
 - .8 Accessories: splices, clips, wire ties, retainers and wall moulding flush to complement concealed suspension system components, as recommended by system manufacturer.

2.2 STEEL STUD FRAMING

- .1 Heavy-duty Metal Framing:
 - .1 Studs: to ASTM C645, 40 mm flange, 204 mm web, 16 mm return, roll formed from 1.27 mm thickness hot dipped galvanized steel sheet. Knock-out service holes at 460 mm centres.
 - .2 Floor and ceiling tracks: to ASTM C 645, 40 mm flange, 204 mm web, roll formed from 1.27 mm thickness hot dipped galvanized steel sheet.

- .2 Light-duty Metal Framing:
 - .1 Studs: to ASTM C645, 32 mm flange, 92 mm or 204 mm web, 16 mm return, roll formed from 0.95 mm thickness hot dipped galvanized steel sheet. Knock-out service holes at 460 mm centres.
 - .2 Floor and ceiling tracks: to ASTM C645, 32 mm flange, 92 mm or 204 mm, roll formed from 0.95 mm thickness hot dipped galvanized steel sheet.
- .3 Resilient furring channels:
 - .1 To ASTM C645, 50 mm long, 13 mm deep with 32 mm screw flange, roll formed from 0.5 mm thickness hot dipped galvanized steel sheet for resilient attachment of gypsum board.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify conditions of substrates previously installed under other Sections are acceptable for product installation in accordance with manufacturer's written instructions prior to partition installation.
 - .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 ERECTION OF FRAMING

- .1 Install steel framing members to receive screw-attached gypsum board in accordance with ASTM C754 except where specified otherwise.
- .2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .3 Install acoustical foam seal under floor tracks, above ceiling tracks and between studs and flanking walls around perimeter of partitions.
- .4 Align partition tracks at concrete floor slab and steel roof deck and secure 600 mm on centre with concrete screws.
- .5 Place studs vertically at 400 mm on centre and maximum of 50 mm from abutting walls, and at each side of openings and corners. Provide double stud at doors. Position studs in tracks at floor and ceiling. Secure stud to track with metal framing screws. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions
- .6 Erect studding to tolerance of 1:1000.
- .7 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

- .8 Erect track at head of door/window openings, duct openings and window sills to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .9 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .10 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .11 Extend partitions to underside of structure except where noted otherwise on drawings. Frame openings around existing roof framing members where interior partitions meet underside of existing roof deck.
- .12 Maintain clearance under beams and roof decks to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks or double track slip joint.
- .13 For partitions having an STC rating of 35 or more, install two continuous beads of acoustical sealant under studs and tracks.

3.3 ERECTION OF CEILING SUSPENSION SYSTEM

- .1 Installation: in accordance with ASTM C636/C636M except where specified otherwise.
- .2 Suspension System:
 - .1 Erect ceiling suspension system after work above ceiling has been inspected by Departmental Representative.
 - .2 Secure hangers to overhead structure using attachment methods acceptable to Departmental Representative.
 - .3 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
 - .4 Install concealed wall moulding trim to provide correct ceiling height.
 - .5 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers grilles and speakers.
 - .6 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
 - .7 Interlock cross member to main runner to provide rigid assembly.
 - .8 Install gypsum board ceilings onto suspension system as per manufacturer's writing instructions and installation details.
 - .9 Ensure finished ceiling system is square with adjoining walls and level within 1:1000.
- .3 Interface with Other Work
 - .1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, to be built into gypsum board ceiling components.

3.4 SOUND ATTENUATION INSULATION

- .1 Install sound attenuation insulation in partitions as indicated.
- .2 Install insulation by friction fit to maintain continuity of acoustic isolation between spaces. Extend insulation into bulkheads associated with partition.
- .3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .4 Do not compress insulation to fit into spaces.
- .5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.
- .6 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.5 ERECTION OF GYPSUM BOARD ACCESSORIES

- .1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.
- .2 Install resilient furring channels for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .3 Install acoustical insulation to fill all voids in cavities of metal framing system.
- .4 Install acoustic sealant in partitions:
 - .1 at perimeter junction of outer layer of gypsum and floor slab, ceiling slab and flanking walls.
 - .2 at all penetrations through the gypsum board on both the inside and outside face.
 - .3 at perimeter of all junction and outlet boxes.
- .5 Install gypsum boards in direction that will minimize number of end-butt joints. Stagger end joints 250 mm minimum.

3.6 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply single layer gypsum board to framing using drywall screws. Maximum spacing of screws 300 mm on centre.

3.7 INSTALLATION

- .1 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 150 mm on centre.

- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .3 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .4 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .5 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .6 Complete installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 35 43.

3.9 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
 - .1 ANSI A108/A118/A136.1:2019, American National Specifications for the Installation of Ceramic Tile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-75.1-M88, Tile, Ceramic.
- .3 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.
- .4 Terrazzo Tile and Marble Association of Canada (TTMAC)
 - .1 Tile Specification Guide 09 30 00 2019/2021, Tile Installation Manual.
 - .2 Hard Surface Maintenance Guide 2019/2021.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Provide product data in accordance with Section 01 33 00.
 - .1 Include manufacturer's information on:
 - .1 Ceramic tile, marked to show each type, size, and shape required.
 - .2 Chemical resistant mortar and grout (Epoxy and Furan).
 - .3 Cementitious backer unit.
 - .4 Dry-set cement mortar and grout.
 - .5 Divider strip.
 - .6 Elastomeric membrane and bond coat.
 - .7 Reinforcing tape.
 - .8 Levelling compound.
 - .9 Latex cement mortar and grout.
 - .10 Commercial cement grout.
 - .11 Organic adhesive.
 - .12 Slip resistant tile.
 - .13 Waterproofing isolation membrane.
 - .14 Fasteners.
- .3 Provide samples in accordance with Section 01 33 00.
 - .1 Backsplash tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
 - .2 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: manufacturer's installation instructions.
 - .2 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.
- .2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
 - .2 Maintenance material same production run as installed material.

PART 2 - PRODUCTS

2.1 WALL TILE

- .1 Porcelain tile: to CAN/CGSB-75.1, Type 3, Class MR 1, 100 x 600 x 8 mm size, square edges, glazed surface, stacked pattern, colour as selected by Departmental Representative. Matching square edge trim to suit application. For installation as wall backsplash tile.

2.2 MORTAR AND ADHESIVE MATERIALS

- .1 Polymer-modified SAG-resistant mortar.
- .2 Latex additive: formulated for use in portland cement mortar and thin set bond coat.
- .3 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

2.3 GROUT

- .1 Epoxy grout: 100% solids, two component water washable epoxy grout, consisting of two components; a hardening resin and a pre-mixed portion of epoxy resin, colour pigments and graded aggregate. To ANSI A118.3 requirements.

2.4 ACCESSORIES

- .1 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.
- .2 Sealant: in accordance with Section 07 92 10.
- .3 Protective coating: to tile and grout manufacturer's recommendations.
- .4 Edge trims: Refer to drawings for location. Size to suit tile depth.

2.5 MIXES

- .1 Cement:
 - .1 Scratch coat: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, and latex additive where required. Adjust water volume depending on water content of sand.
 - .2 Slurry bond coat: cement and water mixed to creamy paste. Latex additive may be included.
 - .3 Mortar bed for floors: 1 part cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand.
 - .4 Mortar bed for walls and ceilings: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.
 - .5 Levelling coat: 1 part cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
 - .6 Bond or setting coat: 1 part cement, 1/3 part hydrated lime, 1 part water.
 - .7 Measure mortar ingredients by volume.
- .2 Dry set mortar: mix to manufacturer's instructions.
- .3 Organic adhesive: pre-mixed.
 - .1 Adhesives: maximum VOC limit 65 g/L to SCAQMD Rule 1168.
- .4 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .5 Adjust water volumes to suit water content of sand.

2.6 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

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 WORKMANSHIP

- .1 Do tile work in accordance with the latest version of the TTMAC Tile Installation Manual, "Ceramic Tile", except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.
- .3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .8 Make internal angles square, external angles rounded.
- .9 Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .10 Allow minimum 24 hours after installation of tiles, before grouting.
- .11 Clean installed tile surfaces after installation and grouting cured.

3.3 WALL TILE

- .1 Install as per drawings.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 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.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM D2047-17, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
 - .2 ASTM E492-09(2016)e1, Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
 - .3 ASTM E648-19a e1, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - .4 ASTM E662-19, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - .5 ASTM E970-17 Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.
 - .6 ASTM F1066-04(2018), Standard Specification for Vinyl Composition Floor Tile.
 - .7 ASTM F1303-04(2014), Standard Specification for Sheet Vinyl Floor Covering with Backing
 - .8 ASTM F2034-18, Standard Specification for Linoleum Sheet Floor Covering.
- .2 International Organization for Standardization
 - .1 ISO 717-2:2013, Acoustics – Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation.
- .3 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.

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 linoleum sheet flooring and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, nosing, feature strips, treads, and edge strips.
- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Low-Emitting Materials:
 - .1 Submit listing of adhesives and sealants and paints and coatings] used in building, showing compliance with VOC and chemical component limits or restriction requirements.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide extra materials of flooring and adhesives in accordance with Section 01 78 00.
 - .2 Provide 2 m² of each colour, pattern and type flooring material required for project for maintenance use.
 - .3 Extra materials one piece and from same production run as installed materials.
 - .4 Identify each roll of sheet flooring and each container of adhesive.
 - .5 Deliver to Departmental Representative, upon completion of the work of this section.
 - .6 Store where directed by Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain air temperature and structural base temperature at flooring installation area above 20 degrees for 48 hours before, during and 48 hours after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Sheet vinyl with backing: to ASTM F1303.
 - .1 Product Description: Construction: A homogeneous floor covering made from natural ingredients including flax seed oil, rosin binders, wood flour, limestone and dry pigments which are mixed and then calendared onto a natural jute backing with an applied polyolefin comfort layer.

- .2 Physical Characteristics: (dimensions are approximate):
 - .1 Gauge: 3.5 mm.
 - .2 Backing: Jute/Polyolefin Foam.
 - .3 Width: 2 meters.
 - .4 Length: 32 meters.
 - .5 Roll Size: 64 m².
- .3 Meets or exceeds all technical requirements as set forth in ASTM F2034 Standard Specification for Linoleum Sheet Flooring, Type III.
- .4 Static Load Limit: Residual compression of 0.02032 cm with 17.57 kg/cm² when tested in accordance with ASTM F970-17, Standard Test Method for Static Load Limit.
- .5 Slip Resistance: Meets or exceeds the industry recommendation of >0.5 for flat surfaces when tested in accordance with ASTM D2047, Standard Test Method for Static Coefficient of Friction.
- .6 Impact Sound Reduction: 17dB when tested in accordance with ISO 717-2, Impact Sound Insulation Test. IIC 60 when tested in accordance with ASTM E492, Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor/Ceiling Assemblies using the Tapping Machine.
- .7 Resistance to Bacteria: Provides a self-sanitizing quality in the form of abactericidal effect. Independent testing has shown that a sterile zone around the material inhibits the growth of organisms such as staphylococcus aureas and Clostridium difficile.
- .8 Anti-Static Properties: Naturally anti-static. This property makes cleaning easier because dirt and dust does not cling to the surface as it may with other materials.
- .9 Fire Testing: Class 1 when tested in accordance with ASTM E648/ NFPA 253, Standard Test Method for Critical Radiant Flux. Meets 450 or less when tested in accordance with ASTM E662/NFPA 258, Standard Test Method for Smoke Density.
- .2 Electrostatic dissipative vinyl tile: to ASTM F1066, Class 2.
 - .1 Type: Static dissipative vinyl tile composed of polyvinyl chloride resin, plasticizers, fillers, pigments, and antistatic additive with colours and texture dispersed uniformly throughout its thickness
 - .2 Size: 305 x 305 mm.
 - .3 Colour: in standard colour to later selection by Departmental Representative.
 - .4 Thickness: 3.2 mm.
- .3 MDF base
 - .1 Install detail: as per drawings
 - .2 Style: 100 mm high.
 - .3 Thickness: 16 mm unless otherwise noted.
 - .4 Lengths: cut lengths minimum 2400 mm.
 - .5 Colour: Painted to match the wall paint as selected by Departmental Representative.
- .4 Primers and adhesives: of types recommended by flooring manufacturer for specific material on applicable substrate, above, on or below grade.

- .5 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste 2 part latex-type filler requiring no water as recommended by flooring manufacturer for use with their product.
- .6 External corner protectors: type recommended by flooring manufacturer.
- .7 Edging to floor penetrations: type recommended by flooring manufacturer.
- .8 Sealer and wax: type recommended by linoleum flooring material manufacturer for material type and location.

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 linoleum sheet flooring 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 SITE VERIFICATION OF CONDITIONS

- .1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.3 PREPARATION

- .1 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .2 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .3 Prime concrete slab and plywood sub-floor to flooring manufacturer's printed instructions.

3.4 APPLICATION: FLOORING

- .1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least 1 month following building occupation.
- .2 Apply adhesive uniformly using recommended trowel. Do not spread more

- adhesive than can be covered by flooring before initial set takes place.
- .3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.
 - .4 Run sheets in direction of traffic. Double cut sheet joints and continuously seal heat weld according to manufacturer's printed instructions.
 - .5 Heat weld seams of linoleum sheet flooring in accordance with manufacturer's printed instructions.
 - .6 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.
 - .7 Cut flooring around fixed objects.
 - .8 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
 - .9 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 APPLICATION: BASE

- .1 Lay out base to keep number of joints at minimum.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly.
- .5 Install straight and level to variation of 1:1000
- .6 Scribe and fit to door frames and other obstructions.
- .7 Mitre corners.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
 - .1 Clean flooring and base surfaces to flooring manufacturer's printed instructions.
- .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.

3.7 PROTECTION

- .1 Protect new floors from after initial waxing until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.
- .3 Use only water-based coating for flooring.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 This Section includes one resinous flooring system, one with epoxy body.
 - .1 Application Method: Metal, power or hand troweled.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C307-18, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
 - .2 ASTM C413-18, Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - .3 ASTM C579-18, Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - .4 ASTM C580-18, Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - .5 ASTM D2240-15e1, Standard Test Method for Rubber Property-Durometer Hardness.
 - .6 ASTM D2794-93(2019), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - .7 ASTM E648-19ae1, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - .8 ASTM F1869-16a, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - .9 ASTM F2170-16a, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- .2 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.

1.3 SUBMITTALS

- .1 Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- .2 Samples for Verification: For each resinous flooring system required, 150 mm square, applied to a rigid backing by Contractor for this Project.
- .3 Room Finish Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on Drawings in room finish schedule.
- .4 Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- .5 Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- .1 Contractor Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
 - .1 Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 - .2 Contractor shall have completed at least 10 projects of similar size and complexity.
- .2 Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- .3 Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.
 - .1 Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.
- .4 Pre-installation Conference:
 - .1 Contractor shall arrange a meeting not less than thirty days prior to starting work.
 - .2 Attendance:
 - .1 Contractor
 - .2 Departmental Representative
 - .3 Manufacturer/Installer's Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- .2 Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.
- .3 All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.6 PROJECT CONDITIONS

- .1 Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature,

moisture, ventilation, and other conditions affecting resinous flooring application.

- .1 Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.
- .2 Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- .3 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- .4 Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.7 WARRANTY

- .1 Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING

- .1 Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include,
 - .2 Build of Broadcast or liquid rich type systems will not be accepted, and will result in a disqualification from bid.
- .2 System Characteristics:
 - .1 Color and Pattern: selected by Departmental Representative.
 - .2 Wearing Surface: Medium (Slip resistant).
 - .3 Integral Cove Base: yes, continuous epoxy base.
 - .4 Overall System Thickness: nominal 6 mm.
- .3 System Components: Manufacturer's standard components that are compatible with each other and as follows:
 - .1 Primer:
 - .1 Material Basis: Standard Primer.
 - .2 Resin: Epoxy.
 - .3 Formulation Description: (2) two component, 100 percent solids.
 - .4 Application Method: Squeegee and roller.
 - .5 Number of Coats: (1) one.
 - .2 Mortar Base:
 - .1 Resin: Epoxy.
 - .2 Formulation Description: (3) three component, 100 percent solids.

- .3 Application Method: Metal Trowel.
 - .1 Thickness of Coats: nominal 4 mm.
 - .2 Number of Coats: One.
 - .4 Aggregates: Pigmented Blended aggregate.
- .3 Undercoat:
 - .1 Material Basis: Undercoat.
 - .2 Resin: Epoxy.
 - .3 Formulation Description: (2) two-component, 100% solids, UV Stable.
 - .4 Type: Clear.
 - .5 Finish: Gloss.
 - .6 Number of Coats: one.
- .4 Broadcast Media:
 - .1 Material Basis: Quartz aggregate.
 - .2 Type: pigmented.
 - .3 Finish: Slip resistant.
 - .4 Number of Coats: one.
 - .5 Pattern: Tweed.
- .5 Sealer:
 - .1 Resin: Epoxy
 - .2 Formulation Description: (2) two-component, 100% solids, UV Stable.
 - .3 Type: Clear.
 - .4 Finish: Gloss.
 - .5 Number of Coats: one.
 - .6 Texture level: Standard
- .4 System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
 - .1 Compressive Strength: 68.95 MPa (10,000 psi) after 7 days per ASTM C579.
 - .2 Tensile Strength: 13.79 MPa (2,000 psi) per ASTM C307.
 - .3 Flexural Strength: 29.65 MPa (4,300 psi) per ASTM C580.
 - .4 Water Absorption: < 1% per ASTM C413.
 - .5 Impact Resistance: > 18.1 Nm (160 in. lbs). per ASTM D2794.
 - .6 Flammability: Class 1 per ASTM E648.
 - .7 Hardness: 85 to 90, Shore D per ASTM D2240.

2.2 ACCESSORY MATERIALS

- .1 Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- .2 Joint Sealant: Type recommended or produced by resinous flooring manufacturer.
- .3 Shower Pans: Pre-Sloped shower pan and preformed curb. Pre-fabricated and pre-sloped shower pan with curb constructed of lightweight high density expanded polystyrene. Use only manufacturer approved adhesives and sealants for installation.
- .4 Low Profile Linear Floor Drain: Comprised of heavy duty 304 stainless steel, 25 mm flange, specially designed for bonded waterproofing installations, allow for epoxy floor finish use in showers with single slope to drain, available with standard, vertical waste line and

horizontal side outlet, and with flow rate of 30 liters per minute. 915 mm length. Slotted grate with brushed stainless steel finish. Grate to have leveling foot support.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.
- .2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - .1 Mechanically prepare substrates as follows:
 - .1 Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - .2 Comply with ASTM C811 requirements, unless manufacturer's written instructions are more stringent.
 - .2 Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
- .3 Verify that concrete substrates are dry.
 - .1 Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.
 - .2 Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. of slab in 24 hours.
 - .3 Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- .4 Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- .5 Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- .6 Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- .7 Treat control joints, wood sub-floor panel edges, and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

- .1 General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

- .1 Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
- .2 Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- .3 At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - .1 Apply joint sealant to comply with manufacturer's written recommendations.
- .2 Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.
- .3 Integral Cove Base: mortar, apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners.
 - .1 Integral Cove Base: 100 mm high.
- .4 Apply metal trowel single mortar coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.
- .5 Undercoat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.
- .6 Broadcast: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.
- .7 Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 TERMINATIONS

- .1 Chase edges to "lock" the flooring system into the concrete substrate along lines of termination.
- .2 Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.
- .3 Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.
- .4 Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.4 JOINTS AND CRACKS

- .1 Treat control joints to bridge potential cracks and to maintain monolithic protection.

- .2 Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.
- .3 Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 FIELD QUALITY CONTROL

- .1 Material Sampling: Departmental Representative may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
 - .1 Departmental Representative will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 - .2 Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
 - .3 If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 CLEANING, PROTECTING, AND CURING

- .1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours.
- .2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.
- .3 Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

- .1 Definitions: Resinous epoxy floor coating system includes a 100% solids, 0 VOC, two component, moisture-tolerant, pigmented, general service, epoxy primer and a 100% solids, 0 VOC, two component, moisture tolerant, pigmented, general service epoxy topcoat.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D2240-15e1, Standard Test Method for Rubber Property—Durometer Hardness.
 - .2 ASTM D2734-16, Standard Test Methods for Void Content of Reinforced Plastics.
 - .3 ASTM D4060-19, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/ULC-S102.2:2018, Standard Method Of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
- .3 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.

1.3 SUBMITTALS

- .1 Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- .2 Samples for Verification: For each resinous flooring system required, 150 mm square, applied to a rigid backing by Installer for this Project.
- .3 Room Finish Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on Drawings in room finish schedule.
- .4 Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- .5 Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- .1 Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose

work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

.1 Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

.2 Contractor shall have completed at least 10 projects of similar size and complexity.

.2 Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

.3 Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

.1 Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

.4 Pre-installation Conference:

.1 General contractor shall arrange a meeting not less than thirty days prior to starting work.

.2 Attendance:

.1 General Contractor

.2 Departmental Representative

.3 Manufacturer/Installer's Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

.2 Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

.3 All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.6 PROJECT CONDITIONS

.1 Concrete or masonry substrates shall be properly cured for a minimum of 30 days and shall be tested to ensure relative humidity or water vapour emission rates are in accordance with Manufacturer's recommendations. A vapor barrier or exterior applied waterproofing membrane must be present for concrete slabs below grade..

- .2 Utilities, including electric, water, heat (air temperature between 32 and 85oF/0 and 30oC) and finished lighting to be supplied by General Contractor.
- .3 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- .4 Protection of finished flooring system from damage by subsequent trades shall be the responsibility of the General Contractor.

1.7 WARRANTY

- .1 Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) full year from date of installation.

PART 2 - PRODUCTS

2.2 RESINOUS FLOORING SYSTEM

- .1 Colors: As selected by Departmental Representative from manufacturer's standard colors.

2.2 RESINOUS FLOORING SYSTEM

- .1 A nominal 0.381-0.508 mm (15-20 mil), 100% solids, 0 VOC, two-component, moisture tolerant, general service, epoxy floor coating with a high solids, UV and stain resistant, aliphatic polyurethane topcoat.
 - .1 Physical Properties: Provide flooring system in which minimum physical properties of the complete system, including primers, fillers, aggregates, and sealers, and when tested in accordance with standards or procedures referenced below, are as follows:
 - .1 Hardness: 80 to 85, Shore D per ASTM D2240.
 - .2 Abrasion Resistance: 0.02 gm max. weight loss (ASTM D4060, CS-17, 1 kg Load, 1,000 cycles)
 - .3 Bond Strength: >2.76 MPa (400 psi)(ASTM D7234) (100% concrete failure)
 - .4 Heat Resistance Limitation: 140°F/60°C (for continuous exposure) 200oF/93oC
 - .5 Cure Rate allow: 8 hours for tack-free surface (at 77°F/25°C). 24 hours minimum for normal operations.
 - .6 Fire Resistance of Dry Film: Class A to CAN/ULC-S102.2
 - .1 Flame Spread - 0
 - .2 Smoke Developed - 34
- .2 Sealer:
 - .1 Material design basis: Standard sealer
 - .2 Two-component, high performance, aliphatic polyurethane coating.

2.3 JOINT SEALANT MATERIALS

- .1 Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Concrete Substrate: Concrete preparation shall be by mechanical means and may include use of diamond grinder, sander, shotblast method and / or other mechanical means for removal of bond inhibiting materials such as curing compounds, dust, form release agents or laitance. General contractor shall approve concrete preparation to ICRI Concrete Surface Profile 3 minimum prior to coating application.

3.2 APPLICATION

- .1 General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic surface of thickness indicated, uninterrupted except at expansion joints or other types of joints (if any), indicated or required.
- .2 Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Primer shall be applied in one coat at 6-8 mils thickness immediately after mixing using high quality medium nap rollers. Coordinate timing of primer application with application of flooring system to ensure optimum inter-coat adhesion. Retain paragraph below if waterproofing membrane is required. Waterproofing membranes may not require a primer; verify requirements for resinous flooring systems selected.
- .3 Coating: Mix material according to manufacturer's recommended procedures. Coating material shall be applied in one coat at 6-8 mils immediately after mixing using high quality medium nap rollers. Strict adherence to manufacturer's coverage rates shall be maintained.
- .4 Topcoat: Mix material according to manufacturer's recommended procedures. Topcoat material shall be applied in one coat at 3-4 mils per coat immediately after mixing using high quality medium nap rollers. Strict adherence to manufacturer's coverage rates shall be maintained.
- .5 Sealer: Apply as per manufacturer's recommended procedures. Strict adherence to manufacturer's coverage rates shall be maintained.

3.3 FIELD QUALITY CONTROL

- .1 The right is reserved to invoke the following material testing procedure(s) at any time, and any number of times during period of flooring application.
- .2 The Departmental Representative will engage service of an independent testing laboratory to sample materials being used on the job site.

Samples of material will be taken, identified and sealed, and certified in presence of Contractor.

- .3 Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.
- .4 The General Contractor shall engage service of an independent coating inspector to perform core tests to verify installation thickness meets the requirements of the specification. Installer shall repair to the Architect's satisfaction any damage in the flooring system.
- .5 If test results show materials being used do not comply with specified requirements, flooring contractor may be directed by Departmental Representative to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CLEANING, PROTECTING, AND CURING

- .1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 4 hours after application.
- .2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.
- .3 Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 References

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B651-18, Adhesive, Contact, Brushable.
 - .2 CAN/CSA-Z809-16, Sustainable Forest Management.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
 - .2 CAN3-A172-M79, High Pressure, Paper, Decorative Laminates.
- .4 American National Standards Institute (ANSI)
 - .1 ANSI/NEMA LD 3-2005, High-Pressure Decorative Laminates (HPDL).
- .5 Forest Stewardship Council (FSC)
 - .1 FSC-STD-CAN-1-1-2018 EN, V1-0 EN, FSC National Forest Stewardship Standard of Canada.
 - .2 FSC-STD-20-2009 V3, Structure and Content of Forest Stewardship Standards.
 - .3 FSC Accredited Certification Bodies.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.3 Samples

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturers' printed product literature for shower enclosures or components, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Shop drawings: Indicate fabrication details, plans, elevations, hardware, and installation details.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples of panel showing finish, two finished edges and core construction.
- .5 Quality control submittals: submit following in accordance with Section 01 45 00.
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and warranties.

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

.6 Closeout Submittals: As per Section 01 78 00.

1.4 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Protect finished laminated plastic surfaces during shipment and installation. Do not remove until immediately prior to final inspection

1.5 Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Divert unused materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of adhesive material at official hazardous material collections site approved by Departmental Representative.

.4 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 Materials

.1 Phenolic panels

.1 Solid phenolic material constructed of solidly fused plastic laminate with matte-finish melamine surfaces, coloured face sheet, and black phenolic-resin core that are integrally bonded. Edges shall be black. Brown edges shall not be acceptable. Laminate colour and pattern to be chosen from manufacturer's standard colour range.

.2 Laminated plastic sheets to NEMA LD-3: matte finish, to be chosen from manufacturer's standard colour range.

.3 Core material: polypropylene or polyethylene solid plastic.

.1 FSC Certified or CAN/CSA-Z809 or FSC-STD-CAN-1 V1-0 EN.

.2 Urea-formaldehyde free.

.4 Laminated plastic adhesive: to CAN/CGSB-71.20.

.1 Urea-formaldehyde free.

- .2 Solid laminated plastic panels: Panels: 6 mm thick solid phenolic panels, height as per drawings, straight cut with fine radius.
- .3 Sealer: water resistant sealer or glue as recommended by laminate manufacturer.
- .4 Stainless steel sheet metal: to ASTM A167, Type 304 with brushed finish.
- .5 Attachment: polyurethane base low VOC adhesive.

2.2 Fabrication

- .1 Laminate plastic to core material ensuring core and laminate profiles coincide to provide continuous support and bond over entire surface

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 Ensure supplementary anchorage, if required, is in place.
- .2 Do work in accordance with CSA B651.

3.3 Erection

- .1 Panel erection:
 - .1 Install partitions secure, plumb and square.
 - .2 Panel to be adhered to cement board substrate.
 - .3 Inside and outside corners to be butt ends.
 - .4 Provide metal trims at exposed edges. Conceal panel and cement board substrate.
 - .5 Bottom of panel to have no finish edge. Panel to go over new epoxy flooring cove.
 - .6 Provide silicone sealant at bottom of panel at epoxy floor and at top of panel.
 - .7 Coordinate installation of washroom accessories mounted on panels.
 - .8 Coordinate installation with epoxy flooring.
 - .9 Coordinate installation with ceiling.
 - .10 Coordinate installation and cutouts with Division 22 and 26.

3.4 Cleaning

- .1 Keep installation and all components clean. Remove blemishes immediately.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

- .1 Section 09 21 16 - Gypsum Board Assemblies.
- .2 Section 06 10 00 - Rough Carpentry: Wood strapping.

1.2 References

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM E1264-19, Standard Classification for Acoustical Ceiling Products.
 - .2 ASTM E1477-98A(2017)e1, Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

1.3 Samples

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit duplicate full size sample of each type acoustical unit.

1.4 Environmental Requirements

- .1 Commence installation after building enclosed and dust generating activities are completed.
- .2 Permit wet work to dry prior to commencement of installation.
- .3 Maintain uniform minimum temperature of 15°C and relative humidity of 20-40% prior to, during and after installation.

1.5 Waste Management

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
- .3 Dispose of unused paint and adhesive material at official hazardous material collections site approved by Departmental Representative.
- .4 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- .5 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .6 Collect and separate for disposal paper, plastic, polystyrene, corrugated

cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 Materials

- .1 Acoustical Panels Type:
 - 1. Surface Texture: Coarse.
 - 2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement.
 - 3. Color: Natural.
 - 4. Size: 605 X 1220 mm.
 - 5. Thickness: 25 mm.
 - 6. Edge Profile: Square.
 - 7. Flame Spread: ASTM E1264; Class A.
 - 8. Light Reflectance (LR) White Panel: ASTM E1477;
- .2 Staples, nails and screws: to CSA B111, non-corrosive finish, type recommended by acoustic unit manufacturer.

PART 3 - EXECUTION

3.1 Installation

- .1 Ensure substrate surface is straight to tolerance of plus or minus 3 mm over 3000 mm.
- .2 Install acoustic units to clean, dry and firm substrate using screws.
- .3 Install acoustic units plumb and aligned. Arrange units as indicated on drawings. Cut units to suit drawings.
- .4 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

3.2 Cleaning

- .1 Keep acoustic installation and all components clean. Remove blemishes immediately.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Environmental Protection Agency (EPA)
 - .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .3 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - 2020.
 - .2 Standard GPS-1-12, MPI Green Performance Standard for Painting and Coatings.
- .4 National Fire Code of Canada, 2015 (NFC).
- .5 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual Volume 2 2005, Systems and Specifications.

1.2 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Contractor: to have a minimum of five years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
 - .2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work
 - .3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.
 - .4 Conform to latest MPI requirements for exterior painting work including preparation and priming.
 - .5 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
 - .6 paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.
 - .7 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
 - .8 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Soffits: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.3 PERFORMANCE REQUIREMENTS

- .1 Environmental Performance Requirements:
 - .1 Provide paint products meeting MPI "Environmentally Friendly" E3 ratings based on VOC (EPA Method 24) content levels.
 - .2 Green Performance in accordance with MPI Standard GPS-1.

1.4 SCHEDULING

- .1 Submit work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Departmental Representative for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about building.

1.5 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 WHMIS SDS - Safety Data Sheets.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Safety Data Sheets (SDS).
- .4 Provide samples in accordance with Section 01 33 00.
 - .1 Submit duplicate 200 x 300 mm sample panels of each paint stainclear coating special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
 - .3 Submit full range of available colours where colour availability is restricted.

1.6 QUALITY CONTROL

- .1 Provide mock-up in accordance with Section 01 45 00.
- .2 When requested by Departmental Representative or Paint Inspection Agency, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours,

number of coats, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.7 MAINTENANCE

- .1 Extra Materials:
 - .1 Submit maintenance materials in accordance with Section 01 78 00.
- .2 Submit 1, one litre can of each type and colour of primer finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.8 DELIVERY, STORAGE AND HANDLING

- .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 Provide and maintain dry, temperature controlled, secure storage.
 - .5 Observe manufacturer's recommendations for storage and handling.
 - .6 Store materials and supplies away from heat generating devices.
 - .7 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
 - .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
 - .9 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.
 - .10 Remove paint materials from storage only in quantities required for same day use.
 - .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
 - .12 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 on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the 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, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Ontario Ministry of Environment, Conservation and Parks.

.3 Material which 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.

.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 Where paint recycling is available, collect waste paint 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 employees, individuals, or organizations for verifiable re-use or re-manufacturing.

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.9 AMBIENT CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Do not perform painting 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 until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

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

.5 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.

.6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be

- provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting 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 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 Relative humidity is above 85% or when dew point is less than 3 degrees C variance between air/surface temperature.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or 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.
 - .4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
 - .5 Do not apply paint when:
 - .1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.
 - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
 - .3 Surface to be painted is wet, damp or frosted.
 - .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
 - .7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
 - .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
 - .9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems: to be products of single manufacturer.

- .3 Only qualified products with E3 "Environmentally Friendly" ratings are acceptable for use on this project.
- .4 Use only MPI listed L rated materials.
- .5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:
 - .1 Be non-flammable.
 - .2 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.
 - .3 Be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .4 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .6 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .8 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.
- .9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.
- .11 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.
- .12 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 COLOURS

- .1 Departmental Representative will provide Colour Schedule after Contract award.
- .2 Colour schedule will be based upon selection of one door colour, one door frame colour, one wood stain colour, asphalt line painting and galvanized structural steel.
- .3 Selection of colours will be from manufacturer's full range of colours.
- .4 Where specific products are available in restricted range of colours, selection will be based on limited range.
- .5 Second coat in three coat 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 only with Departmental Representative's written permission.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.
- .4 Thin paint for spraying according 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 values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G5 - semi-gloss finish	35 to 70	

- .2 Gloss level ratings of painted surfaces as specified and as noted on Finish Schedule.

2.5 EXTERIOR PAINTING SYSTEMS

- .1 Asphalt Surfaces: zone/traffic marking for drive and parking areas, etc.
 - .1 EXT 2.1A - Latex zone/traffic marking finish.
- .2 Galvanized Metal Doors and Frames and Bollards: EXT 5.3A - Latex Semi-Gloss Level 5 finish.
- .3 Exterior Wood Decking:
 - .1 EXT 6.2H - Polyurethane, clear, 2 component 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 Exterior 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 minimum of one week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.
- .2 Exterior 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 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 exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.
- .3 Clean and prepare exterior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the 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 a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using 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 pretreatment 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 a distance up to 1000 mm.

3.4 EXISTING CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.5 PROTECTION

- .1 Protect existing building surfaces and adjacent structures 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 passing pedestrians, building occupants and general public in and about building.
- .5 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.
- .6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Departmental Representative.

3.6 APPLICATION

- .1 Method of application to be as approved by Departmental Representative. Apply paint by brush. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a 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 shall be 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 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Departmental Representative.
- .4 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

- .6 Sand and dust between coats to remove visible defects.
- .7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
- .8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Do not paint over nameplates.
- .4 Paint fire protection piping red.
- .5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.8 FIELD QUALITY CONTROL

- .1 Inspection:
 - .1 Field inspection of exterior painting operations to be carried out by independent inspection firm as designated by Departmental Representative.
 - .2 Advise Departmental Representative when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
 - .3 Co-operate with inspection firm and provide access to areas of work.
- .2 Manufacturer's Field Services:
 - .1 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.

3.9 CLEANING

- .1 Proceed in accordance with Section 01 74 11.
 - .1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

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 exposed surfaces that were not painted. 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.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 06 40 00 - Architectural Woodwork.
- .3 Section 09 21 16 - Gypsum Board Assemblies.
- .4 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI), 2020.
- .2 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).
- .3 National Fire Code of Canada 2015 (NFC).

1.3 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
- .7 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.

.2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.

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

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide paint products meeting MPI "Environmentally Friendly" E3 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 E3 rating.

1.5 INSPECTION REQUIREMENTS

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this 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.

1.6 SCHEDULING OF WORK

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

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

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.7 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00.

- .2 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.8 SAMPLES

- .1 Submit full range colour sample chips in accordance with Section 01 33 00. Indicate where colour availability is restricted.
- .2 Submit duplicate 200 x 300 mm sample panels of each paint stain clear coating special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm birch plywood for finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
 - .5 10 mm cedar hardboard siding plywood for finishes over wood surfaces.
- .3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.9 QUALITY CONTROL

- .1 Provide mock-up in accordance with Section 01 45 00.
- .2 When requested by Departmental Representative Paint Inspection Agency, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.10 EXTRA MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 78 00.
- .2 Submit one - one litre can of each type and colour of primer stain finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Deliver to Contractor and store where directed.

1.11 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Labels shall clearly 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 Provide and maintain dry, temperature controlled, secure storage.
- .5 Observe manufacturer's recommendations for storage and handling.
- .6 Store materials and supplies away from heat generating devices.
- .7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.
- .8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Departmental Representative.
- .10 Remove paint materials from storage only in quantities required for same day use.
- .11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .12 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 on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.12 SITE REQUIREMENTS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.

- .4 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
 - .5 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.
 - .6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
- .1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10°C.
 - .2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is above 85% or when the dew point is less than 3°C variance between the air/surface temperature.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .2 Perform no painting work when the maximum moisture content of the substrate exceeds:
 - .1 12% for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
 - .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
 - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
- .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Additional Interior Application Requirements:
- .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

1.13 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.

- .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Ontario Ministry of Environment, Conservation and Parks, and Regional levels of Government.
- .3 Material which 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 ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .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 Where paint recycling is available, collect waste paint 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 employees, individuals, or organizations for verifiable re-use or re-manufacturing.
- .8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems shall be products of a single manufacturer.
- .3 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be water-based.
 - .2 be non-flammable, biodegradable.
 - .3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

- .4 be manufactured without compounds which contribute to smog in the lower atmosphere.
- .5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .4 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .6 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.
- .7 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .8 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E3 rating.
- .9 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.
- .10 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- .11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

- .1 Departmental Representative will provide Colour Schedule after Contract Award Submit proposed Colour Schedule to Departmental Representative for approval.
- .2 Colour schedule will be based upon the selection of three base colours, three accent colours and one door frame colour. No more than seven colours will be selected for the entire project and no more than three colours will be selected in each area.
- .3 Selection of colours will be from manufacturer's full range of colours.
- .4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .5 Second coat in a three coat 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 only with Departmental Representative's written permission.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in strict 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 shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	Units @ 60°	Units @ 85°
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell	10 to 25	10 to 35

finish			
G4 - satin	20 to 35		min. 35
finish			
G5 -	35 to 70		
semi-gloss			
finish			
G6 - gloss	70 to 85		
finish			
G7 - high	> 85		
<u>gloss finish</u>			

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

2.5 INTERIOR PAINTING SYSTEMS

- .1 Galvanized Metal Doors and Frames: INT 5.3C - Latex Gloss Level G5 finish (over cementitious primer).
- .2 Dimension Lumber: columns, beams, exposed joists, underside of decking, etc.
.1 INT 6.2D Latex gloss level G3 finish (over latex primer).
- .3 Wood Floors and Stairs: including hardwood flooring, etc.
.1 INT 6.5C Polyurethane varnish G5 gloss finish.
- .4 Plaster and Gypsum Board: gypsum wallboard, drywall, "sheet rock type material", etc., and textured finishes
.1 INT 9.2M - Institutional low odour/low VOC, G3 egg shell finish.

PART 3 - EXECUTION

3.1 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

- .3 Maximum moisture content as follows:
 - .1 Stucco, Plaster and Gypsum Board: 12%.
 - .2 Concrete: 12%.
 - .3 Clay and Concrete Block/Brick: 12%.
 - .4 Wood: 15%.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures 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 passing pedestrians, building occupants and general public in and about the building.
- .5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.
- .6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other 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 a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

- .2 Clean the following surfaces with high pressure water washing: .
- .3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .4 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air, or vacuum cleaning.
- .7 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
- .8 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

- .1 Method of application to be as approved by Engineer. Apply paint by roller. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a 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 shall be 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 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by

Engineer.

- .4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .6 Sand and dust between coats to remove visible defects.
- .7 Finish 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 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .9 Finish closets and alcoves as specified for adjoining rooms.
- .10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .7 Paint fire protection piping red.
- .8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .9 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .10 Do not paint interior transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

- .1 Field inspection of painting operations to be carried out by independent inspection firm as designated by Departmental Representative.
- .2 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with inspection firm and provide access to areas of work.

3.8 RESTORATION

- .1 Clean and re-install all 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 exposed surfaces that were not painted. 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.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-20, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A1008/A1008M-18, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-13/G40.21-13(2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-2018, Welded Steel Construction (Metal Arc Welding).
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating
 - .2 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies
 - .3 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Provide product data: in accordance with Section 01 33 00.
- .3 Provide shop drawings: in accordance with Section 01 33 00.
 - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, arrangement of hardware and fire rating.
 - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and fire rating.
 - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653/A653M, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts unless otherwise noted.

2.2 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
 - .1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.3 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.
 - .1 Maximum VOC limit 50 g/L to GC-03.

2.4 PAINT

- .1 Field paint steel doors in accordance with Section 09 91 99. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
 - .1 Maximum VOC emission level 50 g/L to SCAQMD Rule 1113.

2.5 ACCESSORIES

- .1 Exterior and interior top and bottom caps: steel.
- .2 Metallic paste filler: to manufacturer's standard.
- .3 Door silencers: single stud rubber/neoprene type.
- .4 Fire labels: metal riveted.
- .5 Fabricate glazing stops as formed channel, minimum 16 mm height,

accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

- .6 Glazing: as per Section 08 80 50.
- .7 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
 - .2 Design exterior glazing stops to be tamperproof.

2.6 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior and interior doors: honeycomb construction.
- .3 Fabricate doors with longitudinal edges continuously welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware.
- .7 Provide spot welded flush closing channels to top and bottom of doors.
- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .10 Manufacturer's nameplates on doors are not permitted.

2.7 DOOR TYPE A - STANDARD

- .1 Door: minimum 1.27 mm cold rolled steel, commercial quality to ASTM A1008/A1008M.
- .2 Fire resistance rating: as noted in Door and Frame Schedule.
- .3 Acoustic (STC) Rating: 40.

- .4 Core: hexagonal cell kraft paper core.

2.8 DOOR TYPE B - EXTERIOR

- .1 Door: minimum 1.27 mm cold rolled steel, commercial quality to ASTM A1008/A1008M-18.
- .2 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .3 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

2.9 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Frames: minimum 1.59 mm cold rolled steel, commercial quality to A1008/A1008M-18.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Prepare frame for door silencers, 3 for single door.
- .6 Manufacturer's nameplates on frames and screens are not permitted.
- .7 Conceal fastenings except where exposed fastenings are indicated.
- .8 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .9 Insulate exterior frame components with polyurethane insulation.

2.10 FRAMES ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

2.11 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely

weld on inside of profile.

- .3 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .4 Securely attach floor anchors to inside of each jamb profile.
- .5 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.12 FRAME TYPE A: STANDARD DOOR

- .1 Fire resistance rating: as noted in Door and Frame Schedule.
- .2 Acoustic (STC) Rating: 40.

2.13 FRAME TYPE B: EXTERIOR

- .1 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

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 PAINTING

- .1 Paint in accordance with the requirements of Section 09 91 99.

3.3 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Finished floor: 13 mm.
 - .3 Latch side and head: 1.5mm.
- .3 Adjust operable parts for correct function.

3.4 FRAME INSTALLATION

- .1 Fill voids between door frames and partition assemblies with mineral

wool insulation.

- .2 Set frames plumb, square, level and at correct elevation.
- .3 Secure anchorages and connections to adjacent construction.
- .4 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Remove temporary spreaders after frames are built-in.
- .5 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-O132.2 Series-90(R2003), Wood Flush Doors.
 - .2 CAN/CSA-B651-18, Accessible Design for the Built Environment, Includes Errata 1 (2020)
- .2 NFPA - National Fire Protection Association.
 - .1 NFPA 80-2019, Standard for Fire Doors and Other Opening Protectives (2019)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.
 - .2 Submit two copies of WHMIS SDS - Safety Data Sheets. Indicate VOC's:
 - .1 For caulking materials during application and curing.
 - .2 For door materials and adhesives.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Indicate door types and cutouts for lights and louvres, sizes, core construction, transom panel construction and cutouts.

1.3 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Wood fire rated doors: labelled and listed by an organization accredited by Standards Council of Canada.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Storage and Protection:
 - .1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
 - .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
 - .3 Protect doors from scratches, handling marks and other damage. Wrap doors.
 - .4 Store doors away from direct sunlight.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.
- .3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.
- .4 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.
- .5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 WOOD FLUSH DOORS

- .1 Solid core: to CAN/CSA-0132.2.1.
 - .1 Construction:
 - .1 Solid wood core:
 - .1 Solid particleboard core: stile and rail frame bonded to particleboard core with wood lock blocks 7-ply construction.
 - .2 Face Panels:
 - .2 Hardwood; veneer grades: Grade I (Premium) Birch species.
 - .3 Adhesive: Type I (waterproof) for interior doors.

2.2 GLAZING

- .1 Glazing: as per Section 08 80 50.

2.3 FABRICATION

- .1 Vertical edge strips to match face veneer.
- .2 Prepare doors for glazing. Provide hardwood maple species glazing stops with mitred corners.
- .3 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
- .4 Radius vertical edges of double acting doors to 60 mm radius

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Unwrap and protect doors in accordance with CAN/CSA-0132.2 Series, Appendix A.
- .2 Install labelled fire rated doors to NFPA 80.
- .3 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-0132.2 Series, Appendix A and CSA B651.
- .4 Adjust hardware for correct function.
- .5 Install glazing in accordance with Section 08 80 50.
- .6 Install glazing, louvres and stops.

3.3 ADJUSTMENT

- .1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

- .1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking; clean doors and frames.
- .3 Clean glass and glazing materials with approved non-abrasive cleaner.
- .4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International
 - .1 ASTM A36/A36M-19, Standard Specification for Carbon Structural Steel
 - .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A1008/A1008M-18, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .4 ASTM D523-14(2018), Standard Test Method for Specular Gloss.
 - .5 ASTM D822/D822M-13(2018), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - 2020.
 - .1 MPI #18 Primer, Zinc Rich Organic.
 - .2 MPI #80 Primer, Vinyl Wash.

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 doors, hardware, and accessories 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 Indicate materials, operating mechanisms, required clearances and electrical connections.

1.3 CLOSEOUT SUBMITTALS

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

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE AND HANDLING

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

1.8 WARRANTY

- .1 The 12 months warranty period prescribed in subsection GC3.13 of General Conditions is extended to 24 months for the motor.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- .1 Design exterior door assembly to withstand wind load of 1 kPa minimum with horizontal deflection of 1/300 maximum of opening width.
- .2 Design door panel assemblies with thermal insulation factor as per Section 08 45 23.
- .3 Design door assembly to withstand 3000 minimum cycles per annum, and 25 year total life cycle.

2.2 MATERIALS

- .1 Anodized aluminum sheet: plain anodizing quality aluminum sheet.
- .2 Aluminum extrusions: Aluminum Association alloy AA 6063-T5.
- .3 Insulation: refer to Section 08 45 23.
- .4 Cladding: Translucent insulated sandwich panel to match Section 08 45 23.

2.3 ALUMINUM FINISHES

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Clear anodic finish: to designation AA-A41.

2.4 DOORS

- .1 Two Leaf Hinged Stacking Overhead Doors: Two horizontal panels hinged together, lift strap, weather lapped at horizontal joint; rising vertically on roller and track system fixed to building structure to stack in a folded position under lintel. Hydraulic systems are not acceptable.
- .2 Framework: Welded construction fabricated from extruded hollow section aluminum members with minimum wall thickness of 0.125 inch (3.1 mm). Beams shall be designed for maximum dead load deflection of 1/300th part of the span.
- .3 Operating Channels fabricated from carbon steel hot rolled sheet to comply with ASTM A36/A36M. Final finish on track in accordance with Part 2.4.
- .4 Mechanical pin lock fail-safe device that prevents door movement automatically in the event of a lifting device failure. Safety brake shall automatically reset once repairs are completed and be capable of repeated engagement without replacement of brake or components.
- .5 Size:
 - .1 As indicated on Drawings.
- .6 Locking:
 - .1 Internal slide locks, unless otherwise specified.
- .7 Battens and Perimeter Mullions: to match appearance and material of Section 08 45 23.

2.5 HARDWARE

- .1 Accessories:
 - .1 Double contact extruded neoprene weatherstrip for door sill section, full width.
 - .2 Extruded aluminum and arctic grade vinyl weatherstrip for jambs and head, to manufacturer's standard.
- .2 Finish ferrous hardware items with Coating Grade 45, minimum zinc coating of 320 g/m² to ASTM A123/A123M.

2.6 ELECTRICAL OPERATOR

- .1 Commercial Jackshaft Operator
 - .1 Maintenance warning system notifies users when scheduled maintenance is due.
 - .2 Motor: switch-less DC motor with the following:
 - .1 120 volt.
 - .2 Single phase.
 - .3 Separate 8800 series 3 control panel.
 - .4 Diagnostic LEDs.
 - .5 Adjustable force memory, motor power settings.

- .6 Automatic self-adjusting up/down stop system.
 - .7 Momentary contact operation.
 - .3 Photo eye safety sensors.
 - .4 Automatic obstruction sensing; motor reverses if door contacts an obstruction.
 - .5 Interior touchscreen wall controller.
 - .6 Exterior card reader control by Division 28.
- .2 Must be capable of manual operation in event of power outage without use of cranks or special handles.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for multi-leaf vertical lift metal doors 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 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 Install doors and hardware in accordance with manufacturer's instructions.
- .3 Touch-up doors with primer where galvanized finish damaged during fabrication.
- .4 Install electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.
- .5 Installation includes electric wiring from power supply located near door opening.
- .6 Lubricate springs and adjust door operating components to ensure smooth opening and closing of doors.
- .7 Adjust operable parts for correct function.
- .8 Adjust weatherstripping to form weathertight seal.
- .9 Adjust doors for smooth operation.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product within 3 days of review.
 - .2 Submit 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 Ensure manufacturer's representative is present before and during critical periods of installation and testing.
 - .4 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

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.
 - .1 Remove traces of primer; clean doors and frames.
 - .2 Clean glass and glazing materials with approved non-abrasive cleaner.
- .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 multi-leaf vertical lift metal door installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Architectural Manufacturers Association (AAMA)
 - .1 AAMA 1503-09, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - .2 AAMA 2604-20, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- .2 Aluminum Association (AA)
 - .1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .3 American National Standards Institute (ANSI)
 - .1 ANSI/NFRC 100-2017, Procedure for Determining Fenestration Product U-factors.
 - .2 ANSI/NFRC 700-2019, Product Certification Program.
- .4 ASTM International
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM E1748-95(2017), Standard Test Method for Evaluating the Engagement Between Windows and Insect Screens as an Integral System.
 - .3 ASTM D635-18, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 - .4 ASTM D1037 ,
 - .5 ASTM D2244-16 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 - .6 ASTM C297/C297M-16, Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions.
 - .7 ASTM E72-15 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 - .8 ASTM E283-19(2019) Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - .9 ASTM E330/E330M - 14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .10 ASTM E331-00(2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- .5 CSA Group
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440-17, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
 - .2 CSA A440S1-19, Canadian Supplement to AAMA/WDMA/CSA 101/1.S.2/A440, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
 - .3 CAN/CSA-A440.4:19, Window, Door, and Skylight Installation.
 - .4 CAN/CSA-A440.2-19/A440.3:19, Fenestration energy performance/User guide to CSA A440.2:19, Fenestration energy performance.

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- .6 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2017, Adhesives and Sealants.
- .7 Underwriters Laboratories Inc.(UL)
 - .1 UL 723-2018, Standard for Test for Surface Burning Characteristics of Building Materials.
 - .2 UL 972-2006, Standard for Burglary Resisting Glazing Material
- .8 Underwriters Laboratories of Canada(ULC)
 - .1 CAN/ULC-S102:2018, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.
- .9 International Code Council (ICC)
 - .1 AC177 (2018), Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems

1.2 SUBMITTALS

- .1 Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of components.
- .2 Submit shop drawings. Include elevations and details.
- .3 Submit manufacturer's color charts showing the full range of colors available for factory-finished aluminum.
 - .1 Submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.
 - .1 Sandwich panels: 356mm x 711mm units.
- .4 Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.
- .5 Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1.3 QUALITY ASSURANCE

- .1 Manufacturer's Qualifications
 - .1 Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least five consecutive years and which can show evidence of those materials being satisfactorily used on at least ten projects of similar size.

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- .2 Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.
 - .3 Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.
- .2 Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified panel systems for at least five consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

1.4 PERFORMANCE REQUIREMENTS

- .1 The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.
 - .1 Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - .2 Standard panel system shall have less than 0.003m³/m² air leakage by ASTM E283 at 0.298 mPa and no water penetration by ASTM E331 at 0.7182 kPa; and structural testing by ASTM E330/E330M.

1.5 DELIVERY STORAGE AND HANDLING

- .1 Deliver panel system, components and materials in manufacturer's standard protective packaging.
- .2 Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.6 WARRANTY

- .1 Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within one year of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering, defects in accessories, insulated translucent sandwich panels and other components of the work.

PART 2 - PRODUCTS

2.1 PANEL COMPONENTS

- .1 Face Sheets
 - .1 Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
 - .1 Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.

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- .2 Face sheets shall not deform, deflect or drip when subjected to fire or flame.
- .2 Interior face sheets:
 - .1 Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 50 and smoke developed no greater than 250 when tested in accordance with UL 723.
 - .2 Burn extent by ASTM D635 shall be no greater than 25mm.
- .3 Exterior face sheets:
 - .1 Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D2244 after 5 years outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching. Accelerated testing methods such as Z275 shall not be accepted.
 - .2 Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 94 Nm without fracture or tear when impacted by a 83mm diameter, 2.26 kg free-falling ball per UL 972.
- .4 Appearance:
 - .1 Exterior face sheets: Smooth 18mm thick and Crystal in color.
 - .2 Interior face sheets: Smooth 11mm thick and White in color.
 - .3 Face sheets shall not vary more than ± 10% in thickness and be uniform in color.
- .2 Grid Core
 - .1 Thermally broken I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 11mm.
 - .2 I-beam Thermal break: Minimum 38mm, thermoset fiberglass composite. Poured and de-bridged thermal breaks are not acceptable.
- .3 Laminate Adhesive
 - .1 Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".
 - .2 Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C297/C297M after two exposures to six cycles each of the aging conditions prescribed by ASTM D1037.
 - .3 Minimum shear strength of the panel adhesive by ASTM D1002 after exposure to four separate conditions:
 - .1 50% Relative Humidity at 19°C: 3720 kPa
 - .2 82° C: 690 kPa
 - .3 Accelerated Aging by ASTM D1037 at room temperature: 5500 kPa
 - .4 Accelerated Aging by ASTM D1037 at 82°C: 1700 kPa

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2.2 PANEL CONSTRUCTION

- .1 Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
 - .1 Thickness: 70mm
 - .2 Light transmission: 20%
 - .3 Solar heat gain coefficient 0.28.
 - .4 Panel U-factor by NFRC certified laboratory: 70mm thermally broken grid 0.23
 - .5 Grid pattern: Nominal size 300mm x 600mm; pattern Shoji.
- .2 Standard panels shall deflect no more than 48mm at 1.44 kPa in 3.04 m span without a supporting frame by ASTM E72.
- .3 Standard panels shall withstand 650°C fire for minimum one hour without collapse or exterior flaming.

2.3 BATTENS AND PERIMETER CLOSURE SYSTEM

- .1 Closure system: Thermally broken extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.
- .2 Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.
- .3 Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.
- .4 Finish: Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturer's standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Installer shall examine substrates, supporting structure and installation conditions.
- .2 Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Metal Protection:
 - .1 Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - .2 Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

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3.3 INSTALLATION

- .1 Install the panel system in accordance with the manufacturer's suggested installation recommendations and approved shop drawings.
 - .1 Anchor component parts securely in place by permanent mechanical attachment system.
 - .2 Accommodate thermal and mechanical movements.
 - .3 Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.
- .2 Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

3.4 CLEANING

- .1 Clean the panel system interior and exterior, immediately after installation.
- .2 Refer to manufacturer's written recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Passive House Standard
- .2 CSA Group
 - .1 AAMA/WDMA/CSA 101/I.S.2/A440.4:19, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.
 - .2 CSA A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS - North American Fenestration Standard/Specification for windows, doors, and skylights.
- .3 Screen Manufacturers Association (SMA)
 - .1 SMA 1201:2013 Specification for Insect Screens for Windows, Sliding Doors and Swinging Doors.
- .4 ASTM International
 - .2 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - .3 ASTM E1748-95(2017), Standard Test Method for Evaluating the Engagement between Windows and Insect Screens as an Integral System.
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .5 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - 2020.

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 windows 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 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim, junction between combination units elevations of unit, anchorage details, location of isolation coating,] description of related components and exposed finishes fasteners, and caulking.
- .4 Test and Evaluation Reports:
 - .1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.
 - .2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:
 - .1 The product manufacturer.

- .2 The type of product.
- .3 The model number/series number.
- .4 The primary product designation.
- .5 The secondary product designation.
 - .1 Positive design pressure.
 - .2 Negative design pressure.
 - .3 Water penetration resistance test pressure.
 - .4 Canadian air infiltration and exfiltration levels.
- .6 The test completion date.
- .3 The report will also contain the following information:
 - .1 Test dates.
 - .2 Report preparation dates.
 - .3 Test information retention period.
 - .4 Location of testing facilities.
 - .5 Full description of test samples, including:
 - .1 Anodized finish.
 - .2 Condensation resistance.
 - .3 Safety drop - vertical sliding windows only.
 - .4 Block operation - sliding windows only.
 - .5 Sash strength and stiffness - projecting.
 - .6 Sash pull-off - vinyl windows.
 - .7 Forced entry resistance.
 - .8 Mullion deflection - combination and composite windows.
 - .6 Complete description of amendments, as applicable.
 - .7 Conclusion.
 - .8 Drawings signed by the testing laboratory, if provided.
- .4 Passive House Institute certification certificate.

1.3 CLOSEOUT SUBMITTALS

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

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE AND HANDLING

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 All windows of the same material by the same manufacturer. Windows are required to have Passive House certification.
- .2 All frame and sash profiles are made from uPVC interior and aluminum clad exterior. Windows with door units are aluminum frames as per drawings.
- .3 Windows on this project shall be furnished and installed in the sizes, configurations and quantities as described in the Project Contract Documents and within the allowed parameters in PART 1, Section 1 of this specification.
- .4 Face Dimensions (nominal): As indicated on Architectural Drawings.
- .5 Depth Dimensions (nominal): 91 mm.
- .6 Reinforcement: glass fiber reinforcement.
- .7 Joint sealing tape: As per Section 07 92 10.
- .8 Weatherseals:
 - .1 Black polymer (EPDM) replaceable weatherseals:
 - .1 Shapes, designs, and thickness as needed to satisfy performance requirements.
 - .2 Weatherseals shall be provided in continuous lengths, butted firm to ends of races and to each other when in the same planes.
- .9 Fasteners shall be 300 series stainless steel of sufficient size and quantity perform their intended function.
 - .1 Fastener corrosion resistance shall be: 2000 hours minimum, when tested in accordance with ASTM B117.
- .10 Glazing tape: black, closed cell copolymer, polyethylene foam coated with an aggressive acrylic adhesive. All upward facing exterior horizontal joints to have an additional cap bead of neutral cure silicone.
- .11 Internal sealants for frame joints and continuous heel beads: neutral cure silicone sealant.

- .12 All hardware to be supplied by a single manufacturer:
- .13 Hardware finish: Colour to be selected from supplier's standard range.
- .14 Screens: to ASTM E1748 on the ventilating portion of the windows.
 - .1 Type: black fibreglass
 - .2 Insect screening mesh: count 18 x 14.
 - .3 Screen frames: colour to match window frames.
 - .4 Mount screen frames for interior replacement.
- .15 Exterior aluminum sills: as per Section 07 62 00.
- .16 Isolation coating: alkali resistant bituminous paint.
- .17 Back and end dams: Sheet metal pan flashing covered with self-adhesive membrane composed of SBS modified bitumen.
- .18 Insulated Glazing Units: Insulated glazing unit certified by Insulating Glass Manufacturer's Alliance (IGMA). Performance requirements indicated are for center-of-glass.
 - .1 Type: Triple glazed.
 - .2 Edge: primary seal of polyisobutylene; a tubular low conductivity stainless steel spacer-bar with sealed corners, filled with desiccant; and a secondary seal of neutral cure silicone.
 - .3 Fill: 90% Argon filled.
 - .4 Glass: 5.7 mm thick clear glass.
 - .5 Unit Thickness: 35 mm.
 - .6 Solar Heat Gain Coefficient: 0.35.
 - .7 U-value centre of glass (to NFRC Method): 0.09 (0.5 W/m²·K).
 - .8 Visible transmittance: 68%
 - .9 U-Values (overall to NFRC Method): 0.12 (0.7 W/m²·K).
- .19 Exterior Motorized Roller Blinds: as per Section 12 24 13.

2.3 FABRICATION

- .1 Fabricate in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 supplemented as follows:
 - .1 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
 - .2 Face dimensions detailed are maximum permissible sizes.
 - .3 Brace frames to maintain squareness and rigidity during shipment and installation.
 - .4 Finish steel clips and reinforcement with shop coat primer to MPI #79, 380 g/m² zinc coating to ASTM A123/A123M.

2.4 ALUMINUM FINISHES

- .1 Exterior aluminum cladding:

- .1 1.3 mm extruded aluminum
- .2 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
 - .1 Fluoropolymer modified acrylic topcoat applied over primer:
Colour from manufacturer's standard colour range.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 Window installation:
 - .1 Install in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 - .2 Arrange components to prevent abrupt variation in colour.
- .2 Sill installation:
 - .1 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Use one piece lengths at each location.
 - .2 Secure sills in place with anchoring devices located at ends joints of continuous sills and evenly spaced 600 mm on centre in between.
 - .3 Fasten expansion joint cover plates and drip deflectors with self-tapping stainless steel screws.
 - .4 Maintain 6 to 9 mm space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 to 6 mm space at each end.
- .3 Caulking:
 - .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.
 - .2 Apply sealant in accordance with Section 07 92 00. Conceal sealant within window units except where exposed use is permitted by Departmental Representative.
- .4 Pre-Compressed Foam Tape:
 - .1 As per Section 07 92 10, tape to be sealed to window frame and wood stud rough opening.

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 window installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/ Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.9-2015, Cabinet Hardware.
 - .2 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
 - .3 ANSI/BHMA A156.18-2016, Materials and Finishes.

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 cabinet hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, finish and other pertinent information.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .5 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
 - .2 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.

1.3 CLOSEOUT SUBMITTALS

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

1.4 QUALITY ASSURANCE

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

and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cabinet hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping.
 - .4 Replace defective or damaged materials with new.
- .5 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.
- .6 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's product for all similar items.

2.2 CABINET HARDWARE

- .1 Cabinet hardware: to ANSI/BHMA A156.9, ANSI/BHMA A156.16, designated by letter B & L and numeral identifiers as listed below.
 - .1 Hinges: frameless concealed hinges, self-closing, type B01602, finish to 626.
 - .2 Pulls: back mounted wire D-pull finished to 626.
 - .3 Shelf rests: shelf rest installed in holes drilled, type B04013, finished to 626.
 - .4 Drawer slides: bottom edge mounted drawer slides, self-closing, type B05091.
 - .5 Coat hooks: type L0331, finished to 626.
 - .6 Locks: Five disk tumbler, cam lock , finished to 626.
 - .7 Door and Drawer Bumpers: Translucent silicone bumper pads.

2.3 MISCELLANEOUS HARDWARE

- .1 Closet shelf supports: heavy duty support and closet rod, wrought steel, finished to 626, 19mm size.

2.4 FASTENINGS

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Use fasteners compatible with material through which they pass.

PART 3 - EXECUTION

3.1 INSTALLATION

- .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 Install hardware to standard hardware location dimensions in accordance with manufacturer's recommendations and to project design requirements.

3.2 ADJUSTING

- .1 Adjust cabinet hardware for optimum, smooth operating condition.
- .2 Lubricate hardware and other moving parts.
- .3 Adjust cabinet door hardware to ensure tight fit at contact points with frames.

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 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .3 Remove protective material from hardware items where present.
 - .4 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.

3.4 PROTECTION

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

3.5 SCHEDULE

- .1 Cabinet drawers: group A.
 - .1 1 set drawer slides B05091.
 - .2 1 handle pull back mounted wire D-pull finished to 626.
- .2 Cabinet swinging doors: group B.
 - .1 1 pair frameless concealed hinges, type B01602, finish to 626.
 - .2 1 handle pull back mounted wire D-pull finished to 626.
 - .3 3 pairs shelf rests installed in holes drilled, type B04013, finished to 626.
- .3 Pantry swinging doors: group C
 - .1 1-1/2 pair frameless concealed hinges, type B01602, finish to 626.
 - .2 1 handle pull back mounted wire D-pull finished to 626.
 - .3 8 pairs shelf rests installed in holes drilled, type B04013, finished to 626.
- .4 Bedroom closet doors: group D
 - .1 2 overhead roller track system includes keyed locking mechanism, finish to 626.
 - .2 1 handle pull back mounted wire D-pull finished to 626.
 - .3 2 pairs shelf rests installed in holes drilled, type B04013, finished to 626.
 - .4 1 closet shelf supports: heavy duty support and closet rod, wrought steel, finished to 626, 20mm size.
- .5 Locker doors: group E
 - .1 1-1/2 pair frameless concealed hinges, type B01602, finish to 626.
 - .2 1 handle pull back mounted wire D-pull finished to 626.
 - .3 1 cam lock.
 - .4 2 coat hooks.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1-2016, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2-2017, Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.3-2014, Exit Devices.
 - .4 ANSI/BHMA A156.4-2019, Door Controls - Closers.
 - .5 ANSI/BHMA A156.8-2015, Door controls - Overhead Stops and Holders.
 - .6 ANSI/BHMA A156.13-2017, Mortise Locks and Latches.
 - .7 ANSI/BHMA A156.36-2016, Auxiliary Locks.
- .2 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.
 - .2 CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction) - 11/79.

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 door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware 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 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
 - .4 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes].
 - .3 Protect prefinished surfaces with wrapping.
 - .4 Replace defective or damaged materials with new.
 - .5 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Lockset:
 - .1 Mortise locks: to ANSI/BHMA A156.13, Series 1000, Grade 1.
 - .2 Function F01: passage set. Latchbolt retracted by knob/lever from either side at all times. Inside lever is always free for immediate egress.
 - .3 Function F02: privacy set. Outside knob/lever locked by pushbutton on inside knob/lever. Rotating inside knob/lever or closing door releases/unlocks button. Emergency release in outside knob/lever.
 - .4 Function F04: office and inner entry lock. Latchbolt retracted by knob/lever from either side unless outside is made inoperative by key outside or by turning inside thumbturn. When outside is locked, latchbolt is retracted by key outside or by knob/lever inside. Outside knob/lever remains locked until thumbturn is returned to vertical or unlocked by key. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever is always free for immediate egress.
 - .5 Function F07: storeroom lock. Latchbolt retracted by key outside or by knob/lever inside. Outside knob/lever is always inoperative. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever is always free for immediate egress.
 - .6 Function F08: Front Entrance. Latch bolt is operated by knob from either side except when outside knob is made inoperative by a stop or mechanical means other than key. Dead bolt is operated by turn inside. Key outside operates both locks. Inside lever is always free for immediate egress.
 - .7 Lever handles: plain design, round bar, C-shape, 120 mm long.
 - .8 Strikes: stainless steel, box type, lip projection not beyond jamb.
 - .9 Rose: 65 mm diameter, wrought rose
 - .10 Throw: minimum 25 mm.

- .2 Butts and hinges: to ANSI/BHMA A156.1, A1111, stainless steel, full mortise, five knuckle, four ball bearings, grade 1, heavy weight, non-removable pin (where noted), concealed electric (where noted), 114 mm X 114 mm X 3.4 mm.
- .3 Closer: to ANSI A156.4, Grade 1, heavy-duty, double lever arm, surface mounted on door, push side mounted; maximum closing force 22 N, with stop function, aluminum cover.
- .4 Deadbolt: to ANSI/BHMA A156.36, Grade 1, keyed outside, thumbturn inside.
- .5 Door Sweep: extruded aluminum retainer with 45 mm nylon brush sweep, surface mounted.
- .6 Door Gaskets: extruded aluminum retainer with 6 mm diameter silicone gasket, surface mounted.
- .7 Wall Stop: Heavy duty stops. Concave dome. Finish satin chrome.
- .8 Overhead Stop: to ANSI/BHMA 156.8, Grade 1, standard duty, overhead surface mounted, friction type, stops and hold door open, adjustable.
- .9 Threshold: extruded aluminum, minimum 6 mm high, maximum 13 mm high, with black rigid polypropylene thermal break, depth and length to suit door frame.
- .10 Flush Bolt: to ANSI/BHMA A156.3, Type 25, stainless steel and brass with steel components, automatically retracts when active door is opened / automatically extends when active door is closed, 19 mm throw, c/w dust proof strikes.
- .11 Astragal: Z-shaped, stainless steel, minimum 1.98 mm thickness, fastened on the stile side of the door.
- .12 Door Bell with video and audio: as per Section 28 13 00.
- .13 Electronic door security: as per Section 28 13 00.
- .14 Door louver: By Division 23 37 20.
- .15 Electric Exit Device: to ANSI/BHMA A156.3, Grade 1; mortise lock exit device, electric latch retraction, fail secure.

2.4 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.

- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.5 KEYING

- .1 Doors to be keyed as directed. Prepare detailed keying schedule in conjunction with Departmental Representative.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply construction cores.
- .6 Hand over permanent cores and keys to Departmental Representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- .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 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Install key control cabinet.
- .7 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores when directed by Departmental Representative.
 - .1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

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 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .3 Remove protective material from hardware items where present.
 - .4 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.

3.4 DEMONSTRATION

- .1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
 - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
 - .3 Lock key cabinet and turn over key to Departmental Representative.
- .2 Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
 - .3 Use, application and storage of wrenches for door closers and locksets.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.5 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED

- .1 Not Used.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 SCHEDULE

- .1 Provide the following door hardware. Refer to the drawings Door & Frame Schedule for the Hardware Group required for each door opening.
- .2 **Hardware Group HG01:**
 - .1 Butt Hinges: 1-1/2 pair hinges, non-removable pins, one concealed electric type.
 - .2 Electric Exit Device: one, function F08 Front Entrance.
 - .3 Deadbolt: one.
 - .4 Door Sweep: one.
 - .5 Door Gaskets: one set.
 - .6 Threshold: one.
 - .7 Overhead Door Stop: one.
 - .8 Door Card Reader: one, by Division 28 13 00. Rough in conduit by Division 26.
 - .9 Doorbell with audio / video camera: one, by Division 28 13 00. Rough in conduit by Division 26.
 - .10 Door Supervisory Sensor: one, by Division 28 13 00. Rough in conduit by Division 26.
 - .11 Intrusion Alarm: one, by Division 28 13 00. Rough in conduit by Division 26.
- .3 **Hardware Group HG02:**
 - .1 Butt Hinges: 3 pair hinges.
 - .2 Lockset: one, Function F01 (passage set).
 - .3 Lockset: one, (half dummy trim).
 - .4 Wall Stop: two.
- .4 **Hardware Group HG03:**
 - .1 Butt Hinges: 1-1/2 pair hinges.
 - .2 Lockset: one, Function F02 (privacy).
 - .3 Wall Stop: one.
- .5 **Hardware Group HG04:**
 - .1 Butt Hinges: 1-1/2 pair hinges.
 - .2 Lockset: one, Function F04 (office).
 - .3 Wall Stop: one.

- .6 **Hardware Group HG05:**
- .1 Butt Hinges: 1-1/2 pair hinges, non-removable pins, one concealed electric type.
 - .2 Electric Exit Device: one, function F08 Front Entrance.
 - .3 Deadbolt: one.
 - .4 Door Sweep: one
 - .5 Door Gaskets: one set.
 - .6 Threshold: one.
 - .7 Overhead Door Stop: one.
 - .8 Door Card Reader: one, by Division 28 13 00. Rough in conduit by Division 26.
 - .9 Door Supervisory Sensor: one, by Division 28 13 00. Rough in conduit by Division 26.
- .7 **Hardware Group HG06:**
- .1 Butt Hinges: 1-1/2 pair hinges.
 - .2 Function F07 (store room lock).
 - .3 Wall Stop: one.
 - .4 Closer: one.
 - .5 Door Louvre: one. By Division 23.
- .8 **Hardware Group HG07:**
- .1 Butt Hinges: 1-1/2 pair hinges, non-removable pins.
 - .2 Lockset: one, Function F01 (passage set).
 - .3 Overhead Door Stop: one.
- .9 **Hardware Group HG08:**
- .1 Butt Hinges: 1-1/2 pair hinges, non-removable pins, one concealed electric type.
 - .2 Electric Exit Device: one, function F08 Front Entrance.
 - .3 Deadbolt: one.
 - .4 Closer: one with stop function.
 - .5 Overhead Door Stop: one.
 - .6 Door Sweep: one.
 - .7 Door Gaskets: one set.
 - .8 Threshold: one.
 - .9 Door Card Reader: one, by Division 28 13 00. Rough in conduit by Division 26.
 - .10 Door Supervisory Sensor: one, by Division 28 13 00. Rough in conduit by Division 26.
- .10 **Hardware Group HG09:**
- .1 Butt Hinges: 1-1/2 pair hinges, non-removable pins, one concealed electric type.
 - .2 Electric Exit Device: one, function F08 Front Entrance.
 - .3 Deadbolt: one.
 - .4 Closer: one with stop function.
 - .5 Overhead Door Stop: one.
 - .6 Door Sweep: one.
 - .7 Door Gaskets: one set.
 - .8 Door Card Reader: one, by Division 28 13 00. Rough in conduit by Division 26.

- .9 Door Supervisory Sensor: two, by Division 28 13 00. Rough in conduit by Division 26.
- .11 **Hardware Group HG10:**
 - .1 Butt Hinges: 1-1/2 pair hinges, non-removable pins, one concealed electric type.
 - .2 Electric Exit Device: one, Function F07 (store room lock).
 - .3 Deadbolt: one.
 - .4 Closer: one with stop function.
 - .5 Overhead Door Stop: one.
 - .6 Door Sweep: one.
 - .7 Door Gaskets: one set.
 - .8 Threshold: one.
 - .9 Door Card Reader: one, by Division 28 13 00. Rough in conduit by Division 26.
 - .10 Door Supervisory Sensor: one, by Division 28 13 00. Rough in conduit by Division 26.
- .12 **Hardware Group HG11:**
 - .1 Butt Hinges: 3 pair hinges, non-removable pins, one concealed electric type.
 - .2 Electric Exit Device: one, Function F07 (store room lock).
 - .3 Closer: two with stop function.
 - .4 Overhead Door Stop: two.
 - .5 Astragal: one length.
 - .6 Latch Protector: one.
 - .7 Flush Bolts: two, top and bottom on inactive LHR leaf.
 - .8 Door Sweep: two.
 - .9 Door Gaskets: one set.
 - .10 Threshold: one.
 - .11 Door Card Reader: one, by Division 28 13 00. Rough in conduit by Division 26.
 - .12 Door Supervisory Sensor: two, by Division 28 13 00. Rough in conduit by Division 26.
- .13 **Hardware Group HG12:**
 - .1 Butt Hinges: 1-1/2 pair hinges.
 - .2 Function F02 (privacy).
 - .3 Wall Stop: one.
- .14 **Hardware Group HG13:**
 - .1 By Section 08 70 05.
- .15 **Hardware Group HG14:**
 - .1 By Section 08 36 60.
 - .2 Door Card Reader: one, to operate Section 08 36 60 overhead bi-fold by Division 28 13 00. Rough in conduit by Division 26.
 - .3 Door Supervisory Sensor: one, by Division 28 13 00. Rough in conduit by Division 26.
- .16 **Hardware Group HG15:**
 - .1 Butt Hinges: 3 pair hinges.
 - .2 Lockset: Function F07 (store room lock). On RHR leaf.
 - .3 Overhead Door Stop: one

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- .4 Wall Stop: one
- .5 Closer: two.
- .6 Flush Bolts: two, top and bottom on inactive LHR leaf.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C542-05(2017), Standard Specification for Lock-Strip Gaskets.
 - .2 ASTM D2240-15e1, Standard Test Method for Rubber Property - Durometer Hardness.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-12.1-2017, Safety Glass.
 - .2 CAN/CGSB-12.3-M91(2017), Flat, Clear Float Glass.
 - .3 CAN/CGSB-12.8-17-R2017, Insulating Glass Units.
- .3 Glass Association of North American (GANA)
 - .1 GANA Glazing Manual 50th Anniversary Edition-2008.
 - .2 GANA Sealant Manual-2008.
- .4 National Fenestration Rating Council (NFRC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for glazing 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Flat Glass (FG-T):
 - .1 Safety glass: to CAN/CGSB-12.1, transparent, 6 mm thick.
 - .1 Type 2-tempered.
 - .2 Class B-float.
 - .2 Insulated Glazing Units: Insulated glazing unit certified by Insulating Glass Manufacturer's Alliance (IGMA). Performance requirements indicated are for center-of-glass.
 - .1 Type: Triple glazed
 - .2 Edge: primary seal of polyisobutylene; a tubular low conductivity stainless steel spacer-bar with sealed corners, filled with desiccant; and a secondary seal of neutral cure silicone.
 - .3 Fill: 90% Argon filled
 - .4 Glass: 5.7 mm thick clear glass
 - .5 Unit Thickness: 35 mm.
 - .6 Solar Heat Gain Coefficient: 0.35
 - .7 U-value centre of glass (to NFRC Method): 0.09 (0.5 W/m²·K).
 - .8 Visible transmittance: 68%
 - .9 U-Values (overall to NFRC Method): 0.12 (0.7 W/m²·K).
 - .3 Frameless Shower Enclosure: Flat Glass (FG-T):
 - .1 Safety glass: to CAN/CGSB-12.1, transparent, 10 mm thick.
 - .1 Type 2-tempered.
 - .2 Class B-float.
 - .3 All exposed edges polished and rounded.
 - .4 All holes and notches to be drilled prior to the tempering process.
 - .4 Security Films: in accordance with Section 08 87 53.
 - .5 Sealant: in accordance with Section 07 92 00.

2.2 ACCESSORIES

- .1 Setting blocks: EPDM 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .2 Spacer shims: neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .3 Glazing tape: Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.

- .4 Glazing splines: resilient polyvinyl chloride silicone, extruded shape to suit glazing channel retaining slot, black colour.
- .5 Frameless shower enclosure hardware:
 - .1 Heavy duty hinges (Quantity 3 per door) for pivot door and clamps feature from 320 stainless steel with internal pins, springs, and screws made from top quality 316 stainless steel.
 - .2 Pivot door 915 mm wide by 2135 mm height with full-length magnetic catch.
 - .3 Vinyl drip deflector.
 - .4 Hardware mounted through glass (no clamped or glued components)
 - .5 203 mm back-to-back shower door pull.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for glazing installation in accordance with manufacturer's written instructions.
 - .1 Verify that openings for glazing are correctly sized and within tolerance.
 - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
 - .3 Visually inspect substrate in presence of Departmental Representative.
 - .4 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .5 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 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)

- .1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation

instructions, and data sheets.

- .2 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .3 Cut glazing tape or spline to length; install on glazing light. Seal corners by butting tape or spline and sealing junctions with sealant in accordance with GANA Sealant Manual.
- .4 Place setting blocks at 1/4 or 1/3 points, with edge block maximum 150 mm from corners.
- .5 Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- .6 Install removable stops without displacing glazing tape or spline. Exert pressure for full continuous contact.
- .7 Trim protruding tape edge.

3.4 INSTALLATION: INTERIOR - DRY METHOD (TAPE AND TAPE)

- .1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .2 Cut glazing tape to length and set against permanent stops, projecting 1.6 mm above sight line.
- .3 Place setting blocks at 1/4 or 1/3 points, with edge block maximum 150 mm from corners.
- .4 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .5 Place glazing tape on free perimeter of glazing in same manner described.
- .6 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .7 Knife trim protruding tape.

3.5 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.

3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
- .3 Repair damage to adjacent materials caused by glazing installation.

3.7 SCHEDULE

- .1 Flat Glass - Tempered (FG-T): all lites in interior doors.
- .2 Insulating Glass Units (IGU): all lites in exterior doors and windows.
- .3 Security Films: in accordance with Section 08 87 53.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 08 50 50 - Windows.
- .2 Section 08 80 50 - Glazing.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI Z97.1-2015, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - .2 ASTM D1004-13, Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
 - .3 ASTM D1044-19, Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion.
- .3 Government of Canada
 - .1 Canada Labour Code, WHMIS Safety Data Sheets.

1.3 DEFINITIONS

- .1 For the purposes of this specification applying definitions follow:
 - .1 Safety: Reduction of risk of injury, loss or death due to accidental, natural or unintentional causes.
 - .2 Security: Reduction of risk of injury, loss or death due to intentional actions of others.
- .2 Security and safety film types:
 - .1 Type 1: Areas of concern related to common residential or light commercial accidents.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit one 500 x 500 mm sample of film installed on 7 mm thick clear plate glass.

1.5 SHOP DRAWINGS

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

1.6 TEST REPORTS

- .1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications, for film applied to glass.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with section 01 61 00.
- .2 Provide and maintain dry, off-ground weatherproof storage.
- .3 Store rolls of security film flat on cross supports. Do not stand rolls of film on end.
- .4 Remove only in quantities required for same day use.
- .5 Store materials in accordance with manufacturers written instructions.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

1.9 ENVIRONMENTAL AND SAFETY REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Canada Labour Code.

1.10 WARRANTY

- .1 Work of this Section 12 months warranty period prescribed in subsection GC3.13 of General Conditions is extended to 5 years.
- .2 Ensure warranty includes items as follows:
 - .1 Maintain adhesion properties without blistering, bubbling or delaminating from glass.
 - .2 Maintain appearance without discolouration.
 - .3 Remove, replace and reapply defective materials.
 - .4 In event of product failure under warranty terms, remove and re-apply film without glass replacement at no cost to Departmental Representative.

1.11 MAINTENANCE DATA

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

PART 2 - PRODUCTS

2.1 MANUFACTURER

- .1 Use manufacturers who are members of Canadian Society for Industrial Security (CSIS)

2.2 MATERIALS

- .1 Security Film - General: Multi-ply optically clear polyester film with factory applied adhesive between each layer, abrasion resistant coating and release liner.
 - .1 Total thickness of installed film: nominal 6 mils.
 - .2 Elongation: to ASTM D882.
 - .3 Break strength: to ASTM D882.
 - .4 Young's Modulus: to ASTM D882.
 - .5 Tear resistance: to ASTM D1004.
 - .6 Impact resistance: to ANSI Z97.1.
 - .7 Abrasion resistance: ASTM D1044.
 - .8 Flammability: surface burn characteristics to ASTM E84.
 - .9 Adhesive: high mass pressure sensitive, acrylic base, peel strength: 2.5-3.5 kg/25 mm width to ANSI Z97.1.
 - .10 Tensile strength: minimum 206.70 MPa to ASTM D882.

2.3 FABRICATION

- .1 Shop installation of security film to glass windows:
 - .1 Remove window stops and window sealing device.
 - .2 Ensure no deleterious material adheres to glass by blading surface of glass using industrial razors.
 - .3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
 - .4 Examine glass under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems. Report findings to Departmental Representative before starting Work.
 - .5 Proceed with Work only after receipt of written approval from Departmental Representative.
 - .6 Install security film to glass windows ensuring no blisters, bubbles, scratches or distortions.
 - .7 Cut film edges straight and square.
- .2 Shop installation of security film to glass panels:
 - .1 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
 - .2 Examine glass under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems. View glass from 2.0 m minimum. Report findings to Departmental Representative.
 - .3 Proceed with Work only after receipt of written approval from Departmental Representative.
 - .4 Install security film to glass panels ensuring no blisters, bubbles, scratches, edge defects or distortions.
 - .1 Cut film edges straight and square to within 3 mm of edge of panel.
 - .5 Deliver glass panels complete with security film installed to site

in accordance with section 01 61 00.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Clean glass before beginning installation using neutral cleaning solution.
- .2 Ensure no deleterious material adheres to glass by balding surface of glass using industrial razors.
- .3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
- .4 Examine glass under natural daylight and identify cracks, blisters, bubbles, discoloration, edge defects or other anomalies that may cause, film to delaminate, or vision transparency or distortion problems. Report findings to Departmental Representative.
- .5 Proceed with Work only after receipt of written approval from Departmental Representative.
- .6 Before beginning Work, place absorbent material on window sill or at sash frame to absorb moisture accumulation generated by film application.

3.2 INSTALLATION

- .1 Cut film edges straight and square.
- .2 Ensure film is installed behind window stops.
- .3 Cut edges 3 mm minimum from edge of glass sealing device in accordance with manufacturers written instructions.
- .4 Apply and attach film to glass in accordance with manufacturer's written instructions.
- .5 Splicing:
 - .1 Splice film only when glass is greater in width than film.
 - .2 Splice film only after receipt of written approval from Departmental Representative.
 - .3 Use butt factory edges only.
- .6 Use clean, clear water to remove protective water soluble coating on adhesive side of film.
- .7 Use only water and film slip solution on glass to facilitate positioning of film.
- .8 Ensure removal of excess water from between film and glass.
- .9 Remove left over material from work area and return work area to original condition.

3.3 INSPECTION

- .1 Return to work place after 30 days but no longer than 40 days for final cleaning and inspection of installed film.
- .2 Ensure finished surface of film is vision free of blisters, bubbles, tears, scratches, edge defects, delaminating or vision distortion when viewed under natural daylight from 2.0 m minimum.
- .3 Remove and replace film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 2.0 m minimum after 30 day period.
- .4 Remove and replace without glass replacement, film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion [in film] when viewed under natural daylight from 2.0 m minimum after 30 day period.

3.4 FINAL CLEANING

- .1 Wash interior and exterior of each window and glass panel and film using cleaning solution recommended by film manufacturer.

3.5 MAINTENANCE

- .1 Follow manufacturers written instructions for care and maintenance of security film.
- .2 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of security film.

3.6 SCHEDULE

- .1 Security film to be installed on all glazing lites between grade and 4.5 meters above grade.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM E84-20, Standard Test Method for Surface Burning Characteristics of Building Materials
 - .2 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 Environmental Choice Program (ECP)
 - .1 CCD-046-95, Adhesives.
- .3 Green Seal Environmental Standards (GS)
 - .2 GS-36-2013, Standard for Adhesives for Commercial Use.
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .2 SCAQMD Rule 1168-A2017, Adhesives and Sealants Applications.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102.2:2018, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

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 tackboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Installation Drawings:
 - .1 Submit installation drawings.
 - .2 Indicate location, type, size, panel arrangement.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm sample of each type of tackboard.
- .5 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
 - .2 Low-Emitting Materials:
 - .1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or

restriction requirements.

1.3 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Surface burning characteristics of materials: listed and labelled by an organization accredited by Standards Council of Canada.
- .2 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: submit 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.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect tackboards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Mounting adhesive: to manufacturer's standard.
- .2 Facings:
 - .1 Composition cork tackboards: resilient smooth surface, uniform density composition cork with an anti-soil, washable surface finish which is resistant to fading under artificial or natural light, colour selected by Departmental Representative from manufacturer's standard colour range.
 - .2 Class B when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics. FSC1 - 54; SD - 316 when tested in accordance with CAN/ULC-S102.
- .3 Backing: 13 mm plywood.

2.2 FABRICATION

- .1 Fabricate tackboard panels to sizes indicated on drawings.

2.3 FINISHES

- .1 Stainless steel trim finishes to ASTM A167:
 - .1 Type 304.
 - .2 Trim profile as per drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for tackboard 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 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

- .1 Install tackboards in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure surface.
- .2 Install trim around tackboard panels. Make mitres and joints to hair-line fit, free of rough edges. No exposed fasteners permitted. Butt tackboard tightly to metal trim with hairline joint.
- .3 Adhesive attachment:
 - .1 Adhere tackboard material directly to gypsum wallboard substrate in accordance with manufacturer's instructions.

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 tackboard installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM
 - .1 ASTM A242/A242M-13(2018), Standard Specification for High-Strength Low-Alloy Structural Steel
 - .2 ASTM A895-89(2017), Standard Specification for Free-Machining Stainless Steel Plate, Sheet, and Strip.
 - .8 ASTM D3451-06(2017), Standard Guide for Testing Coating Powders and Powder Coatings.
- .2 Canadian Standards Association (CSA)
 - .1 CSA W59-18, Welded Steel Construction (Metal Arc Welding) (Imperial Version).
- .3 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - 2014.
- .4 Society for Protective Coatings
 - .1 SP 6/NACE No. 3, Commercial Blast Cleaning

1.2 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Submit shop drawings stamped by a structural engineer licensed to practice in the Province of Ontario.
- .3 Indicate materials, thicknesses, sizes, finishes, colours, construction details, removable and interchangeable components, mounting methods, schedule of signs.
- .4 Submit full size templates for individually incised lettering indicating word and letter spacing.
- .5 Digital files for artwork and text will be provided by the Departmental Representative.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00.
- .2 Submit representative sample of each type of sign, sign image and mounting method.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.

- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Reduction Work Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .6 Unused paint or coating material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.
- .7 Fold up metal banding, flatten and place in designated area for recycling.
- .8 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W, minimum 30% recycled content. 5 mm thick plates.
- .2 Cut vinyl lettering.
- .3 Flexible cast vinyl overlamine:
 - .1 Non-shrinking
 - .2 Clear, luster finish
 - .3 Suitable for exterior application
 - .4 Service temperature: -54°C to +107°C
 - .5 Compatible with direct-to-media printing
- .4 No parking signs:
 - .1 Aluminum.
 - .2 305 mm wide x 460 mm high x 1.6 mm thick.
 - .3 Cast vinyl overlamine.
 - .4 Mounting Type: mounting holes.
- .5 Sign supports:
 - .1 Steel posts: to CSA G40.20/G40.21, 3 m long, flanged "U" shaped in cross section, measuring 65 mm wide x 30 mm deep. Metal thickness: 3.7 mm. Hot dipped galvanized: to ASTM A123/A123M.
 - .2 Fasteners: exposed bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

2.2 SIGN GRAPHICS

- .1 Direct-to-media printing on powder coated metal panels.
- .2 Self-stick vinyl film: individual letters die cut from 0.1 mm thick white integral colour, matte finish, upper and lower case, exterior grade PVC film, with self-stick adhesive backing.
- .3 Cast vinyl overlamine

2.3 FABRICATION

- .1 Fabricate components in accordance with details, specifications and shop drawings.
- .2 Build units square, true, accurate to size, free from visual or performance defects.
- .3 Accurately fit and securely join sections to obtain tight, closed joints.
- .4 Allow for thermal movement without distortion of components.
- .5 Exposed fasteners permitted only where indicated. Anchor painted sign panel to support structures by welded stainless steel studs on reverse side of panel, and stainless steel nuts. Spacing and size of anchors to suit design loads. Isolate sign panel from support panel with rubber-impregnated fabric washers.
- .6 Do steel welding to CSA W59. Finish exposed welds flush and smooth. Ease edges of steel plates to remove sharp corners.
- .7 Manufacturer's nameplates on sign surface locations visible in completed work not acceptable.

2.5 FINISHES

- .1 Apply overlamine to entire face of sign panels.
- .2 Powder coating: Powder-coated surfaces must receive electrostatic zinc coating prior to painting. Powder coating must be electrostatically applied and oven cured. Polyester powder coating must be resistant to ultraviolet (UV) light.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Erect and secure signs plumb and level at elevations indicated and at locations as directed by Departmental Representative.

- .2 Comply with sign manufacturer's installation instructions and approved shop drawings.
- .3 Mechanical attachment:
 - .1 To concrete or stone use epoxy anchored threaded rods as indicated, as appropriate for stresses involved.
- .4 Self-adhesive application.
 - .1 Apply vinyl lettering in accordance with manufacturer's instructions as indicated.

3.2 CLEANING

- .1 Leave signs clean. Remove debris from interior of sign boxes.
- .2 Touch up any damaged finishes.

3.3 SCHEDULE

- .1 Glazing unit beside Door D1.01A: Self Stick Vinyl Film. 600 x 900 mm panel with 150 letters.
- .2 Powder Coated 5 mm Steel Plate (no exposed fasteners):
 - .1 Direct-to-media printing signage.
 - .2 Fisheries and Oceans Canada logo in both English and French. 300 x 900 mm in size.
 - .3 Canadian Coast Guard Badge in duo-tone. Maximum 450 x 900 mm in size.
- .3 Quantity of one (1) no parking sign with the following text:
"NO PARKING EXCEPT FOR COAST GUARD & EMERGENCY VEHICLES ONLY. ALL OTHERS WILL BE TOWED AT OWNER'S EXPENSE."
Sign to be bilingual.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip. Withdrawn 2014, no replacement.
 - .3 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A924/A924M-19, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - .5 ASTM B456-17, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .5 National Building Code (NBC) 2015.

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 and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.
- .4 Sustainable Standards Certification:
 - .1 Low-Emitting Materials: submit listing of laminate adhesives used in building, verifying that they contain no urea-formaldehyde.

1.3 CLOSEOUT SUBMITTALS

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Tools:
 - .1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00.
 - .2 Deliver special tools to Departmental Representative.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.
 - .3 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 in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating, minimum 30% recycled content.
- .2 Stainless steel sheet metal: to ASTM A167, Type 304, with satin finish, minimum 75% recycled content.
- .3 Sustainability Characteristics:
 - .1 Laminate Adhesives.
 - .1 Urea Formaldehyde Free.
- .4 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness, minimum 75% recycled content.
- .5 Fasteners: concealed screws and bolts hot dip galvanized, fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

- .1 Toilet tissue dispenser: single roll type, surface mounted, chrome plated steel frame, capacity of 500 double ply roll.
- .2 Towel bar: 19 mm diameter stainless steel tubing, stainless steel end brackets, concealed fasteners, 600 mm long.
- .3 Robe hook: stainless steel with 75 mm projection.
- .4 Grab bars: 30 to 40 mm diameter x 1.6 mm wall tubing of stainless steel, 76 mm diameter wall flanges, exposed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl

- bar at area of hand grips. Designed to maintain a gap of between 35 and 45 mm between bar and wall surface. Grab bar material and anchorage to withstand force of 1.3 kN applied in any direction. Minimum lengths:
- .1 Behind water closet: straight 600 mm
 - .2 Beside water closet: L-shaped, 760 mm X 760 mm
- .5 Mirror: wall mounted unit, 6 mm, stainless steel frame with integral shelf, 610 mm wide X 940 mm high.

2.3 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Shop assemble components and package complete with anchors and fittings.
- .6 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .7 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

- .1 Manufacturer's or brand names on face of units not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.
- .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 from Departmental Representative.

3.2 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
 - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
- .2 Fill units with necessary supplies shortly before final acceptance of building.

3.3 ADJUSTING

- .1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.
- .2 Lubricate moving parts to operate smoothly and fit accurately.

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 toilet and bathroom accessories installation.

3.6 SCHEDULE

- .1 Locate accessories where indicated on drawings.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 10-2018, Standard for Portable Fire Extinguishers.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

Part 2 PRODUCTS

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

- .1 Cartridge operated type with hose and shut-off nozzle, ULC labelled, pressurized with ABC powder, 6A, 80 BC classification, 4.5 kg capacity operating at 1620 kPa. With brackets as recommended by extinguisher manufacturer or inside cabinets on finished floors.

2.2 IDENTIFICATION

- .1 Identify extinguishers in accordance with recommendations of NFPA 10.

- .2 Attach label to extinguishers, indicating month and year of installation. Provide space for service dates.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install or mount extinguishers in cabinets or on brackets as indicated, in accordance with NFPA 10.

3.3 LOCATIONS

- .1 In office areas, storage space, kitchen and cafeteria:
 - .1 Every 557 m² and as required by authorities having jurisdiction.
- .2 In electrical, mechanical and loading docks:
 - .1 Every 278 m² or as close as possible to each door and as required by authorities having jurisdiction.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 British Standards Institution: BS EN 13561:2015 - External blinds and awnings. Performance requirements including safety.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 70 (2020), National Electrical Code (NEC).
 - .2 NFPA 701 (2019), Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry.

1.3 ACTION SUBMITTALS

- .1 Product Data: For each type of product.
 - .1 Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for blinds.
- .2 Shop Drawings: Show fabrication and installation details for blinds, including fabric panel materials, their orientation to rollers, and their seam and batten locations.
- .3 Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- .4 Samples: For each exposed product and for each color and texture specified, 250 mm long.
- .5 Samples for Initial Selection: For each type and color of fabric panel material.
 - .1 Include Samples of accessories involving color selection.
- .6 Samples for Verification: For each type of blind.
 - .1 External Venetian Material: One venetian slat.
 - .2 Roller Shade: Full-size operating unit, not less than 400 mm wide by 900 mm long for each type of roller shade indicated.
 - .3 Installation Accessories: Full-size unit, not less than 250 mm long.
- .7 Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTAL

- .1 Product Certificates: For each type of panel material, signed by product manufacturer.
- .2 Product Test Reports: For each type of panel material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- .1 Maintenance Data: For blinds to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- .1 Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - .1 Approval of mockups does not constitute approval of deviations from the plans and specifications contained in mockups unless Departmental Representative specifically approves such deviations in writing.
- .2 Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- .1 Field Measurements: Where blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Departmental Representative of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MOTOR-OPERATED, EXTERNAL VENETIAN BLINDS

- .1 Provide complete front mounted, motorized, external venetian blinds with flanged slats in rail system. Colour to be selected from Manufacturer's standard colour range.
- .2 Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-rewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
- .3 Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- .4 Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - .1 Electrical Characteristics: Single phase, 110 V, 60 Hz.

- .5 Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
 - .1 Individual Switch Control Station: Momentary-contact, five-position, rocker-style, wall-switch-operated control station with open, close, and center off functions.
- .6 Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- .7 Performance requirements: Wind Class in accordance with BS EN 13561: WK 3. Guaranteed to 120 km/h.
- .8 Slats: Aluminum, 75 mm flanged slat.
- .9 Slat cable: Stainless steel guide cable: 2 mm, sheathed in PVC
- .8 Guide rails: Extruded aluminum guide rails at window jambs to receive hem bar ends.
- .9 Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- .10 Front Mounted Head Cover:
 - .1 Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for front mounted window installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - .2 Height: Manufacturer's standard height required to enclose blind when shade is fully open, but not less than 143 mm.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BLINDS INSTALLATION

- .1 Install blinds level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- .2 Electrical Connections: Connect motor-operated blinds to building electrical system.

3.3 ADJUSTING

- .1 Adjust and balance blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- .1 Clean blinds surfaces after installation, according to manufacturer's written instructions.
- .2 Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that blinds are without damage or deterioration at time of Substantial Completion.
- .3 Replace damaged blinds that cannot be repaired, in a manner approved by Departmental Representative, before time of Substantial Completion.

3.5 DEMONSTRATION

- .1 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated blinds.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- .1 Work in this section consists of the following:
 - .1 Design, supply and installation of a new 12.2 m self-support tower including all appurtenances. Appurtenances shall include but are not necessarily limited to:
 - .1 Fall arrest system.
 - .2 Anti-climb system: 3.0m high.
 - .3 Grounding system.
 - .4 Lightning rod system.
 - .2 Install of top mount Departmental VHF antenna and associated cabling.
- .2 Work in this section excludes the following:
 - .1 Supply of two (2) additional antennas by Departmental Representative.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA S37-18, Antenna Towers and Antenna Supporting Structures.
 - .2 CSA W47.1:19, Certification of Companies for Fusion Welding of Steel Structures.
 - .3 CSA G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CSA G164-18, Hot dip Galvanizing of Irregularly Shaped Articles.
 - .5 CSA W59-18, Welded Steel Construction.
 - .6 CSA Z259.2.5-17, Fall Arresters and Vertical Lifelines.
- .2 Health and Welfare Canada Limits of Exposure to Radio-Frequency Fields Frequencies from 3KHz - 300GHz, Safety Code 6.
- .3 Standards and Guidelines for Communication Sites, Motorola, R-56, recent edition.

1.3 SUBMITTALS

- .1 Submittals shall be forwarded to Departmental Representative in accordance with the provisions of section 01 33 00.
- .2 Tower Design:
 - .1 Provide a drawing and associated construction specification stamped by an Engineer licensed to practice in the province of Ontario.
- .3 Erection Plan
 - .1 A construction plan of adequate detail to clearly show Departmental Representative that the work will be undertaken in a competent and safe manner.
 - .1 Identify hoisting equipment and associated certification.

1.4 CONTRACTOR'S QUALITY CONTROL

- .1 The following activities shall be completed by the Contractor at the Contractor's expense as a demonstration that the delivered product is of the quality prescribed within the specification.
- .2 Contractor shall provide Steel Mill Test Certificates.
- .3 Tests for thickness and uniformity of galvanized coating shall be made as considered necessary by Departmental Representative. Tests shall be conducted in full accordance with the requirements of CSA S37. If required, Contractor shall pay for testing, all costs to be included in the tender price.
- .4 Ground resistance testing

1.5 QUALITY ASSURANCE

- .1 Departmental Representative's minimum inspection requirements are detailed below:
 - .1 The Contractor shall be responsible to notify Departmental Representative of the date and time that the works may be inspected.
 - .1 Notice must be provided no less than three [3] working days in advance to permit scheduling of quality assurance testing
 - .2 All deficiencies in the works identified at the time of inspection shall be remedied to the satisfaction of Departmental Representative, by the Contractor at their expense.
 - .3 Work shall not progress until inspections have been completed and the Contractor has been provided with written notice to proceed with the works
 - .2 Throughout tower erection
 - .3 Upon completion for the testing of Cables
 - .1 The Contractor shall inform the Departmental Representative at least three days in advance of the installation of the cables and antennas so that Departmental Representative can perform quality checks after the connectors and all supports and grounding kits are in place.

1.6 WARRANTY

- .1 Contractor shall warranty all galvanizing work for a period of not less than three 3 years.
 - .1 For clarity: for a period of three years following substantial completion any damage to the paint from normal environmental conditions prevalent at the site shall be repaired by the Contractor at no cost to the Departmental Representative in a manner approved by the Departmental Representative.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

- .1 Must conform to CSA G40.21, Grade 300W, or better. All materials used in the tower to be new and in conformance with requirements of CSA S37.

2.2 FASTENERS

- .1 Bolts shall be hot-dip galvanized with hexagonal heads and be supplied with hexagonal nuts. The unthreaded part of the bolt shall be long enough for full bearing of the adjoining parts and enough washers shall be placed on each bolt under the nut to prevent the nut from reaching the end of the bolt threads when tightened.

2.3 ANTENNAS

- .1 One (1) antenna will be supplied by Departmental Representative.
 - .1 Sinclair SD214 antenna per data sheet found in Appendix C.
 - .1 Mounting location: top of tower 12.2 m elevation.
- .2 The successful bidder shall be responsible for picking up the Sinclair antenna from the identified Staging Location.

2.4 MOUNTING HARDWARE

- .1 All mounts, mount hardware, and line hangers shall be new (not salvaged) and be heavy-duty hot dip galvanized or stainless steel.

2.5 CABLING

- .1 VHF antenna: LDF4-50.
 - .1 Cable shall be terminated with an Andrew L4PNF (female type N connector) to mate with the male type N connector that comes with the antenna.
 - .1 This connection is to be protected with a weatherproof kit.
 - .2 The free end will extend below the concrete slab and enter from below into Utility Room 107 and will be left with 7.62 m of excess cable.
 - .3 The cable will be terminated in the Utility Room 107 by Departmental Representative.
- .2 Two (2) runs of 50 mm conduit shall be installed below grade between the tower base and the new building for cable installation.

2.6 FALL ARREST SYSTEM

- .1 Must be a rail system, cable systems are prohibited.
- .2 Rail and trolley must meet all requirements of CSA Z259.2.5.
 - .1 Trylon TSF Cougar Rail, complete with trolley.

2.7 GROUNDING

- .1 Rods: Must be 19mm copper clad, 3.0 m long ground rods.
- .2 Conductors: Must be tinned copper, AWG 4/0.
- .3 Connections: Must be exothermic or irreversible mechanical type.

PART 3 - EXECUTION

3.1 DESIGN

- .1 The 12.2m tower shall be designed in accordance with CSA S37 to support all antennas identified herein.
- .2 The Contractor shall design all tower accessories, including new mounts for all antennas, climbing facility with a fall arrest assembly, and anti-climb panels.
- .3 Tower design shall account for all Transport Canada requirements for obstruction markings.
- .4 The tower shall be designed to resist all loads specified in CSA S37 as well as maximum loads caused by all equipment installed in the towers as described in these specifications and plans.
- .5 Unless otherwise specified, loads shall be determined in accordance with CSA S37; reliability Class I.
- .6 Contractor shall submit Engineering Plans outlining materials, dimensions, loading and any other pertinent details for tower construction to Departmental Representative for approval prior to fabrication.
- .7 Ground System:
 - .1 The tower shall be designed with a ground electrode system compliant with Motorola R56 (Latest edition).
 - .2 All three tower legs shall be connected to the grounds. Ground must be connected to a tab fabricated as part of the tower leg and not by exothermic welds to legs or drilling which could affect the tower's leg strength.
 - .3 Conductors shall connect to a buried ground ring compete with ground rods or plates driven to a sufficient depth.
 - .1 Ground system resistance must be less than 5 ohm.
- .8 Climbing Apparatus:
 - .1 The tower shall be equipped with a climbing apparatus complete with a fall arrest system, in compliance with applicable CSA S37 requirements.
 - .2 The climbing apparatus shall provide an unobstructed climbing path and maintain the required climbing clearance radius as per CSA S37.
 - .3 Climbing apparatus configuration, shall comply with CSA S37-13 and Canada Labour Code. Rungs shall be horizontal, have adequate clearance and line up vertically.
- .9 Fall Arrest System:
 - .1 The Contractor shall supply a fall arrest system to meet CSA S37 requirements.
 - .2 The fall arrest system shall be free from obstructions for the complete height of the tower.
 - .3 The fall arrest system shall be supported at spans not more than 1 m, or to meet the manufacturer's instructions.

- .4 The fall arrest system shall run up the tower or ladder in a manner to facilitate climbing. The fall arrest rail shall be straight and true to prevent trolley binding.
- .5 The extension of the fall arrest system beyond the top of the tower must be structurally supported for the entire height.
- .6 Proper manufactured stop hardware is to be installed at the top of the fall arrest rail to prevent accidental dislodging of the trolley from the rail.

- .10 Anti-Climb Panels:
 - .1 The tower shall include one [1] sets of anti-climb panels.
 - .2 Anti-climb panels must fully enclose the perimeter of the tower. Protection of the ladder assembly only is prohibited.
 - .3 Each panel shall be no less than 3.05m in height.
 - .4 Anti-climb panels shall be included in the design drawings of the tower and shall be of galvanized steel or stainless.
 - .5 The anti-climb must be hinged on the climbing face of the tower, and must allow for locking of the panel
 - .1 The 12.2m tower shall be designed in accordance with CSA S37 to support all antennas identified herein.

3.2 FABRICATION

- .1 Each tower segment shall be designated with a number that is easily read after galvanizing. This mark shall be stamped into each piece in such a manner, or in such a place, as will not injure or reduce the strength of the piece. The marks on like pieces shall be in the same relative position on each piece. The markings indicated on each piece shall correspond with that shown on the erection drawings.
- .2 All members shall be fabricated in accordance with the Engineering Plans and as per CSA S37.
- .3 All like parts shall be interchangeable. All like parts shall have the same number.
- .4 In any bending or reworking of any material, methods employed shall ensure that the physical properties of the material are not impaired.
- .5 All welding shall be performed in accordance with CSA W59 and shall be undertaken by a fabricator approved by the Canadian Welding Bureau to the requirements to CSA W47.
- .6 Special mounting arrangements shall be incorporated into the tower sections for the secure mounting of:
 - .1 All lighting fixtures, junction boxes, and cable supports.
 - .2 Fall arrest system extension where it extends above the top of the tower.
 - .3 Ground lugs or grounding attachments.
- .7 The Contractor shall ensure that electrical continuity exists between all tower sections.

3.3 GALVANIZING

- .1 All materials, structural steel, pipe and fittings, including bolts, nuts and washers shall be hot dip galvanized to the requirement of CSA S37 and CSA G164 and as otherwise specified therein.
- .2 All materials shall be completely fabricated before galvanizing except the tapping of nuts.
- .3 Before galvanizing, the steel shall be thoroughly cleaned of all paint, grease, rust, scale or other materials that will interfere with proper binding of the zinc with the steel.

3.4 HANDLING OF MATERIAL AND TRANSPORTATION

- .1 The tower and parts are to be built so they may be safely transported to the site from the manufacturer's premises.
- .2 Materials shall be handled and stored in the plant and on the job site in such a manner that no damage shall be done to the materials of any existing building or structure.
- .3 Tower sections should be stored on the gravel parking pad and not the grass, if possible.
- .4 Special care shall be taken to ensure that galvanizing is not damaged during handling and erection of materials.
- .5 Storage of materials on the site will be the responsibility of the Contractor.

3.5 TOWER INSTALLATION

- .1 Prior to site mobilization, Contractor shall submit a Construction Plan detailing construction tasks, methods, and equipment required to complete work to Departmental Representative for review. Construction Plan should include methods of completing work, equipment required, as well as hazards and mitigation for hazards for each work task.
- .2 The contractor shall give Departmental Representative a written notice one week prior to the commencement of the standing of the tower.
- .3 The tower shall be erected in a manner that will not bend, scrape, distort, or injure the component parts of the galvanizing.
- .4 The Contractor shall be responsible to ensure that no members of the tower are over stressed during erection.
- .5 Every failure of the tower sections to join together properly shall be reported to the Departmental Representative.
- .6 Upon completion of erection, the tower shall be inspected by the Contractor for damage. Any damaged or missing items, including nuts, bolts, etc.,

shall be replaced. The tightness of all bolts shall be rechecked at this time.

- .1 Any members damaged during erection shall be replaced at the Contractor's cost.
- .7 The Contractor shall be responsible for any damages done to the work of others, or to adjoining structures and property during erection.
- .8 The Contractor shall touch up in the field all steel members of the tower where the galvanized finish has been scraped or chipped during erection using zinc-enriched or Galvicon paint, or an approved equal.
- .9 The Contractor shall field paint all steel members of the tower where the painted finish has been scraped or chipped during erection in the field.
 - .1 The Contractor shall be responsible for damage done by paint spraying or dripping on the Departmental Representative's or other's property.

3.6 TRANSMISSION LINES

- .1 All lines shall be mounted to mounting plates included in the fabrication of the tower.
 - .1 The use of wrap lock/tie wrap devices to secure TX lines is not acceptable.
- .2 Cables shall be buried from inside of the skirting to the tower base in a conduit 50 mm diameter. Conduit end shall be weatherproofed at the tower end to prevent water entry.
- .3 The cable is to run through conduit from the VHF Antenna to the base of the tower, underground to the side of the building, into the building's crawl space and terminate below the radio room with 7.62 m of surplus cable.
- .4 Every effort shall be made to ensure that the external connections are made waterproof using the best commercial practice.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 20 - Construction/ Demolition Waste Management and Disposal.
- .3 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 SHOP DRAWINGS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Shop drawings; submit drawings for all materials to be installed prior to manufacturing. When required, provide shop drawings that are stamped and signed by professional engineer licensed in the Province of Ontario, as instructed in specific sections.
- .3 Shop drawings to show and include:
 - .1 Mounting arrangements and connections.
 - .2 Operating and maintenance clearances.
 - .3 Wiring and controls diagrams.
 - .4 Capacities.
 - .5 Detailed drawings of bases, supports, and anchor bolts.
 - .6 Acoustical sound power data, where applicable.
 - .7 Points of operation on performance curves.
 - .8 Manufacturer to certify current model production.
 - .9 Certification of compliance to applicable codes.
- .4 Shop drawings shall be specific to the project and identified with the name of the project, date of submission, name of the Departmental Representative and equipment identification code as indicated on the drawings and specifications. Catalog cuts will not be accepted.
- .5 Review of shop drawings by the Departmental Representative is a general review to reduce the risk of errors in the manufacturing process. It does not relieve the contractor from its responsibilities to provide an installation that is compliant with the drawings and specifications.
- .6 Shop drawings shall be submitted in English.

- .7 Insert the copy of the shop drawings stamped as reviewed by the Departmental Representative in the Operations and Maintenance manuals.

1.3 OPERATION AND MAINTENANCE MANUALS

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 74 20.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection and prior to any scheduled training.
- .3 Bind data in vinyl hard cover 3 "D" ring type loose leaf binders for 212 x 275 mm size paper. Binders must not exceed 75 mm thick or be more than 2/3 full.
- .4 Enclose title sheet labelled "Operation Data and Maintenance Manual," project name, date and list of contents. Project name must appear on binder face and spine.
- .5 Include one complete set of final shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.
- .6 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .7 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
- .8 Maintenance data to include:
 - .1 Servicing, maintenance, and operation instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .3 Lubrication products and schedules.

- .4 Trouble shooting procedures.
- .5 Adjustment techniques.
- .6 Operational checks.
- .7 Supplier's names, addresses and telephone numbers and components supplied by suppliers must be included. Identify components by description and manufacturer's part number.
- .9 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93.
- .10 Guarantees showing:
 - .1 Name and address of projects.
 - .2 Guarantee commencement date (date of Interim Certificate of Completion).
 - .3 Duration of guarantee.
 - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .5 Signature and seal of Guarantor.
- .11 Spare parts: list recommended spares parts and materials to be maintained on site to ensure optimum efficiency. List special tools appropriate to unique application. Parts and tools detailed must be identified as to manufacturer, manufacturer part number and supplier.
- .12 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for verification. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .13 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

1.4 AS-BUILT DRAWINGS

- .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
- .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .3 Submit to Departmental Representative for approval and make corrections as directed.
- .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .6 Submit copies of as-built drawings for inclusion in final TAB report.

1.5 LETTERS OF CONFORMANCE

- .1 At the end of the work, every subcontractor has to submit to the Departmental Representative the certificate of compliance which provides evidence that all the work were executed according to drawings and specifications and according to the current applicable codes and standards.

1.6 INTERFERENCE DRAWINGS

- .1 General Requirements:
 - .1 Interference drawings, also called coordination and integration drawings, are required in all cases where interference between the various trades render such drawings necessary.
 - .2 The interference drawings must clearly and precisely show all relevant work done by the concerned section or these done by others.
- .2 Description:
 - .1 Interference drawings consist of dimensioned and scaled drawings showing location of equipment, ducts, piping, valves and other accessories with all necessary sections and details. Drawings shall be complete with dimensions of piping and ducts, location of sleeves, openings, anchors and supports, including their location relative to structural and architectural work and other mechanical and electrical work.

.3 Preparation:

- .1 Each trade shall be responsible for the information provided on the interference drawings for its own work.
- .2 Division 23 - Heating, Ventilating & Air Conditioning (HVAC) shall be responsible for the coordination of interference drawings for all mechanical and electrical sub-contractors. These sections shall supply all the data, drawings and diagrams required for this coordination.
- .3 All drawings with no exception shall be coordinated by the General Contractor with the collaboration of all mechanical and electrical sections, including structural and architectural elements.
- .4 All interference drawings for a given area shall be submitted all at once for review.

.4 Collaboration:

- .1 Close collaboration is required between the various mechanical and electrical trades to determine the location of their work and to avoid any possible interference.

.5 Distribution of interference drawings:

- .1 Submit to the Departmental Representative, for information, two copies approved by the contractor and signed by all parties involved.
- .2 Drawings to be corrected and resubmit if required.

.6 Responsibility:

- .1 Each section shall be solely responsible for the exact location and dimensioning of openings, holes and sleeves, location of equipment, piping and ductwork, whether the structural, architectural or engineering drawings bear dimensions or not.
- .2 No compensation will be given in the event of changes to work rendered necessary for purposes of coordination or integration of the various electrical and mechanical systems.

- .3 Notwithstanding the responsibility for coordination and integration, the work shall not be executed prior approval of the interference drawings. Each section shall do over, at its own cost, all work not in accordance with the interference drawings and will be given no compensation based on a misinterpretation of the scope. Such misinterpretations shall not relieve the concerned section from its responsibilities and obligations to turn over systems that are complete, properly tested, ready to operate and fully integrated.
- .4 Existing work: interference drawings shall take into account existing or future mechanical, electrical, structural and architectural work.
- .7 Interference drawings are required:
 - .1 For the location of sleeves, openings and holes to be provided in walls, floors, beams and columns.
 - .2 For mechanical rooms.
 - .3 Where indicated in specifications.
 - .4 The present clause is not restrictive; additional interference drawings may be required where they are deemed necessary.

1.7 FEES, PERMITS, AND CERTIFICATES

- .1 Obtain and pay for certificates, licenses and other permits as required by municipal, provincial and federal authorities.
- .2 Provide authorities with plans and information for acceptance certificates.
- .3 Provide inspection certificates as evidence that Work conforms to requirements of authority having jurisdiction.

1.8 WARRANTY

- .1 Each section must provide warranties for the work and materials for a period of one year after the substantial Completion Certificate has been issued or 18 months after the installation of the equipment. Each section must repair or replace at its own cost any defect that appears during this period, within forty-eight hours after having been formally advised.
- .2 The warranty may exceed a period of one year wherever indicated.

1.9 FAMILIARIZATION WITH SITE

- .1 Contractor may visit site prior to submitting Bid to examine site conditions and assess risks and requirements for completing their work. No allowance is made on account of error or negligence to properly observe and determine existing conditions.

1.10 REMOVED MATERIALS

- .1 Unless otherwise specified, materials for removal become Contractor's property. Remove materials promptly.

1.11 CONCEALED WORK

- .1 The Contractor formally agrees not to conceal work or material such as piping, junction box, etc., without authorization from the Departmental Representative. Contractor shall perform all required work to allow examination of concealed work at its own expense in case of failure to meet this requirement.

1.12 SLEEVES

- .1 Supply and install sleeves for piping passing through walls and floors.
- .2 In concrete beams, metal sleeves shall be installed before pouring concrete.
- .3 For openings in concrete walls or floors, install metal or plastic sleeves before pouring concrete.
- .4 Sleeves shall be installed flush with surfaces. Apparent or concealed pipes passing through a slab that is not on grade shall have metal sleeves having smooth top edges and projecting 2" (50 mm) over the floor finish in order to hold water.
- .5 Outside surfaces of steel sleeves shall be covered with a thick coat of zinc paint.
- .6 Sleeves diameter shall be sufficient for piping and thermal insulation when needed.
- .7 Plastic sleeves: maintained by appropriate supports.
- .8 Steel sleeves: made with schedule 40 steel pipes with three supports spot-welded to steel structure.

- .9 Sealed steel sleeves: all mechanical and electrical pipes, apparent or concealed and going through slabs that are not on grade or mechanical room floor shall have a sealing plate made with schedule 40 steel pipe welded all around to a 1/8" (6 mm) plate attached to the floor.
- .10 Galvanized steel sleeves: all pipes going through masonry wall or dry-walls finish (wall or ceiling), shall be installed in sleeves when the pipe temperature is 100°F (37.78°C) or above. Sleeves shall be made with schedule 20 galvanized steel.

1.13 SEALING OF OPENINGS

- .1 Coordinate sealing of openings with architectural divisions.
- .2 General requirements:
 - .1 Resilient mastic: fireproof type.
 - .2 Fire barrier: fire barrier fiber ad-double UL approved.
 - .3 Sealing applies to sleeves and openings.
 - .4 Sealing should be done by mechanical and electrical divisions in coordination with other divisions.
- .3 Protection against fire, fire separation wall and floor:
 - .1 For all boring, drilling, sleeves, openings in fireproof separation or in any fireproof construction, the space between piping or duct and sleeve or opening should be caulk with packed fiberglass and a resilient fireproof mastic, 1" (25 mm), thick on each side of the opening.
 - .2 If the caulk space around pipe or ducts is more than 1" (25 mm), clog this space with iron-angle on each side, after glass fiber and resilient mastic.
- .4 Smoke seal and acoustic: unless otherwise indicated, seal space between piping and sleeve or opening, space between duct and sleeve or opening, with packed glass fiber and 1" (25 mm), resilient mastic on each side of the opening. When free space around ducts or pipes is more than 1" (25 mm), clog space with iron-angle on each side of the opening and then insulate with glass fiber and resilient mastic.

.5 Water seal:

- .1 For spaces where there is a possibility of water damage, especially in mechanical rooms, rooms above transformers, communication, computer and alarm, all non-circular duct work, all piping shaft and/or ducts through floor should be surrounded by a low concrete wall of 75 mm (3") high from finish floor, in order to prevent any water leakage through those openings. See "CONCRETE WORK" of the current section.
- .2 For spaces where there is a possibility of water damage and in the locations mentioned above, any circular pipe or duct going through a floor should be provided with a steel tightness sleeve, exceeding the finish floor of 2" (50 mm).
- .3 The space between the interior of the sleeve, the low wall (or concrete, where no sleeve is required) and piping or ductwork should be waterproof by the concerned section with packed fiber glass and a 1" (25 mm), depth fireproof resilient mastic. If space around pipes or duct is more than 1" (25 mm), clog space with iron-angle on each side, after glass fiber and resilient mastic installation.
- .4 For all work and ducts passing through slab with a damp-proof membrane should be installed in order to ensure water-tightness of these floors.
- .5 Any pipe except other than iron piping and any ductwork going through roof should be provided with a roof companion supplied and installed by the concerned section. Roof joints and casing surrounding piping and duct are at the expense from other section and allows piping expansion.
- .6 Low walls, removable covers, tightness of piping going through these low walls at the roof are at the expense of General Contractor.

1.14 ROUGHING-IN

- .1 Be responsible for obtaining manufacturer's literature and for correct roughing-in and hook-up of equipment, fixtures and appliances.

1.15 HAZARDOUS MATERIALS

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Safety Data Sheets (SDS) acceptable to Human Resources and Social Development Canada (HRSDC), Labour program.

Part 2 PRODUCTS

2.1 NEW MATERIALS

- .1 Unless otherwise indicated, all materials shall be new, without imperfection or fault and of required quality; they shall bear ULC, CSA or FM approval tags and be submitted to the Departmental Representative for approval.

2.2 MANUFACTURERS' INSTRUCTIONS

- .1 Unless otherwise indicated, the installation of components and equipment and prefabricated materials shall be made in accordance with the manufacturer's instructions.
- .2 Contractor shall obtain and understand all pertinent instructions.
- .3 When required, approved manufacturer's representative shall validate conformity of the installation.

Part 3 EXECUTION

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

- .1 Clean-up work area as work progresses. At end of each work period, and more often if required, remove debris from site, neatly stack material for use, and clean up generally.
- .2 Upon completion remove scaffolding, temporary protection and surplus materials. Make good defects noted at this stage.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 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.

3.4 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

1.2 SCOPE OF WORK

- .1 The scope of work for Division 22 includes, in a general way, the labour, supply and installation of all materials or equipment required for the plumbing works as described in the drawings and specifications.
- .2 Scope of work include but is not limited to the following:
 - .1 Installation of new domestic water and sanitary piping system.
 - .2 Connection of the new drainage and domestic water system to all new plumbing fixtures and accessories.
 - .3 All thermal insulation work related to the plumbing division.
 - .4 Record drawings.
 - .5 Identification of piping and equipment.
 - .6 Domestic Cold Water:
 - .1 All required piping, valves, and accessories.
 - .7 Domestic Hot Water:
 - .1 All required piping valves and accessories.
 - .2 Hot water tank
 - .8 Drainage:
 - .1 New drainage system.
 - .2 New vent system and connections to new fixtures.
 - .3 Connection of drain pans, fans with drains, in coordination with Division 23.
 - .9 Plumbing Fixtures:
 - .1 Provision for plumbing fixtures, kitchenette sinks, etc., including the connection to the domestic water and drainage systems as indicated and as appropriate.
 - .10 Other services:
 - .1 Steel support elements.
 - .2 All required tests.

- .3 Sleeves.
- .4 The installation of springs, pads, flexible piping and other noise and vibration reducing equipment.
- .5 Seismic restraints relative to work of Division 22.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Provide a list of Identifications legends for piping and valves.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.
 - .2 Approvals:
 - .1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for verification. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
 - .3 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 PAINING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes that have been damaged.

3.2 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 01 74 20 - Construction / Demolition Waste Management and Disposal.
- .5 Section 01 78 00 - Closeout Submittals.
- .6 Section 21 05 01 - Common Work Results for Mechanical

1.2 REFERENCES

- .1 American Society of Mechanical Engineers International (ASME)
 - .1 ASME B16.15-2018 Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ASME B16.22-2018 (R2010), Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ASME B16.24-2016, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60000 PSI Tensile Strength.
 - .2 ASTM A536-84(2019)e1, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B88M-18, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American Water Works Association (AWWA).
 - .1 AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242-05 (R2016), Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-2017, Butterfly Valves.
 - .2 MSS-SP-70-2011, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71-2018, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Building Code 2015
- .9 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage materials in accordance with Section 01 61 00.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA and Regional and Municipal regulations.

Part 2 PRODUCTS

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.

2.2 FITTINGS

- .1 Cast bronze threaded fittings, Class 125: to ASME B16.15.
- .2 Cast copper, solder type: to ASME B16.18.
- .3 Wrought copper and copper alloy, solder type: to ASME B16.22.
- .4 NPS 2 and larger: ASME B16.18 or ASME B16.22 roll grooved to CSA B242.
- .5 NPS 1 and smaller: cast copper to ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

- .1 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .2 Solder: 95/5 tin copper alloy.
- .3 Teflon tape: for threaded joints.
- .4 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Brass body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle
- .2 NPS 2 and under, soldered:
 - .1 To ANSI/ASME B16.18, Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with NPC and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ASME standards.
- .3 Install domestic cold water piping below and away from domestic hot water and other hot piping so as to maintain temperature of cold water as low as possible.
- .4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with gate valves.

3.4 PRESSURE TESTS

- .1 Conform to requirements of Section 21 05 01.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean to Federal potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

3.7 DISINFECTION

- .1 Flush out, disinfect and rinse system to approval of Departmental Representative.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

3.8 START-UP

- .1 Timing: start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring HWS storage tank up to design temperature slowly.
 - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

- .1 Scheduling:
 - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .3 Sterilize HWS and HWC systems for Legionella control.
 - .4 Verify performance of temperature controls.
 - .5 Verify compliance with safety and health requirements.

- .6 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .7 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
 - .1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products.

3.11 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 - Cleaning
- .3 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .4 Section 22 02 00 - Common Work Results for Plumbing.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM B32-08(2014), Standard Specification for Solder Metal.
 - .2 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564-14, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CSA B70:19, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CSA B125.3-18, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
 - .1 GS-36, Green Seal Standard for Adhesives for Commercial Use, Edition 2.1, July 12, 2013.
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.
- .5 National Building Code of Canada. 2015

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

- .3 For each joint, use 450 gr. (1lb) of lead for each inch of pipe diameter. Augment lead quantity when cut pipes are used. PC-4 cans be used in accordance with manufacturer's instructions and requirements of the National Building Code of Canada.
- .4 No trace of tar or greasy matter will be tolerated.
- .3 Cast iron piping with mechanical joints (NPS 8 and under):
 - .1 Approved by authorities having jurisdiction.
 - .2 Stainless steel rings, CSA B-602 approved.
 - .3 Joint material in accordance with CSA B-70-M1991.
 - .4 T-304 Stainless steel clamps.
- .4 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.
- .5 Cast iron piping with neck for very high water temperature:
 - .1 Cold caulking fillet PC4 AF.
 - .2 For this type of joint, thoroughly clean the inside of the piping with a lime. Material must not have any tar or grease. Then apply clear water with brush on all surfaces of the joint, immediately before the application of the sealing compound. Eliminate still water.

2.4 FITTINGS AND ACCESSORIES

- .1 Cast iron piping: The trade mark, pipe size and CSA logo shall be cast in the pipe, CSA B70, Class 4000.
- .2 Cast iron piping with mechanical joints: The trade mark, pipe size and CSA logo shall be cast in the pipe, CSA B70, with stop notch for the positioning of gasket.
- .3 Copper piping: Connections for welding.
- .4 In the ground, appliance plumbing fittings: cast iron, ASTM-A74, Class 4000.
- .5 Galvanized steel piping: drainage type, black cast iron fittings.
- .6 Drainage of ventilation equipment:
 - .1 25 mm (NPS 1) and less: soldered joints.

- .2 32 mm (NPS 1¼) and over: soldered joints, drainage type.
- .7 For piping made of other materials, use fittings of the same material and the same class as the pipe on which they are used.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 GENERAL

- .1 Comply with requirements of Section 23 05 15 - Common Installation Requirements for HVAC Pipework and Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .2 Connection to municipal services:
 - .1 Before starting the plumbing, determine on site the availability of water supply services, as well as their exact location and depth.
 - .2 If the locations shown for these services or the connection projections shown in the drawings do not correspond fully to the site requirements, immediately submit all details of the deviations to the Departmental Representative and suspend that part of the work until instructions and drawings correcting the deviations are issued.
 - .3 This section is responsible for any inaccuracies in the work and expenditures that may result if it fails to take the aforementioned precautions.
- .3 General layout of the works:
 - .1 The layout of the pipe network, the position of sanitary fixtures, special equipment, etc., mentioned in the specification or shown on the drawings give the general layout of the equipment. This section must execute this installation while complying with provincial and municipal health regulations while respecting the architectural and structural arrangement of the building.
 - .2 Apply extra caution to avoid any interference of plumbing pipes with other disciplines.

- .4 Vents:
 - .1 Extend vents up to 300 mm (12") above roof and augment pipe size by one increment using conical fitting from 300 mm (12") under the roof. Any pipe penetrating the roof shall be 100 mm (NPS 4) or more. Install sleeves on all pipes that emerge above the roof and fill the free space with an approved caulking composition to make it watertight.
- .5 Pipes penetrating the roof:
 - .1 Supply and install copper or aluminum flashing (of the same properties as that of the parapet) around all pipes emerging from the roof.

3.3 SLOPES

- .1 Horizontal vent and drain pipes shall be sloped in the direction of the flow. Unless otherwise indicated, install with 2% slope for 75 mm (NPS 3) piping and less, and 1% slope for 100 mm (NPS 4) piping and over.

3.4 TESTING AND PERFORMANCE VERIFICATION

- .1 General:
 - .1 Perform all the tests specified below.
 - .2 All tests must have been performed successfully prior to being performed in the presence of the Departmental Representative.
 - .3 Any piping or part thereof must be proven before being covered with insulation or be concealed in partitions, ceilings or walls. Prior to pressure testing systems remove or protect devices such as control devices, air valves, or any equipment that is not designed to be subjected to pressures corresponding to those used in the tests.
 - .4 During hydrostatic testing ensure that the piping is completely filled with liquid and purged of all the air.
 - .5 In cold weather use an antifreeze for hydrostatic tests, and at the end of the tests drain the piping completely to prevent any risk of freezing.
 - .6 Send for analysis, comments, and approval three copies of the final report of all tests and adjustment. Enter the results on 8½" x 11" format sheet by clearly identifying the system, equipment, design characteristics and test results.

- .2 Drainage, sewer, and vent piping testing:
 - .1 Perform hydrostatic testing on the drainage and vent piping by sections of a maximum height of 15 m. completely fill each section of water to a height of 2.1 m above the highest lateral branch of each section. The water level should remain stable for a period of two hours.
- .3 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .4 Test to ensure traps are fully and permanently primed.
- .5 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .6 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (15 ft) (whichever is less).

3.5 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 22 05 00 - Common Work Results for Plumbing.

1.2 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM D2235-04(2016), Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564-12(2018), Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B1800-18, Thermoplastic Non-pressure Pipe Compendium.
- .3 Green Seal Environmental Standards (GSES)
 - .1 GS-36, Green Seal Standard for Adhesives for Commercial Use, Edition 2.1, July 12, 2013.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.
- .6 National Plumbing Code 2015.
- .7 Provincial Plumbing Code

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Provide two (2) copies WHMIS SDS - Safety Data Sheets.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Store at temperatures and conditions recommended by manufacturer.

Part 2 PRODUCTS

2.1 MATERIAL

2.2 PIPING AND FITTINGS

- .1 For above ground DWV piping to:
 - .1 CSA B1800.

2.3 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

3.3 TESTING

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

3.4 PERFORMANCE VERIFICATION

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

3.5 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 02 81 01 - Hazardous materials
- .5 Section 22 05 00 - Common Work Results for Plumbing.

1.2 REFERENCES

- .1 American National Standards Institute/ Canadian Standards Association (ANSI/CSA):
 - .1 ANSI Z21.10.1-2017/CSA 4.1-2017 - Gas Water Heaters - Volume I, Storage Water Heaters with Input Ratings of 75,000 BTU/h or Less.
 - .2 ANSI Z21.10.3A-2017/CSA 4.3-2017 - Gas Water Heaters - Volume III, Storage Water Heaters, with Input Ratings Above 75,000 BTU/h, Circulating and Instantaneous.
- .2 Canadian Standards Association (CSA)/CSA International:
 - .1 CSA B51:19 - Boiler, pressure vessel, and pressure piping Code.
 - .2 CSA B139-Series 19 + Ontario Amendments, Installation code for oil-burning equipment.
 - .3 CSA B140.0-03(R2018) - Oil-Burning Equipment: General Requirements.
 - .4 CSA B140.12-03(R2018) - Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
 - .5 CSA B149.1-15 with 2017 Ontario Amendments, Natural gas and propane installation code.
 - .6 CSA B149.2-15 - Propane storage and handling code.
 - .7 CAN/CSA-C22.2 No 110-94(R2018) - Construction and Test of Electric Storage-Tank Water Heaters.
 - .8 CAN/CSA C191-13 - Performance of electric storage tank water heaters for domestic hot water service.
 - .9 CAN/CSA-C309-M90 (R2019) - Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.3 SUBMITTALS

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

- .2 Product data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
- .3 Shop drawings:
 - .1 Shop drawings must include the seal and signature of a professional Engineer recognized in Canada, in the province of Ontario.
- .4 Certificates:
 - .1 Submit certificates signed by the manufacturer certifying that the products and materials comply with the specified performance and physical requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit all document/elements required, in accordance with section 01 78 00.
- .2 Operation and maintenance data (O&M): provide instructions with respect to the operation and maintenance, to be incorporated into the O&M manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Transport, store and handle hazardous materials in accordance with Section 01 74 20.
- .2 Shipping and receiving: deliver material to site in the original packaging, which must bear the name and address of the manufacturer.
- .3 Waste management and disposal:
 - .1 Separate waste materials for 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 and corrugated cardboard packaging material for recycling in accordance with the waste management plan.
 - .4 Separate steel, metal and plastic materials in designated containers for recycling in accordance with the waste management plan.
 - .5 Divert unused metal materials from landfill to metal recycling facility.

Part 2 PRODUCT

2.1 ELECTRIC WATER HEATER

- .1 Provide Electric water heaters with tanks as indicated. They shall be of the same manufacturer, CSA certified, c/w relief valve.
- .2 The water heaters shall be listed by Underwriters' Laboratories. Models shall meet or exceed the standby loss requirements of current edition of ASHRAE/IESNA 90.1.
- .3 Capacity: As shown on drawings.
- .4 Heaters shall have 150 psi working pressure and be equipped with extruded high density anode rod. Electric heating elements shall be medium watt density with zinc plated copper sheath. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch.
- .5 The outer jacket shall be of baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panels and shall enclose the tank with foam insulation.
- .6 Electrical junction box with heavy duty terminal block shall be provided.
- .7 The drain valve shall be located in the front for ease of servicing.

2.2 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.
- .2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.
- .3 Pressure gauge: 75 mm dial type with red pointer, syphon, and shut-off cock.
- .4 Thermowell filled with conductive paste for control valve temperature sensor.
- .5 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

2.3 WATER DETECTOR SHUTOFF

- .1 The contractor shall install an electronically actuated resettable shutoff valve on the cold water supply of the water heater.

- .2 The electronically actuated valve shall be a full flow valve that closes upon detection of water at the water detector pad supplied with the valve.
- .3 A water detector pad shall be installed on the floor beneath the water heater. The water detector pad shall be supplied with an integral cable with connector to connect to the valve control unit. The water detector pad shall be an electronic sensing device.
- .4 The electronically actuated valve shall act to shut off both the water supply and the power to the water heater simultaneously upon detection of water.
- .5 A visual and audible indication of actuation shall be initiated and normally open contacts suitable for connection to remote monitored alarm actuation shall close.
- .6 The remote alarm contacts will be connected to a building alarm system by the alarm contractor
- .7 The valve shall be provided with an integral control unit, a water dam, a power supply and a power cutout module in addition to the water detection pad.
- .8 All connections to the control unit shall be plug in style unique to the device. Removal of any connector shall result in shut off of the valve.
- .9 The valve shall be resettable upon repair of the system or system test.

Part 3 EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with the manufacturer's written recommendations, including all available product technical bulletins, instructions for handling, storing, and implementation of the products, and with datasheet indications.

3.2 INSTALLATION

- .1 Install water heaters in accordance with the manufacturer's recommendations.
- .2 Supply and install all necessary steel structural components required for the suspension and support of horizontal tanks and instantaneous water heaters.
- .3 Install insulation between the tank and its supports.

3.3 ONSITE QUALITY CONTROL

- .1 The start-up and commissioning of water heaters must be performed by a qualified individual who has received the necessary training from the manufacturer.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTION

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A126-04 (2014), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM A278/A278M-01 (2015), Standard Specification for Gray Iron Castings for Pressure Containing Parts for Temperatures up to 650 Degrees F (350 degrees C).
 - .3 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .4 ASTM B306-13, Standard Specification for Copper Drainage Tube (DWV).
- .2 American Water Works Association (AWWA).
 - .1 AWWA C700-15, Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 AWWA C701-15, Cold Water Meters-Turbine Type for Customer Service.
 - .3 AWWA C702-15, Cold Water Meters-Compound Type.
- .3 Canadian Standards Association (CSA International).
 - .1 CSA B64 Series-11 (R2016), Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08(R2018), Commercial and residential drains and cleanouts.
 - .3 CSA B356-10 (R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).

- .5 Plumbing and Drainage Institute (PDI).
 - .1 PDI-G101-2017, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
 - .2 PDI-WH201-2017, Water Hammer Arrestors Standard.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
 - .2 Indicate dimensions, construction details and materials for specified items.
 - .3 Shop Drawings:
 - .4 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Manufacturers' Field Reports: manufacturers' field reports specified.
- .6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00, include:
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting prior to beginning work of this Section.
 - .1 Review installation conditions.
 - .2 Co-ordination with other building sub-trades.

- .3 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for 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 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
 - .5 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 FLOOR DRAINS

- .1 Floor Drains: to CSA B79, with P-trap.
- .2 P-Traps:
 - .1 P-trap shall have a bronze cleaning cap at the bottom and an 13mm (NPS ½) connection for trap seal primer.
 - .2 Minimum 100 mm (4") deep seal p-trap.
 - .3 Floor drains for air handling units shall be of a deep seal type. The height of the seal shall be at least 80 mm (3") over the pressure produced by the air-handling unit.
 - .4 Install with trap guard, complete with a ten years warranty.
- .3 Floor drain:
 - .1 General duty; cast iron body round, with protective coating, 131 mm (5 1/8") adjustable head, nickel bronze strainer, cast iron sediment bucket, with secondary seepage.
 - .2 Cast iron grate, held in place with screws, 203 mm (8") diameter.

- .4 Floor drains in washrooms:
 - .1 Cast iron body round, with protective coating, 229 mm (9") adjustable head, nickel bronze strainer, cast iron sediment bucket, with secondary seepage.
 - .2 Membrane flashing clamp and frame for adjustable extension with heavy duty cast iron grate, 171 mm (6¾") diameter.
- .5 Floor drains in mechanical rooms:
 - .1 Cast iron body, with baked epoxy coating.
 - .2 Bronze heavy duty grate, 172 mm (6¾") diameter with 206 mm (8 1/8") diameter top.
 - .3 Cast iron sediment bucket.
 - .4 Use with common header trap seal primers and dead seal P-Trap.
- .6 Combination funnel floor drain (FFD-1):
 - .1 Cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.
 - .2 Cast iron sediment bucket.
 - .3 Adjustable frame.
 - .4 Grate with cast iron funnel, oval shaped, 85 mm x 232 mm (3 3/8" x 9 1/8").
- .7 Funnels:
 - .1 Build funnels using 0.74 kg (26 ounces) copper, edge reinforced using a copper wire with rectangular section on the upper part, removable grate and cover with opening cut to allow passage of piping.
 - .2 Funnels for sprinklers shall be in cast iron, NPS 6 and 1220 mm (48") high.
- .8 Trench Drain (TD-1):
 - .1 Modular channel sections are made of 16 ga. fabricated stainless steel conforming to ASTM A240 (type 304).
 - .2 Channels are 1524mm long, 178mm wide and have a 102mm throat.
 - .3 Channels have a bolted, flanged connection between channel sections that will not separate during the installation, complete with flange gaskets.
 - .4 Channels weigh less than 1.05kg per linear foot, have a smooth, 38mm radiused, self cleaning bottom with a Manning's coefficient of .009 and 1.04% or neutral 0% built in slope.

- .5 Channels have feet for patty pour or leveling studs standard to secure trench in its final location. Channels are provided with standard FS grates that lock down to frame.
- .6 Wide reveal fabricated stainless steel grate conforming to ASTM specification A240, (type 304), rated class C per the DIN EN1433 top load classification.
- .7 Supplied in 1016 nominal lengths with 8 wide slots, and 19 bearing depth.
- .8 Grate has an open area of 7,742 sq. mm per meter.
- .9 All welds must be performed by a certified welder per ASTM standard AWS D1.6.
- .10 Drain to be complete with catch basin with heavy duty frame assembly.

2.2 OIL INTERCEPTOR

- .1 Recessed epoxy coated steel oil interceptor.
- .2 Gasketed epoxy coated steel skid-proof cover secured with hex head center bolts, double wall deep seal trap, draw-off connection.
- .3 Dual vent connections, integral stainless steel flow control plate, and no hub (standard) connections.
- .4 Capacity: As shown on drawings.

2.3 CLEANOUTS

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
 - .1 Wall Access: face or wall type, stainless steel square cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: nickel bronze, round, gasket, vandal-proof screws.

2.4 NON-FREEZE WALL HYDRANTS (HB-02)

- .1 Unless otherwise indicated, all outdoor hydrants shall be of the non-freeze, recessed type with integral vacuum breaker, 19 mm (NPS $\frac{3}{4}$) hose outlet, removable operating key. Polished bronze finish.
- .2 Provide the Departmental Representative with one key per each ten valve installed, minimum two keys

2.5 NON-FREEZE YARD HYDRANTS (HB-03)

- .1 Non-freeze yard hydrant with epoxy coated cast iron head with lift handle and lockable, galvanized casing, bronze internal working parts and valve housing, and 1/8" NPT drain port. 19 mm (NPS $\frac{3}{4}$) hose outlet, 25 mm stem of 762 mm height, total height of 914 mm. Buried depth to be confirmed.

2.6 HOSE BIBBS (HB-01)

- .1 Inside the building as indicated, hose bibb 13 mm (NPS $\frac{1}{2}$) with connection for hose, complete with 90° elbow, vacuum breaker, with welded steel supports and wall anchors.

2.7 WATER HAMMER ARRESTORS

- .1 Install prefabricated water hammer arrestors in required locations.
- .2 Manufactured with stainless steel, 18-8 series, piston bellows type and screwed end.
- .3 The water hammer arrestor must be accessible. Provide and install access door where required.

2.8 TRAP SEAL PRIMERS

- .1 Mechanical trap primer: Bronze, with integral vacuum breaker, 13 mm (NPS $\frac{1}{2}$) solder ends, 13 mm (NPS $\frac{1}{2}$) drip line connection

2.9 STRAINERS

- .1 Y type with 20 mesh, bronze or stainless steel removable screen. Strainers shall be the pipe size.
- .2 50mm (NPS 2) and under, bronze body ASTM-B62, screwed ends, with brass cap. Operating pressure of 2758 kPa at 65.6°C (400 psi at 150°F) to 1724 kPa at 207°C (250 psi at 405°F).

- .3 63 mm (NPS 2½) and over, heavy duty cast iron body, semi-steel, ASTM-A278, Class 30, di-electric flanged ends, with bolted cap. Operating pressure 1200 kPa at 65.6oC (174 psi at 150°F).

2.10 WATER - PRESSURE RELIEF VALVE

- .1 Pressure relief valve with test lever, capacities certified according to ASME.
- .2 On domestic hot water tanks, of the pressure and temperature type.

2.11 BACKFLOW PREVENTERS

- .1 Preventers: to CSA B64 Series, application as indicated, double check valve assembly.
- .2 Bronze or steel body. Internal mechanism shall be bronze or stainless steel.
- .3 With unions, strainer and isolation valves. Strainer located downstream of the first shut-off valve.
- .4 Locations: As shown on drawings.

2.12 EXPANSION TANKS

- .1 Expansion tanks for domestic hot water tanks: Capacity as shown on drawings.
- .2 The interior of the tank must be lined with polypropylene.

2.13 WATER METERS

- .1 To AWWA C700.
- .2 Coordinate water meter requirements with the City of Cobourg.

2.14 WASHING MACHINE HOT/COLD SUPPLY

- .1 Single lever operated valve, hose end outlets, copper liner, service stops, 12mm (NPS1/2)H&CW connection,

38mm(NPS 1 ½) drain outlet, provide P trap cast brass, 38mm (NPS 1 ½) concealed in wall.

- .2 Connector hoses: FloodSafe Auto-Shutoff, braided stainless steel. Supplied with standard brass female hose bibb fittings at each end of the flexible connector

2.15 TRIM AND INSTRUMENTATION

- .1 Drain valve: NPS 1 with hose end.

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 data sheet.

3.2 INSTALLATION

- .1 Install in accordance with provincial codes and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.3 FLOOR DRAINS

- .1 Floor drains installed within monolithic slabs and ceramic tiles, tiles or other finishing materials: during the floor pour, coat the adjustable part of the floor drain with polythene for subsequent adjustment of the grate to the level of the finished floor.

3.4 CLEANOUTS

- .1 Supply and install on all drain pipes, envision cleanouts at all locations where obstructions can occur, at the pipe ends, at all direction changes, after 15 m of horizontal runs, at the bottom of each stack, at all locations required by code and at the locations specified and/or indicated on the drawings.
- .2 Construct the cleanouts using Y connectors.
- .3 The main cleanouts for the building sewage outlets must have the same diameter as the drain pipe.
- .4 Elsewhere, line size to maximum NPS 4.

3.5 DRAINAGE - FUNNELS

- .1 Supply and install all drains and funnels needed for the drainage, the overflow, and pressure relief valves of all fixtures or systems.
- .2 The air gap between the funnel and the drain pipe must not exceed the nominal pipe diameter.
- .3 Bevel at 45° the end of pipes discharging into a funnel. The higher flow rate drain pipe must be centered with the drain.

3.6 WATER HAMMER ARRESTORS

- .1 Install prefabricated water hammer arrestors on hot and cold domestic water pipes:
- .2 At the highest point of the cold and hot water risers.
- .3 Where possible, the water hammer arrestor for each fixture can be replaced by a single arrestor sized for a group of fixtures. Submit for approval the manufacturer's technical recommendations on the number and location of water hammer arrestors.
- .4 At all locations with possible pressure buildup, installation of prefabricated water hammer arrestors.

3.7 TRAP PRIMERS

- .1 Where indicated on the drawings, or where floor drains are not equipped with a trap seal guard, on the cold water supply lines serving washbasins or sinks, supply and install trap primers with NPS ½ copper piping of the same material and solder as the domestic water piping. The location and the installation to be according to the manufacturer's recommendations.

3.8 WATER - PRESSURE RELIEF VALVE

- .1 Connect the pressure relief valves to the drain by means of drainage pipes and funnels. Securely anchor the piping, center it in the funnel preventers and bevel at 45°.

3.9 BACKFLOW PREVENTERS

- .1 Drain the backflow preventers, and securely anchor the drainage piping.

- .2 The qualified Contractor must complete the installation and testing in compliance with the standard CSA-B64. Provide three copies of the test report to the Departmental Representative.
- .3 Install on the domestic cold water lines at the following locations:
- .4 Where indicated and elsewhere as required by code.

3.10 WATER HAMMER ARRESTORS

- .1 Install a water hammer arrestor on the supply lines connected to each sanitary fixture or each group of sanitary fixtures, as well as at the indicated locations.

3.11 WATER METERS

- .1 Install water meters provided by the company or the local water supply authority.
- .2 Install water meters as indicated.

3.12 STRAINERS

- .1 Install with sufficient room to remove basket.

3.13 TESTING AND ADJUSTING

- .1 Perform the testing and balancing of special fixtures and equipment at this time.
 - .1 Defects found in the start-up have been rectified.
 - .2 The completion certificate was issued by the competent authorities
- .2 Tolerances:
 - .1 Pressure at fixtures: allowable deviation of more or less 70 kPa.
 - .2 Flowrate at fixtures: allowable deviation of more or less 20%.
- .3 Floor drains:
 - .1 Verify operation of the trap seal primer.
 - .2 Prime, using trap primer. Adjust flow rate to suite site conditions.
 - .3 Check operations of the flushing features.
 - .4 Check security, accessibility, removability of strainer.
 - .5 Clean out baskets.

- .4 Vacuum breakers, backflow preventers and check valves:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
 - .3 Verify visibility of discharge from open ports.
- .5 Access doors:
 - .1 Verify size and location relative to items to be accessed.
- .6 Cleanouts:
 - .1 Ensure the cover is gas-tight, secure, yet readily removable.
- .7 Water hammer arrestors:
 - .1 Ensure that the water hammer arrestors installed are of the appropriate type and are adequately implemented.
- .8 Hose bibs:
 - .1 Ensure that the water connections are completely emptied and that they are protected against freezing.
 - .2 Check the operation of the vacuum breaker.
- .9 Pressure reducers/regulators:
 - .1 Adjust set points according to the location, and flow and pressure conditions.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 - Cleaning.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45 Series-02(R2018), Plumbing Fixtures.
 - .2 CSA B125.3-18, Plumbing Fittings.
 - .3 CSA B651-18, Accessible Design for the Built Environment.
- .2 National Building Code 2015.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data in accordance with Section 01 78 00.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .2 Packaging Waste Management: remove for reuse and return of pallets, crates, paddling and packaging materials in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CSA B125.3.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: architectural drawings to govern.
- .5 Fixtures to be product of one manufacturer.
- .6 Trim to be product of one manufacturer.
- .7 Refer to mechanical plumbing schedules for specific information.

2.2 WATER CLOSETS

- .1 WC-01 Water Closet
 - .1 Comfort height, 430 mm - 480 mm high floor mounted, vitreous china with antimicrobial surface, elongated syphon jet flush action bowl, 54mm fully glazed internal trapway, low consumption 4.8 LPF.
 - .2 Seat - elongated heavy duty anti-microbial solid plastic open front with cover, with reinforced stainless steel check hinge, posts, washers and nuts.
 - .3 Supply -FloodSafe Auto-Shutoff Connector. Chrome plated finish. All metal construction, light duty angle stops.
 - .4 Provide Floor Flange

2.3 LAVATORIES

- .1 L-01- Oval undermount lavatory
 - .1 Vanity basin, 425 mm x 337 mm x 140 mm, undercountertop mounted, vitreous china, rear overflow, undermount clips.

- .2 Faucet - Single handle Faucet, Polished Chrome finish, Escutcheon for mounting on 102 mm (4") centers, Brass, 4.5 L/min (1.2 gal/min) aerator outlet, 114 mm (4-1/2") projection, Metal lever handle, Metal pop-up drain, 10 mm (3/8") compression inlets, Braided flexible supply hoses, adjustable hot limit safety stop.
- .3 Below Deck Mechanical Water Mixing Valve, Bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120 °F (48.8 °C), Integral checks, offer temperature range from full cold through 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation.
- .4 Supply - FloodSafe Auto-Shutoff Connector. Chrome plated finish, rigid horizontal integral copper sweat tube nipples, 12mm I.D. x 127mm long, all brass 1/4 turn ball valve angle stops with combination V.P. loose key handles, escutcheons and flexible copper risers.
- .5 P-trap - Provide 'p' Trap, cast brass 38mm with cleanout, union and escutcheon.

2.4

SINKS

- .1 S-01 - Double Bowl Sink - Undercounter mount - 304 Stainless Steel.
 - .1 Undercounter mount stainless steel sink, grade 18-8 type 304 stainless steel, double compartment, Bowl Depth: 8" (200mm). Overall dimensions of 794 mm wide x 521 mm long x 127 mm high. Crumb waste cup. Satin finish with a highlighted inside top bowl radius. Underside of sink is fully protected by heavy duty under coating to prevent condensation and deaden sound.
 - .2 Faucet - Single lever. The kitchen sink faucet shall be made of metal construction. Product shall feature a 8.3 L per minute maximum flow rate. Product shall feature a one-piece, self-contained ceramic disc valve, which allows both volume and temperature control. Product shall feature temperature memory, allowing the faucet to be turned on and off at any temperature setting. Product shall be for single-hole mounting, without sidespray, with an 241 mm swing spout reach and c/w aerator kits.

- .3 Below Deck Mechanical Water Mixing Valve, Bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120 °F (48.8 °C), Integral checks, offer temperature range from full cold through 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation.
- .4 Supply - FloodSafe Auto-Shutoff Connector. Chrome plated finish, rigid horizontal integral copper sweat tube nipples, 12mm I.D. x 127mm long, all brass 1/4 turn ball valve angle stops with combination V.P. loose key handles, escutcheons and flexible copper risers.
- .5 P-trap - Provide 'p' Trap, cast brass 38mm with cleanout, union and escutcheon.
- .2 S-02 - Single Bowl Sink - Undercounter mount - 304 Stainless Steel.
 - .1 Undercounter mount stainless steel sink, grade 18-8 type 304 stainless steel, double compartment, Bowl Depth: 9" (225mm). Overall dimensions of 540 mm wide x 410 mm long x 225 mm high. Crumb waste cup. Satin finish with a highlighted inside top bowl radius. Underside of sink is fully protected by heavy duty under coating to prevent condensation and deaden sound.
 - .2 Faucet - Single lever. The faucet shall be made of metal construction. Product shall feature a 8.3 L per minute maximum flow rate. Product shall feature a one-piece, self-contained ceramic disc valve, which allows both volume and temperature control. Product shall feature temperature memory, allowing the faucet to be turned on and off at any temperature setting. Product shall be for single-hole mounting, without sidespray, with an 241 mm swing spout reach and c/w aerator kits.
 - .3 Below Deck Mechanical Water Mixing Valve, Bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120 °F (48.8 °C), Integral checks, offer temperature range from full cold through 46 °C (114.8 °F). Provide tee, adaptors and flex. copper tubing to suit installation.
 - .4 Supply - FloodSafe Auto-Shutoff Connector. Chrome plated finish, rigid horizontal integral copper sweat tube nipples, 12mm I.D. x 127mm long, all brass 1/4 turn ball valve angle stops with combination V.P. loose key handles, escutcheons and flexible copper risers.

- .5 P-trap - Provide 'p' Trap, cast brass 38mm with cleanout, union and escutcheon.
- .3 S-03 - Double Bowl Laundry Sink.
 - .1 Two compartment Stainless steel free standing sink. All welded 1.02 mm (18 gauge) thick constructed body, rolled front edge, hemmed side edges, back shelf. Each compartment has centered basket waste with brass tailpiece. Stainless steel legs. CSA approved. Nominal Dimensions: 915 mm (36") wide x 686 mm (27") long x 340 mm (13-3/8") high, compartments 340 mm (13-3/8") deep
 - .2 Faucet - Two handles Faucet, Polished Chrome finish, Metal deck plate, Full flow, Spout with hose end, 156 mm (6-1/8") projection, Metal lever handles, 13 mm (1/2") male threaded inlet shanks
 - .3 Below Deck Mechanical Water Mixing Valve, Bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 48.8 °C, Integral checks, offer temperature range from full cold through 46 °C. Provide tee, adaptors and flex. copper tubing to suit installation.
 - .4 Supply - FloodSafe Auto-Shutoff Connector. Chrome plated finish, rigid horizontal integral copper sweat tube nipples, 12mm I.D. x 127mm long, all brass 1/4 turn ball valve angle stops with combination V.P. loose key handles, escutcheons and flexible copper risers.
 - .5 P-trap - Provide 'p' Trap, cast brass 38mm with cleanout, union and escutcheon.
- .4 S-04 - Single Bowl Laundry Sink.
 - .1 Single compartment Stainless steel free standing sink. All welded 1.02 mm (18 gauge) thick constructed body, rolled front edge, hemmed side edges, back shelf. Centered basket waste with brass tailpiece. Stainless steel legs. CSA approved. Nominal Dimensions: 600 mm (24") wide x 686 mm (27") long x 340 mm (13-3/8") high, compartments 340 mm (13-3/8") deep
 - .2 Faucet - Two handles Faucet, Polished Chrome finish, Metal deck plate, Full flow, Spout with hose end, 156 mm (6-1/8") projection, Metal lever handles, 13 mm (1/2") male threaded inlet shanks
 - .3 Below Deck Mechanical Water Mixing Valve, Bronze body, temperature adjusting dial, 10 mm inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when

temperature exceeds 48.8 °C, Integral checks, offer temperature range from full cold through 46 °C. Provide tee, adaptors and flex. copper tubing to suit installation.

- .4 Supply - FloodSafe Auto-Shutoff Connector. Chrome plated finish, rigid horizontal integral copper sweat tube nipples, 12mm I.D. x 127mm long, all brass 1/4 turn ball valve angle stops with combination V.P. loose key handles, escutcheons and flexible copper risers.
- .5 P-trap - Provide 'p' Trap, cast brass 38mm with cleanout, union and escutcheon.

2.5 SHOWER (SH-01)

- .1 Universal Thermostatic shower, barrier free, c/w 600mm stainless steel bar with ADA slide handshower, 9.5 L/min and shower diverter. Chrome plated finish, lever volume control, field adjustable to limit rotation on hot water zone, temperature adjustment dial.

2.6 MOP SINK (MS-01)

- .1 Floor mounted - terrazzo composed of pearl gray marble chips and Portland cement ground smooth sealed to resist stain finish with integral stainless steel caps on all sides, without tiling flange, cast brass drain with stainless steel strainer, 3" (75 mm) outlet. Nominal Dimensions: 914 mm (36") wide x 914 mm (36") long x 305 mm (12") high.
- .2 Faucet - Wall Mounted Two handles scullery Faucet, Polished Chrome finish, Flexible installation within the range of 6" (152 mm) to 10" (254 mm), Cast brass body, Integral stops, Washerless ceramic disc valve cartridges, 22.7 LPM (6.0 GPM) unrestricted hose end outlet, Spout with atmospheric vacuum breaker and bucket hook, 237 mm (9-5/16") from wall to outlet, Lever handles, top brace, Offset shank with 13 mm (1/2") NPT female inlets and integral supply stops.
- .3 Accessories:
 - .1 Hose and Wall Hook 36" (914 mm) long hose with 3/4" (19 mm) chrome coupling, stainless steel wall bracket.
 - .2 Mop Hanger stainless steel #4 finish, 24" (610 mm) long with 3 rubber spring loaded clips.
 - .3 Back Splash Panel 20 GA. (0.9 mm) type 304 stainless steel.
 - .4 P-Trap, Same material as the connecting pipe drain.

2.7 EYE WASH STATION (EW-01)

- .1 Deck mounted eye/face wash station, with stainless steel corrosion resistant receptor with eye/face wash head featuring inverted directional laminar flow with flow control, chrome-plated brass stay-open ball valve and chrome-plated brass inline mesh water strainer. Unit to include plastic pop-off dust cover for eyewash head, universal sign according to ANSI regulations, 15 mm inlet.
- .2 Provide complete with waterproof test card with space for date and initials of inspector. Used to record weekly testing of emergency equipment.
- .3 Certified by CSA to meet the ANSI Z358.1-2014 Standard for Emergency Eyewash and Shower Equipment.
- .4 Instantaneous water heater, on demand, prepackaged water tempering system for eye wash station. Outlet water temperature factory set at 27⁰C. 25kW heater, hot water shut-off valve, 50x50mesh filter, outlet temperature gauge, inlet and outlet NPS 3/4. NEMA 4 enclosure, Electrical supply 208V/3-phase.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
 - .2 Wall-hung fixtures: measured from finished floor.
 - .3 Physically handicapped: to comply with most stringent of either NBCC or CSA B651.

3.3 ADJUSTING

- .1 Conform to water conservation requirements specified this section.
- .2 Adjustments:

- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks:
 - .1 Aerators: operation, cleanliness.
 - .2 Vacuum breakers, backflow preventers: operation under all conditions.
 - .3 Wash fountains: operation of flow-actuating devices.
- .4 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 20 - Construction / Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 21 05 01 - Common Work Results For Mechanical.
- .5 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 SCOPE OF WORK

- .1 The scope of work for division 23 includes, in a general way, the labour, supply and installation of all materials or equipment required for the heating, ventilation and air-conditioning work as described in the drawings and specifications.
- .2 Scope of work include but is not limited to the following:
 - .1 New ventilation distribution ductwork.
 - .2 All fans and ERVs
 - .3 The production and coordination of interference drawings in coordination with all other disciplines.
 - .4 All access doors required for HVAC equipment.
 - .5 Testing adjusting and balancing of all HVAC systems and equipment.
 - .6 Seismic restraints for HVAC systems and equipment.
 - .7 Thermal insulation for hydronic systems and ventilation systems.
 - .8 Sealing of sleeves and openings for HVAC.
 - .9 Provide the springs and anti-vibration pads as required.
 - .10 All structural steel and support required for piping, ductwork and HVAC equipment.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.

-
- .2 Operating and maintenance clearances.
 - .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .4 Provide a list of Identifications legends for piping and valves.
 - .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 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 directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.

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

1.4 INSTALLATION DRAWINGS

- .1 Provide installation drawings for integration in the interference drawings.
- .2 Installation drawings shall include the following information:
 - .1 Name of the Owner.
 - .2 Location of the project with complete address.
 - .3 The orientation of the building on the drawing.
 - .4 Full height building sections.
 - .5 All crossings, connections to risers and associated dimensions.

- .6 Type of supports, bushings and sleeves.
- .7 All control valves, check valves and isolation valves.
- .8 Dimension and location of piping.
- .9 Plumbing fixtures and equipment.
- .10 Name and address of the installer.

1.5 INTERFERENCE DRAWINGS

- .1 Refer to Section 21 05 01.

1.6 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 61 00 -
Common Product Requirements and as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One head gasket set for each heat exchanger.
 - .4 One glass for each gauge glass.
 - .5 One filter cartridge or set of filter media for each
filter or filter bank in addition to final operating
set.
- .2 Provide one set of special tools required to service
equipment as recommended by manufacturers and in
accordance.
- .3 Furnish one commercial quality grease gun, grease and
adapters to suit different types of grease and grease
fittings.

1.7 DELIVERY, STORAGE, AND HANDLING

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

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

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

3.3 FIELD QUALITY CONTROL

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

3.4 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 78 00 - Closeout Procedures.
- .4 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):
 - .1 ASHRAE 90.1-19 - Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Canadian Standards Association (CSA International)
 - .1 CSA C390-10 (R2019), Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors.
- .4 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE Standard 112B, Induction Motor Efficiency Tests. 2009
- .5 International Electrotechnical Commission (IEC)
 - .1 IEC 60034-2: 2009, Rotating Electrical Equipment Standards: Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles).
- .6 American National Standards Institute (ANSI /National Electrical Manufacturers Association (NEMA)).
 - .1 ANSI/NEMA MG 1-2016, Motors and Generators (Includes 2017 Supplement (Part 34)).

1.3 SUBMITTALS

- .1 Submit the documents and samples required in accordance with section 01 33 00.

- .2 Product data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment in accordance with section 01 33 00. Data sheets must include product characteristics, performance criteria, dimensions, limits and finish.
 - .2 Shop drawings: shop drawings must include the seal and signature of a professional Engineer recognized in Province of Ontario, Canada.
- .3 Documents to submit at the end of work:
 - .1 Submit the maintenance documents of the motors, transmissions and guards, and attach them to the manual described in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Transport, store and handle materials in accordance with Section 01 61 00.
- .2 Transport and store materials according to manufacturer's written instructions.

Part 2 PRODUCT

2.1 GENERAL

- .1 Provide the prescribed motors for the aimed mechanical devices and systems.
- .2 T-Frame type motor housing, class B insulation, type with silencer, and special type junction box.
- .3 Unless otherwise indicated, squirrel-cage induction type, operating at 208 V, three-phase, and 60 Hz or at 575 V, three-phase, and 60 Hz. Some motors operate at different voltages, according to their description which is given in each of the respective sections.
- .4 1 HP or higher motors, high efficiency type, according to the standards CSA C390, IEEE 112B, IEC 60034-2.
- .5 Some motors must be explosion-proof. See the respective sections.
- .6 Some motors must be of a special type, which can withstand high ambient temperatures, such as those installed in boiler rooms, transformer rooms, generator rooms, or other.

- .7 All motors, except those that are directly connected, must be installed on sliding rails enabling easy adjustment and connected to their respective devices with V belts. Adjustment on sliding rails should be done with worm screws. The metal frame forming the bottom of the unit and the motor must be built in one piece if the frame is the assembly's only base. All motors connected to devices with belts must have their axes chosen to firmly support the pulleys and to cross them entirely.
- .8 When frequency inverters are used to control the speed of the motors, the motors must be of the Inverter-Duty type, class F insulation, compliant with NEMA MG1, part 31.
- .9 Replace, at no cost to the Departmental Representative, all excessively noisy or vibrating motors.

2.2 CHARACTERISTICS

- .1 Comply with the following characteristics:

Description	Power (HP)		
	0 to 7½	10 to 15	20 or more
Regular "drip proof" (open engine protected)	Yes	Yes	Yes
Service factor	1.15	1.15	1.15
Possible overheating	90°C	90°C	90°C
Thermistor type thermal protection on each winding			Yes
Multiple groove pulley for V-belt and variable diameter	Yes		
Multiple groove pulley for V-belt and fixed diameter		Yes	Yes
Grease lubricating ball and/or roller bearings		Yes	Yes
Permanently lubricated ball bearings	Yes		

- .2 For axial fans with motors placed in the airflow, the totally enclosed and cooled by the outside airflow type of motor (TEAO) with a minimum service factor of 1.0 can be used.
- .3 The manufacturer must provide terminals with identified connections. The motor's terminal box must be of an appropriate size and have a double compartment, without knockouts (knockouts will be made on-site by the Division 26).

2.3 SINGLE SPEED MOTORS

- .1 Single coil and normal torque motors. Unless otherwise indicated, the motors with six leads for star and triangle connections are prohibited when used with starters other than star-delta.

2.4 TWO SPEED MOTORS

- .1 Unless otherwise indicated, motors with star connections and variable torque.
 - .1 1 800 and 1 200 rpm: separate windings type.
 - .2 1 800 rpm and 900: consequent poles.

2.5 BELT DRIVES

- .1 Reinforced belts must be installed in the drive pulley. The multiple belts must be provided and installed by matched sets.
- .2 The pulleys must be in cast iron or steel, and be fixed on the shafts by means of removable keys, unless otherwise indicated.
- .3 Motors under 10 HP: standard drive pulleys with pitch diameter adjustable in a range of plus or minus 10%. Use the intermediate position when setting the prescribed speed.
- .4 10 HP and higher motors: unless otherwise indicated, fixed pitch diameter pulleys, with split taper bushing and keyway. Provide pulleys of suitable dimensions, suitable to the system balancing characteristics.
- .5 The required dimensions of the pulleys will be determined during commissioning.
- .6 Transmission design features: at least 1.5 times the nominal values stated on the motor nameplate. On the drive motor shafts, the cantilevered loads must stay below the manufacturer's calculation limits.
- .7 The mounting plates on rails must allow adjustments along the axis.

2.6 BELT DRIVE GUARDS

- .1 Provide guards for the unprotected transmissions.
- .2 Belt drive guards:
 - .1 Expanded metal grating, welded to a steel frame.
 - .2 Sheet metal top and bottom, at least 1.2 mm thick.
 - .3 Holes 38 mm in diameter on the two axes of the shaft, for the installation of a tachometer.
 - .4 Removable for maintenance.

- .3 The lubrication of the equipment and the use of test instruments must be possible even when the guards are in place.
- .4 The belt guards must permit the displacement of the motors for the tension adjustments.
 - .1 U-shaped components made of galvanized mild steel, at least 1.6 mm thick.
 - .2 Securely fastened in place.
 - .3 Removable for maintenance.
- .5 Guards for unprotected fan air inlets and outlets:
 - .1 Wire rod or expanded metal gratings, galvanized, 19 mm mesh.
 - .2 Net free area of at least 80% of the fan openings' area.
 - .3 Securely fastened in place.
 - .4 Removable for maintenance.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with the requirements, the recommendations, and the manufacturer's written specifications, including product technical bulletins, instructions for product handling, storage, and installation, and data sheet indications.

3.2 INSTALLATION

- .1 Fix the devices and the components securely into place.
- .2 The appliances and the components must be removable for maintenance and they must be easy to put back and fix into place.

3.3 MOTOR START-UP

- .1 Before operating the engine for the first time, the Division 26 must:
 - .1 Ensure the presence of the section that provided the engine.
 - .2 Check the motor's direction of rotation. If the rotation is wrong, see to the corrections and the new connections on the motor and not in the starter, in order to respect the wiring's colour coding.
 - .3 Ensure the main shaft's free movement for all pumps with mechanical joints before starting the motor.

- .4 Check the overload protection and the overcurrent protection to ensure that they are adequate.
- .5 Check the insulation at the "megger".
- .6 Measure the voltage of the electric circuit powering the motor.
- .7 Check the voltage (volt) and the current (ampere) of each motor at the start-up and normal operation on each phase.
- .8 Check the operation of the motor control centers and the switches.
- .2 Ensure the presence of the manufacturer of the engine and/or the device.
- .3 The motors' manufacturers must provide the start-up curves of the motor.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 61 00 -Common Product Requirements.
- .3 Section 01 74 11 - Cleaning
- .4 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .5 Section 23 08 16 - Cleaning and Start-up of HVAC Piping Systems.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.181-99 - Ready Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA)/CSA International:
 - .1 CSA B139-19 - Installation Code for Oil-Burning Equipment.
- .3 Green Seal Environmental Standards (GSES):
 - .1 Standard GS-11-2011, 3rd Edition - Paints and Coatings.
- .4 National Fire Code of Canada (NFC 2015)
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1113-A2011 - Architectural Coatings.
 - .2 SCAQMD Rule 1168-A2005 - Adhesive and Sealant Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Sustainability Standards Certification:
 - .1 Low-Emitting Materials: provide listing of sealants and coatings used in building, comply with VOC and chemical component limits or restriction requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.

- .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 pallets, crates, padding, packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCT

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 UNIONS, FLANGES, MECHANICAL COUPLINGS

- .1 To permit easy dismantling of piping and devices, install unions, flanges, or mechanical seals at all devices, manifolds, pumps, chilled water coils, hot water coils, glycol coils, steam coils, cooling towers, tanks, fan-coil units, etc.
- .2 Piping NPS 2 or smaller: unions.
- .3 Piping NPS 2½ or larger: flanges or mechanical seals.
- .4 Flanged joints with appropriately sized bolts, nuts, and washers, bolt length equal to the thickness of the two flanges, the nut, and the two washers.

3.4 CLEARANCE

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada.
- .2 Provide space for disassembly, removal of equipment and components as indicated without interrupting operation of other system, equipment, components.

3.5 DRAINS

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

3.6 DIELECTRIC COUPLINGS

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

3.7 PIPEWORK INSTALLATION

- .1 Install pipework to CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 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.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use gate valves at branch take-offs for isolating purposes except where specified.
 - .7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .8 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.

- .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEON

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

3.10 PREPARATION FOR FIRE STOPPING

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

3.11 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 16 - Cleaning and Start-up of HVAC Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11, supplemented as specified in relevant mechanical sections.

- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise 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.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 45 00 - Quality Control
- .2 Section 01 74 20 - Construction / Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-18, Power Piping.
- .2 ASTM International
 - .1 ASTM A125-96 (2018)e1, Standard Specification for Steel Springs, Helical, Heat Treated.
 - .2 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-15, 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 SP58-2018, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
- .5 Underwriter's Laboratories of Canada (ULC)
- .6 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .7 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

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 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address. Refer to 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 SP58.
 - .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 SP58.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: painted with zinc-rich paint.
 - .2 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
 - .1 Rod: 13 mm FM approved.

- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, FM approved to MSS-SP58.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, FM approved to MSS SP58.
 - .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 FM approved.
- .4 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
 - .3 Sway braces for seismic restraint systems.
- .5 Hanger rods: threaded rod material to MSS SP58:
 - .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.
- .6 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP58 FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP58.
- .9 U-bolts: carbon steel to MSS SP58 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated or epoxy coated.

- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP58.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, FM approved.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP58, 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 SP58.

2.6 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.9 HOUSE-KEEPING PADS

- .1 Provide 100 mm or greater concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

2.10 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel.
- .2 Submit structural calculations with shop drawings.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers and as indicated.
- .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.

- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .5 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .6 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25% of total load.

3.3 HANGER SPACING

- .1 Plumbing piping: to Provincial Code and to authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 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.
- .6 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	

- .7 Pipework greater than NPS 12: to MSS SP58.

3.4 HANGER INSTALLATION

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

3.5 HORIZONTAL MOVEMENT

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

3.6 FINAL ADJUSTMENT

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

3.7 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS:

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control
- .3 Section 01 74 20 - Construction / Demolition Waste Management and Disposal
- .4 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2019, Standard for the Installation of Sprinkler Systems.
- .3 National Building Code 2015.
- .4 ASHRAE - A Practical Guide to Seismic Restraint, 2nd Edition, 2012
- .5 SMACNA Seismic Restraint Manual, 3rd Edition, 2008.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
- .2 Submit shop drawings in accordance with Section 01 33 00.
 - .1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Provide separate shop drawings for each isolated system complete with performance and product data.
 - .3 Provide detailed drawings of seismic control measures for equipment and piping. Submit design data including:
 - .1 Full details of design criteria.

- .2 Working drawings, materials lists, schematics, full specifications for components of each SRS to be provided.
- .3 Design calculations (including restraint loads resulting from seismic forces in accordance with National Building Code, detailed work sheets, tables).
- .4 Separate shop drawings for each SRS and devices for each system, equipment.
- .5 Identification of location of devices.
- .6 Schedules of types of SRS equipment and devices.
- .7 Details of fasteners and attachments to structure, anchorage loadings, attachment methods.
- .8 Installation procedures and instructions.
- .4 Design calculations including restraint loads to NBC and Supplement.
 - .1 Detailed work sheets, tables.
- .3 Quality assurance submittals: submit following in accordance with Section 01 45 00.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 DESCRIPTION

- .1 Seismic Restraint System (SRS) fully integrated into, and compatible with:
 - .1 Noise and vibration controls specified elsewhere.
 - .2 Structural, mechanical, electrical design of project.
- .2 Systems, equipment not required to be operational during and after seismic event.
- .3 During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position.
- .4 Designed by Professional Engineer specializing in design of SRS and registered in Province of Ontario.

1.5 LEVEL OF PROTECTION

- .1 Install SRS for ventilation ductwork, equipment, tanks and piping other than sprinkler system in conformance with ASHRAE - A Practical Guide to Seismic Restraint and SMACNA Seismic Restraint Manual.
- .2 Level of Protection:
 - .1 SHL-C for piping and ducts
 - .2 SHL-D for piping of toxic or explosive gas
 - .3 SHL-D for tanks
 - .4 SHL-B for equipment
- .3 Install SRS for sprinkler system in accordance with NFPA 13. $V_p = 0.26 W_p$.

1.6 SRS MANUFACTURER

- .1 SRS to be from one manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 74 20.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Size and shape of bases type and performance of vibration isolation as indicated.
- .2 SRS to provide gentle and steady cushioning action and avoid high impact loads.
- .3 SRS to restrain seismic forces in every direction.
- .4 Fasteners and attachment points to resist same load as seismic restraints.
- .5 SRS of Piping systems compatible with:
 - .1 Expansion, anchoring and guiding requirements.
 - .2 Equipment vibration isolation and equipment SRS.
- .6 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.

- .7 Attachments to RC structure:
 - .1 Use high strength mechanical expansion anchors.
 - .2 Drilled or power driven anchors not permitted.
- .8 Seismic control measures not to interfere with integrity of firestopping.

2.2 SRS FOR STATIC EQUIPMENT, SYSTEMS

- .1 Floor-mounted equipment, systems:
 - .1 Anchor equipment to equipment supports.
 - .2 Anchor equipment supports to structure.
 - .3 Use size of bolts scheduled in approved shop drawings.
- .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Install tight to structure.
 - .2 Cross-brace in every direction.
 - .3 Brace back to structure.
 - .4 Slack cable restraint system.
 - .2 SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
 - .3 Hanger rods to withstand compressive loading and buckling.

2.3 SRS FOR VIBRATION ISOLATED EQUIPMENT

- .1 Floor mounted equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Vibration isolators with built-in snubbers.
 - .2 Vibration isolators and separate snubbers.
 - .3 Built-up snubber system consisting of structural elements and elastomeric layer.
 - .2 SRS to resist complete isolator unloading.
 - .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
 - .4 Cushioning action: gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.
- .2 Suspended equipment, systems:
 - .1 Use one or combination of following methods:
 - .1 Slack cable restraint system.

- .2 Brace back to structure via vibration isolators and snubbers.

2.4 SLACK CABLE RESTRAINT SYSTEM (SCS)

- .1 Use elastomer materials or similar to avoid high impact loads and provide gentle and steady cushioning action.
- .2 SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

2.5 ELASTOMERIC PADS

- .1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.
- .2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
- .3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
- .4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.6 ELASTOMERIC MOUNTS

- .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.7 SPRINGS

- .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
- .2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
- .3 Cadmium plate for outdoor 100% relative humidity installations.
- .4 Colour code springs.

2.8 SPRING MOUNT

- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
- .2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
- .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
- .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
- .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

2.9 HANGERS

- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
- .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
- .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
- .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
- .5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

2.10 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

- .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.11 HORIZONTAL THRUST RESTRAINT

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.12 STRUCTURAL BASES

- .1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.
- .2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.
- .3 Bases to clear housekeeping pads by 25 mm minimum.

2.13 INERTIA BASE

- .1 Type B3 - Full depth perimeter structural or formed channels, frames: welded in place reinforcing rods running in both directions; spring mounted, carried by gusseted height-saving brackets welded to frame; and clear housekeeping pads by 50 mm minimum.
- .2 Pump bases: "T" shaped, where applicable, to provide support for elbows.
- .3 Concrete: by architectural.

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 Seismic control measures to meet requirements of National Building Code.

- .2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mounting to level equipment.
- .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.
 - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .4 Where isolation is bolted to floor use vibration isolation rubber washers.
- .5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.
- .6 Slack Cable Systems (SCS):
 - .1 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
 - .2 Use appropriate grommets, shackles, other hardware to ensure alignment of restraints and to avoid bending of cables at connection points.
 - .3 Piping systems: provide transverse SCS at 10 m spacing maximum, longitudinal SCS at 20 m maximum or as limited by anchor/slack cable performance.
 - .4 Small pipes may be rigidly secured to larger pipes for restraint purposes, but not reverse.
 - .5 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), tie back to structure at maximum of 45 degrees to structure.
 - .6 Adjust restraint cables so that they are not visibly slack but permit vibration isolation system to function normally.
 - .7 Tighten cable to reduce slack to 40 mm under thumb pressure. Cable not to support weight during normal operation.
- .7 Install SRS at least 25 mm from equipment, systems, services.

- .8 Miscellaneous equipment not vibration-isolated:
 - .1 Bolt through house-keeping pad to structure.
- .9 Coordinate connections with other disciplines.
- .10 Vertical tanks:
 - .1 Anchor through house-keeping pad to structure.
 - .2 Provide steel bands above centre of gravity.
- .11 Horizontal tanks:
- .12 Provide at least two straps with anchor bolts fastened to structure.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.
 - .2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Twice during the installation, at 25% and 60% completion stages.
 - .4 Upon completion of installation.
 - .3 Submit manufacturer's reports to Departmental Representative within 3 days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 Canadian Gas Association (CGA)
 - .1 CSA B149.1-20, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-12, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2019, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2019, Standard for the Installation of Standpipe and Hose Systems.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.

- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

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

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

- .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
 - .1 Terminal cabinets, control panels: use size #5.
 - .2 Equipment in Mechanical Rooms: use size #9.
- .5 Identification:
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: size #9.
 - .2 Source and Destination identifiers: size #6.
 - .3 Terminal cabinets, control panels: size #5.
 - .3 Equipment elsewhere: sizes as appropriate.

2.3 PIPING SYSTEMS GOVERNED BY CODES

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

2.4 IDENTIFICATION OF PIPING SYSTEMS

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

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE

Background colour:	Legend, arrows:
Red	WHITE

2.5 BACKGROUND COLOUR MARKING AND LEGENDS FOR PIPING SYSTEMS

Contents	Background colour marking	Legend
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Diesel	Yellow	DIESEL
Compressed air	Green	COMP. AIR
Domestic Hot Water	Green	DHW ECD
Dom. HWS recirculation	Green	DHWR ECDR
Domestic cold water supply	Green	DCW EFD
Sanitary	Green	SAN.
Storm	Green	STORM PLUV.
Plumbing vent	Green	VENT

2.1 IDENTIFICATION DUCTWORK SYSTEMS

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

2.2 VALVES, CONTROLLERS

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

2.3 CONTROLS COMPONENTS IDENTIFICATION

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

2.4 LANGUAGE

- .1 Identification in English and French.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

- .1 Provide identification only after painting specified on architectural drawings has been completed.

3.3 INSTALLATION

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

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

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

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

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

3.6 VALVES, CONTROLLERS

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

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 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 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2016, 7th Edition.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-2019, Ninth Edition.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC Systems Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

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 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 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 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 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 all construction affecting TAB.
- .4 Provisions for TAB installed and operational.
- .5 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 Ventilation Systems:
 - .1 At terminal units: plus or minus 10%.
 - .2 At main branches: plus or minus 5%.
 - .2 Hydronic systems: plus or minus 10%.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments 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 PROCEDURES - VENTILATION

- .1 Verification of equipment and system:
 - .1 Start-up fans (supply, return, exhaust) and check:
 - .1 Voltage and amperage of motors to avoid overload.
 - .2 Fan rotation
 - .3 Adequate operation of differential pressure detector
 - .4 Position of motorized dampers
 - .5 Temperature control of chilled water, hot water or glycol with controls contractor.
 - .6 Obvious air leaks.
 - .2 Develop a ventilation system diagram which identifies all device that will be used for testing, adjusting and/or balancing flow. Also identify all locations where measurements will be taken to ensure that sufficient connections are provided on ductwork. Use this identification as a reference in the balancing report. Ensure there is no short circuiting in the ductwork system.

- .2 Air flow at main branches:
 - .1 Using a Pitot tube, measure flow in the main branches
 - .2 If required, adjust fan speed the design air flow.
 - .3 Check motor power as well as fan rpm to ensure that operation is within critical limits.
 - .4 Adjust balancing dampers at main branches until the design airflow is reached.
- .3 Minimum outside air:
 - .1 Adjust static pressure in the mixing plenum at zero or slightly negative, following the requirements and site conditions, when the return damper is open to its maximum position. Balancing damper installed in the mixing plenum is used to set the static pressure inside the plenum.
 - .2 Adjust dampers to set the outside air to a maximum of 105% of design requirements.
- .4 Terminal equipment adjustments:
 - .1 Adjust air flow from terminal units up to fans.
 - .2 Use balancing dampers at main branches for major adjustments and dampers at terminal equipment for precision adjustments.
 - .3 These adjustments may require multiple iterations.
- .5 When airflow is adjusted at system, main branches and at outlets, perform the following readings:
 - .1 Motor amperage
 - .2 Differential pressure at fans (discharge minus inlet)
 - .3 Differential pressure at all secondary component in the system
 - .4 Differential pressure at all primary component of the system (air intake, exhaust air, filters, coils, mixing dampers, etc.)
- .6 Adjustment procedure:
 - .1 Check maximum air flows that must be obtained from supply and return fans. Diversity implies that the airflow at fans will be lower than the sum of all airflows at grilles and diffusers.
 - .2 Get fan curves and surge data.
 - .3 Get characteristics of VFD or any other airflow control device where applicable.
 - .4 Get minimum and maximum operating pressure of terminal units.
 - .5 Establish theoretical operating curve of the system.

- .6 Adjust terminal units in accordance with maximum air flow.
- .7 Adjust fans at the required speed plus 5%.
- .8 Spot check terminal units that are the most representative. If the variation of static pressure is significant or if air flow at terminal units is inferior when fan speed is at the maximum, check all terminal units
- .9 Read airflow at main branches with Pitot tube.
- .10 If static pressure or flow is too low, accelerate fan.
 - .1 If flow is satisfactory but static pressure too high, decelerate fan.
 - .2 If static pressure is high or satisfactory but airflow too low, check fan installation for system effect. If there is no system effect, re-adjust all terminal units to required airflow.
- .11 Repeat the procedures from 1.13.6.7 to 1.13.6.10 for the return air and exhaust air fans once the system is adjusted to the minimum outside air.
- .12 Adjust air to the diffusers and check design air flow when terminal unit is open to its maximum position. Check minimum adjustment.
- .13 Set terminal elements at their minimum position and adjust air flow control mechanisms at fans to get minimum flow and pressure.
- .14 Coordinate with Division 25 - CONTROLS for the adjustment of flow switches, static pressure detectors, air flow regulators, etc.
- .15 Verify that the return fan speed is adjusted in synchronization with supply fan to ensure that the right outside airflow is supplied at that static pressure is maintained in the mixing plenum on all operating conditions.
- .16 Operate system at 100% outside air to verify power and static pressure of that supply and return fans.

1.14 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 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.

1.16 VENTILATION TAB REPORT

- .1 Format 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 3 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.
- .4 TAB report shall include, as a minimum, the following information:
 - .1 Dated reports: On the report's cover page as well as on all pages of the report, dates when measurements were taken must be clearly indicated.
- .5 Design Data:
 - .1 Air flows:
 - .1 Supply
 - .2 Return
 - .3 Exhaust
 - .2 Fans static pressure
 - .3 Motor horsepower (HP)
 - .4 Brake horsepower (BHP)
 - .5 Fan speed (rpm)
 - .6 Minimum outside air percentage.
- .6 Characteristics of the installed equipment:
 - .1 Manufacturer, model, serial number.
 - .2 Dimensions.
 - .3 Arrangement.
 - .4 Construction class
 - .5 Motor nameplate:
 - .1 Horsepower

- .2 Voltage
- .3 Number of phases
- .4 Frequency
- .5 FLA
- .6 Rpm
- .7 Tests at main elements:
 - .1 Fan speed
 - .2 Power reading at motor connections (voltage and amperage at all phases)
 - .3 Differential pressure through each system component (coils, filters, etc.)
 - .4 Pressure at suction and discharge of fans
 - .5 Measures air flow
 - .6 Fan curve indicating the operating point, based on readings.
 - .7 Pressure as measures at pressure sensors provided and installed by Division 25.
- .8 Test at terminal devices:
 - .1 Identification of the terminal element by ID number and location
 - .2 Type of terminal device:
 - .1 Manufacturer
 - .2 Model
 - .3 Dimension
 - .4 K factor
 - .3 Design air flow and air speed.
 - .4 Air flow and air speed results.
 - .5 Adjustment (where applicable) of airflow pattern at diffuser.
- .9 Additional information:
 - .1 Fans:
 - .1 Dimensions and number of belts
 - .2 Dimensions of pulleys
 - .3 Position of adjustable pulleys
 - .4 Full load motor rotation
 - .5 Overload protection adjustments
 - .6 Filter type, initial pressure drop at full flow, pressure drop for filter replacement
 - .7 Air speed readings at coils
 - .8 Airflow control device type

- .2 Air distribution system:
 - .1 Pressure reading at main branches
 - .2 Pressure reading in ceilings
 - .3 Pressure difference between the building and exterior when the building is in operation at minimum outside air and at maximum outside air
 - .4 List of Pitot tests and results
 - .5 List of all airflow readings at each grille and diffuser, indicating also design airflow requirement
 - .6 Equipment Data:
 - .1 Identification.
 - .2 Manufacturer, model, serial number.
 - .1 Size.
 - .2 Type.
 - .3 Maximum operating pressure.
 - .4 Seals Type.
 - .5 Motor nameplate : HP, voltage, phases and frequency, FLA, rpm.
- .3 Measurement results:
 - .1 At terminal equipment:
 - .1 Identification
 - .2 Manufacturer, model, size.
 - .3 Pressure in
 - .4 Pressure out
 - .5 Flow
 - .2 Other locations :
 - .1 Branches and risers: pressure readings. Identify location on diagram.

1.17 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

1.18 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. Do not eradicate or cover markings.

1.19 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

1.20 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.

1.21 POST-OCCUPANCY TAB

- .1 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

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 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.
- .2 Related Requirements
 - .1 Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart
 - .2 Section 01 33 00 - Submittal Procedures.
 - .3 Section 01 35 29 - Health and Safety Requirements
 - .4 Section 23 05 00 - Common Work Results for HVAC.

1.2 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 - .1 SMACNA 016-2012 HVAC Air Duct Leakage Test Manual, 2nd Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
 - .1 Submit proposed report form and test report format to Departmental Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.
 - .2 Prepare report of results and submit to Departmental Representative within 24 hours of completion of tests. Include:
 - .1 Schematic of entire system.
 - .2 Schematic of section under test showing test site.

- .3 Required and achieved static pressures.
- .4 Orifice differential pressure at test sites.
- .5 Permissible and actual leakage flow rate (L/s) for test sites.
- .6 Witnessed certification of results.
- .3 Include test reports in final TAB report.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building sub-trades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

Part 2 PRODUCTS

2.1 TEST INSTRUMENTS

- .1 Test apparatus to include:
 - .1 Fan capable of producing required static pressure.
 - .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
 - .3 Flow measuring instrument compatible with the orifice plate.
 - .4 Calibration curves for orifice plates used.
 - .5 Flexible duct for connecting to ductwork under test.
 - .6 Smoke bombs for visual inspections.
- .2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.

- .3 Submit details of test instruments to be used to Departmental Representative at least three months before anticipated start date.
- .4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.
- .5 Re-calibrated every six months thereafter.

2.2 EQUIPMENT LEAKAGE TOLERANCES

- .1 Equipment and system components such as VAV boxes, duct heating leakage: 2%

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 TEST PROCEDURES

- .1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.
- .2 Section of duct to be tested to include:
 - .1 Fittings, branch ducts, tap-ins.
- .3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.
- .4 Base partial system leakage calculations on SMACNA 016 HVAC Air Duct Leakage Test Manual.
- .5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .2 Leakage tests on following systems not to exceed specified leakage rates.
 - .1 Small duct systems up to 250 Pa: leakage 2%.
 - .2 VAV box and duct on downstream side of VAV box: leakage 2%.

- .3 Large low pressure duct systems up to 500 Pa: leakage 2%.
- .4 HP duct systems up to 1000 Pa pressure classification, including upstream side of VAV boxes: leakage 1.
- .3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

- .1 Test ducts before installation of insulation or other forms of concealment.
- .2 Test after seals have cured.
- .3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.
- .4 Flexible connections to VAV boxes.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services.
 - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
 - .4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.
- .2 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 Performance Verification:
 - .1 Departmental Representative to witness tests and to verify reported results.
 - .2 To be certified by same TAB agency approved by Departmental Representative to undertake TAB on this project.

3.6 CLEANING

- .1 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 REQUIREMENTS

- .1 Section 21 05 01 - Common Work Results for Mechanical.
- .2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 Definitions:
 - .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - means "not concealed" as previously defined.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
 - .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
- .2 Reference Standards:
 - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 90.1-2019 (SI); Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 ASTM International Inc.
 - .1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C335C/335M-17, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07(R2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C547-17, Standard Specification for Mineral Fiber Pipe Insulation.

- .6 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612-14(2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795-08(R2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .9 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-01, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-18 Rev1, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701.1:2017, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.
- .3 Manufacturers' Instructions:
 - .1 Provide manufacture's written duct insulation jointing recommendations and special handling criteria, installation sequence, cleaning procedures.
- .4 Samples submit for approval:
 - .1 Complete assembly of each insulation proposed type, including insulation material, coating and adhesive with indications on VOC value.

- .2 Mount sample on a ½" (1.25 cm) thick plywood board.
- .3 Affix typewritten label be heath sample indicating service.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 74 20.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

Part 2 Products

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Mineral fibre: as 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 Type C: Glass fiber blankets bounded together with factory applied aluminium reinforced vapor retarder, 12 kg/m³ (0.75 lb/ft³) density.
 - .1 Maximum "k" factor: 0.042 W/m.°C (0.29 BTU.in/h.fti².°F) at 24°C (75°F).
- .4 Type D: Rigid mineral fibre board to ASTM C553 faced with factory applied FSK vapour retarder jacket, 36 kg/m³ (2.25 lb/ft³) density.
 - .1 Jacket: to CGSB 51-GP-52Ma.

- .2 Maximum "k" factor: 0.035 W/m.°C (0.23 BTU.in/h.ft²)
at 24°C (75°F).

2.3 JACKETS

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
 - .1 Maximum VOC limit to SCAQMD Rule 1168 and GS-36.
- .3 Aluminum:
 - .1 To ASTM B209M with and without moisture barrier as scheduled in PART 3 of this section.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Stucco embossed.
 - .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
 - .5 Type: 304.
 - .6 Thickness: 0.50 mm sheet.
 - .7 Finish: Stucco embossed.
 - .8 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
 - .1 Maximum VOC limit to SCAQMD Rule 1168 and GSES GS-36.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .6 Contact adhesive: quick-setting
 - .1 Maximum VOC limit to SCAQMD Rule 1168 and GSES GS-36.

- .7 Canvas adhesive: washable.
 - .1 Maximum VOC limit to SCAQMD Rule 1168 and GSES GS-36.
- .8 Tie wire: 1.5 mm stainless steel.
- .9 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .10 Facing: 25 mm stainless steel hexagonal wire mesh stitched on one face of insulation one face of insulation.
- .11 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 3 EXECUTION

3.1 APPLICATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
- .2 Hot Duct and Plenum - (20°C to 65°C)
 - .1 Rigid Insulation
 - .1 Preparation:
 - .1 Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm centres, each direction.
 - .2 Application:
 - .1 Cut insulation without integral vapour retarder to required size and apply to exterior of duct and/or plenum, with horizontal surfaces overlapping vertical surfaces and edges tightly butted together. Secure insulation by impaling on mechanical fasteners.
 - .2 Flexible insulation
 - .1 Preparation:
 - .1 On round ducts and on rectangular ducts 740mm or less in width, no preparation is necessary. On rectangular ducts 762mm or more in width, apply to bottom surface, either mechanical fasteners at approximately 450 mm centres, or insulation adhesive applied in strips 100mm wide on approximately 300 mm centres.

- .2 Application:
 - .1 Cut insulation without integral vapour retarder to required size allowing for 50 mm overlap at each joint and apply to exterior of duct. Secure insulation with either twine or wire fastening on approximately 300 mm centres, or by stapling laps; or by 100% insulation adhesive coverage.
- .3 Cold or Dual Temp Duct and Plenum - (Ambient to 65°C)
 - .1 Rigid Insulation
 - .1 Preparation:
 - .1 Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm on centres, each direction.
 - .2 Application:
 - .1 Cut insulation with integral vapour retarder to required size and apply to exterior of duct and/or plenum with vapour retarder to the warm side with horizontal surfaces overlapping vertical surfaces. Butt edges together tightly.
 - .2 Secure insulation by impaling on mechanical fasteners. Where mechanical fasteners penetrate vapour retarder, and at all corners and joints, apply vapour retarder tape or vapour retarder strips adhered with vapour retarder adhesive. Where raised seams are encountered, secure to the seams an overlapping strip of flexible insulating material with integral vapour retarder to provide a continuous vapour retarder.
 - .2 Flexible insulation
 - .1 Preparation:
 - .1 On round ducts and on rectangular ducts 740 mm or less in width, no preparation is necessary. On rectangular ducts 762 mm or more in width, apply to bottom surface, either mechanical fasteners at approximately 450 mm centres or insulation adhesive in strips 100 mm wide on approximately 300 mm centres.

- .2 Application:
 - .1 Cut insulation with integral vapour retarder to required size and apply to exterior or duct with vapour retarder to the outside. Where mechanical fasteners or staples penetrate the vapour retarder and at all joints apply vapour retarder tape or vapour retarder strips adhered with vapour retarder adhesive. All joints shall be overlapped a minimum of 50 mm and stapled on approximately 100 mm centres.
 - .2 Secure insulation with either twine or wire fastening on approximately 300 mm centres.
- .4 Outside Air Duct and Plenum - (-40°C to Ambient)
 - .1 As Rigid insulation above but first apply a layer of rigid insulation without vapour retarder before applying layer of rigid insulation with vapour retarder. All joints shall be staggered.
- .5 Exceptions:
 - .1 For external applications of rigid insulation where the use of mechanical fasteners is unsuitable due to space limitations, twine or wire fastenings, insulation adhesive or other suitable method of attachment may be substituted.
 - .2 Except where specifically called for in the Insulation section of the project specifications, where an interior duct liner is used, external insulation shall not be applied.

3.2 FINISHES

- .1 Indoors:
 - .1 Rectangular ductwork with rigid insulation:
 - .1 Use rigid insulation with an integral vapour retarder. Apply continuous metal corner bead to all corners. Adhere vapour retarder tape over all joints and breaks in vapour retarder, and at all corners.
 - .2 Where ductwork is exposed, apply treated fabric jacket over insulation using fabric adhesive and finish with one (1) coat of fabric coating.
 - .3 Use rigid insulation with an integral vapour retarder. Apply continuous metal corner bead to all corners. Adhere vapour retarder tape over all joints and breaks in vapour retarder, and at all corners.

- .2 Round Ductwork
 - .1 Use flexible insulation with integral vapour retarder. At all joints and breaks, apply vapour retarder tape.
 - .2 Where ductwork is exposed, apply treated fabric jacket over insulation using fabric adhesive and finish with one (1) coat of fabric coating.

3.3 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.4 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .4 Hangers and supports in accordance with Section 23 05 29.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.5 DUCTWORK INSULATION SCHEDULE

- .1 Thermal insulation is not required on: ductwork with acoustical liner used as thermal insulation, unless otherwise indicated.
- .2 Insulation types and thicknesses: conform to following table:

Description	Type	Thickness
Exhaust from damper/ERV to louver	D	50 mm
Fresh air intake, exhaust air outlet and ductwork to ERV	D (C if concealed)	50 mm
Acoustically lined ducts	None	

3.6 SPECIAL CONSIDERATIONS

- .1 Exhaust air systems:
 - .1 From fan outlet up to air exhaust louvers including motorized dampers:
 - .1 Insulation type D
 - .2 Thickness: 50 mm
 - .2 Fresh air intakes and exhaust outlets:
 - .1 Over drainage pans, on all parts not acoustically treated, that is bottom and sides on bin height. Thermal insulation must overlap acoustical lining (installed inside) by at least 2".
 - .1 Insulation type C
 - .2 Thickness: 50 mm
- .3 Return air duct:
 - .1 No insulation.
- .4 Non treated air (transfer air duct, etc.):
 - .1 No insulation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENT

- .1 Section 23 05 00 - Common Work Results For HVAC.

1.2 REFERENCES

- .1 Definitions:
 - .1 For the purposes of this section, the following definitions apply:
 - .1 In this section, the term "insulation" and "thermal insulation" will be considered synonymous.
 - .2 The acronym "CGSB" stands for the Canadian General Standards Board.
 - .3 "Concealed" elements: insulated mechanical services and equipment located above suspended ceilings or in inaccessible chases and furred-in spaces.
 - .4 "Exposed" elements: elements that are not concealed (as previously defined).
 - .5 Insulation system: systems consisting in particular of the insulation itself, the fasteners, jackets and other accessories.
 - .2 TIAC acronyms:
 - .1 CRD: Code Round Ductwork.
 - .2 CRF: Code Rectangular Finish.
- .2 References:
 - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
 - .1 ASHRAE Standard 90.1-2019, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C51-18, Standard Test Method for Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - .2 ASTM B209M-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.

- .3 ASTM C177-13, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .4 ASTM C335/C335M-17, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation
- .5 ASTM C411-17, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .6 ASTM C449-07(R2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .7 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .8 ASTM C533-17, Calcium Silicate Block and Pipe Thermal Insulation.
- .9 ASTM C547-17, Mineral Fiber Pipe Insulation.
- .10 ASTM C795-08(R2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .11 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB):
 - .1 CGSB 51-GP-9M-76, Thermal Insulation, Mineral Fibre, Sleeving for Piping and Round Ducting.
 - .2 CAN/CGSB-51.40-95, Flexible, Elastomeric, Unicellular Thermal Insulation, Sheet and Pipe Covering.
 - .3 CGSB 51-GP-11M-76, Thermal Insulation, Mineral Fibre, Blanket for Piping, Ducting, Machinery and Boilers.
 - .4 CGSB 51-GP-10M-76, Standard for: Thermal Insulation, Mineral Fiber, Block or Board, for Ducting, Machinery and Boilers
 - .5 CGSB 51-GP-51M-1981, Polyethylene Sheet for Use in Building Construction.
 - .6 CGSB 51-GP-52Ma-01, Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .7 CGSB 51-GP-53M-77, Jacketing, Polyvinyl, Chloride Sheet, for Insulating Pipes, Vessels and Round Ducts.

- .4 Department of Justice Canada (JUS):
 - .1 Canadian Environmental Assessment Act (CEAA), c. 19 s. 52, 2012.
 - .2 Canadian Environmental Protection Act (CEPA), ch. 33, 1999.
 - .3 Transportation of Dangerous Goods Act (TDGA), ch. 34, 1992.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Safety Data Sheet (SDS).
- .6 Manufacturers' associations:
 - .1 Thermal Insulation Association of Canada (TIAC), National Insulation Standards.
- .7 Underwriters' Laboratories of Canada (ULC):
 - .1 CAN/ULC S102-11, Method of test for surface burning characteristics of building materials and assemblies.
 - .2 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC S702.1-14, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
 - .4 CAN/ULC S702.2-15, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

1.3 MANUFACTURER'S INSTRUCTIONS

- .1 Submit the manufacturers' instructions for the installation of the insulating materials.
- .2 The instructions must specify the methods to be used, as well as the required execution quality, particularly in regards to the joints and the overlaps.

Part 2 PRODUCT

2.1 FIRE AND SMOKE RATING

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

2.2 TYPE A INSULATION

- .1 Preformed wrap made of mineral fiber bonded with thermosetting resin, maximum service temperature of 454°C.

- .2 Reinforced vapor barrier: factory applied all service jacket, paintable finish. Jacketing permeability: 0.02 perm. maximum.
- .3 Maximum thermal conductivity "k": 0.035 W/m.°C at 24°C.

2.3 TYPE B INSULATION

- .1 Elastomeric cellular thermal insulation in tubular, flexible sheet, or roll form, according to the application.
- .2 Maximum thermal conductivity "k": 0.039 W/m.°C at 32°C.

2.4 TYPE C INSULATION

- .1 Glass fiber blankets bounded together with factory applied aluminium reinforced vapor retarder, 12 kg/m³ (0.75 lb/ft³) density.
 - .1 Maximum "k" factor: 0.042 W/m.°C (0.29 BTU.in/h.fti².°F) at 24°C (75°F).

2.5 ADHESIVES

- .1 Compliant with ASTM E84 and CAN/ULC-S102.
- .2 Use to adhere the canvas, tabs and all service jackets, seal joints, and secure the insulation to metal surfaces.

2.6 JACKETS

- .1 Canvas jackets:
 - .1 Cotton canvas having a density of 220 g/m² where exposed and 120 g/m² where concealed, coated with a diluted insulating fire retardant adhesive, compliant with the standards ASTM C921 and ASTM E84.
- .2 Aluminum:
 - .1 To ASTM B209M, for exterior installations.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: corrugated.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
- .3 PVC jackets:
 - .1 Preformed one piece molded jacket compliant with CGSB 51-GP-53M. PVC type or equivalent.
 - .2 Operating temperatures:
 - .1 Minimum: -20°C

- .2 Maximum: 65°C
- .3 Permeability: 0.02 perm.
- .4 Thickness:
 - .1 Internal: 0.508 mm minimum.
 - External: 0.762 mm minimum; 1.016 mm minimum on piping 380 mm and larger.
- .5 Adhesive and sealant: follow manufacturer's recommendations.

2.7 RIGID SUPPORT MATERIAL

- .1 Characteristics:
 - .1 Permeability: 0.00 perm/cm.
 - .2 Non-combustible.
 - .3 Compressive strength: 7.0 kg/cm²
 - .4 Average density: 128 kg/m³
 - .5 Coefficient of linear thermal expansion: 8.6 x 10⁻⁸ /°C
 - .6 Maximum Operating Temperature: 482°C
 - .7 Thermal conductivity: 0.48 W/m.°C.

Part 3 EXECUTION

3.1 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.

3.2 INSTALLATION

- .1 Insulation work is considered as:
 - .1 Concealed: pipes and ducts are installed in suspended ceilings, walls, shafts, and floors.
 - .2 Exposed: exposed pipes and ducts must be insulated on all sides, even on non-visible sides against walls or ceilings.
 - .3 Ducts and pipes in mechanical rooms, tunnels, and service spaces are considered exposed.
- .2 Install insulation once all tests are complete and accepted, and air inside the building is dry enough and conditions conforming to the manufacturers standards. Install insulation continuously, without interruption.
- .3 All equipment, piping, and ducts must be clean and dry before installing the insulation.

- .4 Consult mechanical divisions to determine the type of ducts, piping, fittings, valves, and other accessories installed by other contractors. The insulation contractor must consider that contractors from divisions 21, 22, and 23 will use the grooved type fittings where allowed, and will tender accordingly.
- .5 This section is responsible for the proper installation of insulation, where specified.
- .6 When insulation is likely to be damaged by impact or crushing near the access doors, doors, access panels, corridors, etc., protect with a 1.3 mm galvanized steel sleeve (18 gauge).
- .7 For all insulated piping exposed to water, steam, or oil, and all insulated piping passing through the mechanical room floor: cover the insulation with a 0.75 kg copper sheet with blind welded 50/50 joints or with a corrugated aluminum sheet with two stainless steel straps of 225 mm in minimum height.
- .8 Install all piping supports for chilled water, cold glycol water, and domestic cold water completely outside the insulation. For this piping, use a rigid material at each support. Install a steel saddle of appropriate length and width to distribute the weight. This material must be supplied and installed by this section. Steel supports and saddles are supplied and installed by each relevant mechanical section to this section's satisfaction.
- .9 Notify applicable sections and properly adjust the supports and saddles to ensure that saddles remain in place.
- .10 Leave access to strainers uncovered. However, for domestic cold water and chilled water piping, insulate them with a removable cover shaped piece of insulation to allow removal of the strainer for cleaning purposes. Have a sample of this cover approved.

3.3

APPLICATION

- .1 See the articles "PIPING INSULATION SCHEDULE" for thicknesses.

- .2 Hot piping (15 to 315°C):
 - .1 Piping:
 - .1 Pipe covering without integral jackets must be held in place with fasteners at not less than 300 mm centre to centre. Pipe insulation with integral jacket shall be held in place by stapling the tab every 75 mm centre to centre. Pipe insulation with integral self-sealing jacket does not require additional fastening.
 - .2 Fittings:
 - .1 Insulate fittings with sections of pipe insulation mitred to fit tightly, insulating cement, or with tightly placed flexible insulation covered with a reinforcing membrane stapled in place. Alternatively, insulate the fittings with tightly placed flexible insulation and PVC fitting covers.
 - .3 Valves and strainers:
 - .1 Insulate valve bodies and strainers with insulating cement, or fitted pipe insulation segments, or mitred blocks, all of the same thickness as the adjacent pipe insulation, or insulate with tightly placed flexible insulation covered with a reinforcing membrane stapled in place. Drains, drain plugs, and caps shall be left uncovered. Alternatively, insulate with tightly placed flexible insulation and apply PVC fitting covers.
 - .4 Flanges:
 - .1 Insulate flanges with oversized pipe covering or mitred blocks of the same thickness as the adjacent pipe covering. Alternatively, insulate flanges with tightly placed flexible insulation and PVC fitting covers.
 - .2 Insulation termination points:
 - .1 Terminate insulation at 75mm from the fittings to provide a working clearance and bevel the insulation at a 45° angle.
 - .5 Closed cell insulation:
 - .1 Where indicated, flexible elastomeric or closed cell insulation to be used and installed in accordance with the manufacturer's instructions with an adhesive covered by a paint specific to the product.

- .3 Cold piping (5 to 15°C):
 - .1 Piping:
 - .1 Apply pipe insulation with an integral vapor barrier jacket to the piping and hold it in place by securing the jacket flap. Seal all flaps and butt strips with vapor barrier adhesive, or alternatively, secure them with staples every 75 mm and cover them with vapor barrier tape. Pipe insulation with integral self-sealing vapor barrier jacketing does not require additional fastening.
 - .2 Fittings:
 - .1 Insulate fittings with sections of pipe insulation mitered to fit tightly or with tightly fit flexible insulation then apply reinforcing membrane embedded in vapour barrier coating. Alternatively, insulate fittings with tightly fit flexible insulation then apply reinforcing membrane embedded in vapour barrier coating and apply PVC fitting cover.
 - .3 Valves and strainers:
 - .1 Insulate valve bodies, flanges, and strainers with insulating cement, fitted pipe insulation segments, or mitred blocks, all of the same thickness as the adjacent insulation and then apply a vapor barrier coated reinforcing membrane. Alternatively, insulate with tightly fitted flexible insulation, then apply a vapor barrier coated reinforcing membrane. Drains, drain plugs, and caps to be left uncovered. Alternatively, insulate with tightly fit flexible insulation, then apply a vapor barrier coated reinforcing membrane and apply PVC cover.
 - .4 Flanges:
 - .1 Insulate flanges with oversized pipe covering or mitred blocks of the same thickness as the adjacent pipe covering, then cover with a vapor barrier coated reinforcing membrane. Alternatively, insulate with flexible insulation covered with a vapor barrier coated reinforcing membrane and apply PVC cover.
- .4 Finishes:
 - .1 See article "JACKETS" of Part 2.

- .2 Indoor (exposed areas):
 - .1 Factory applied all service jacket must be properly applied to receive the fire retardant canvas jacket. Install the jacket with an adhesive coating.
 - .2 Fittings (valves and strainers, if specified) not finished with a PVC cover must be covered with a layer of hard cement and finished with a fire retardant canvas applied with an adhesive coating.
 - .3 Finish the lining with a layer of adhesive coating.
- .3 Indoor (concealed areas):
 - .1 Apply pipe insulation with factory applied all service jacket. Secure the jacket with appropriate fasteners at approximately 100 mm centre to centre. Cover longitudinal and circumferential joints with a tight fitted jacket finishing tape. Alternatively, secure the jacket using the integral self-sealing overlap joints and self-sealing circumferential joint bands.
 - .2 Fittings (valves and strainers, if specified) not finished with a PVC cover must be covered with a layer of hard cement and finished with a fire retardant canvas applied with an adhesive coating.
- .4 Indoor (concealed areas):
 - .1 Apply pipe insulation with factory applied all service jacket. Secure the jacket with appropriate fasteners at approximately 100 mm centre to centre. Cover longitudinal and circumferential joints with a tight fitted jacket finishing tape. Alternatively, secure the jacket using the integral self-sealing overlap joints and self-sealing circumferential joint bands.
 - .2 Fittings (valves and strainers, if specified) not finished with a PVC cover must be covered with a layer of hard cement and finished with a fire retardant canvas applied with an adhesive coating.

3.4 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings on cold systems (domestic water, chilled water and glycol).
- .2 Where type A or B is specified, thicknesses are given for type A. If type B is used, thickness shall be reduced by 13 mm ($\frac{1}{2}$ ") from the specified thickness.

- .3 Pipe dimensions are "Nominal Pipe Sizes" (NPS).
- .4 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 13' long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Applications	Insulation type	Pipe Sizes NPS and insulation thickness in.				
		Run Out	Up to 1	1 1/4 to 2	2 1/2 to 4	6 and over
Horizontal vent piping 6 m (20') from roof outlet.	C	1	1	1	1	1
Domestic Cold Water	A or B	½	1	1	1	1
Domestic Hot Water & Recirculation	A or B	½	1	1	1½	1½
A/C Condensate Drain	B	0.4	0.4	0.4	0.4	0.4

- .5 Finishes:
 - .1 Exposed indoors: PVC jacket.
 - .2 Exposed in mechanical rooms: PVC jacket.
 - .3 Concealed, indoors: canvas on valves, fittings. No further finish.
 - .4 Outdoors: water-proof aluminum jacket.
 - .5 Installation: to appropriate TIAC code CRF/1 through CPF/5.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- .2 ASTM International:
 - .1 ASTM A480/A480M-16a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements.
 - .3 ASTM A653/A653M-19a, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS):
 - .1 GS-36-2013 - Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Agency Association (NFPA):
 - .1 NFPA 90A-18, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-18, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96-17, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - .1 SMACNA 1966, HVAC - Duct Construction Standards - Metal and Flexible, 3rd Edition, 2005.
 - .2 SMACNA 016-2012, HVAC Air Duct Leakage Test Manual, 2nd Edition 2012.
 - .3 SMACNA 008-2007, IAQ Guideline for Occupied Buildings Under Construction 2008.

- .6 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1168-A2017 - Adhesives and Sealants Applications.

Part 2 PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

2.2 SEALANT

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA 016, HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
 - .1 Rectangular: standard radius or short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius. Centreline radius: 1.5 times diameter.
 - .3 Double-wall, flat oval: smooth radius centreline radius: 1.5 times outer minor axis of duct.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with double thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45° entry on branch.

- .2 Round or flat oval main and branch: enter main duct at 45° with conical connection.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 20° maximum included angle.
 - .2 Converging: 30° maximum included angle.
- .6 Offsets:
 - .1 Full radius elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.

2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z275 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA

2.8 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29.
 - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 500.
 - .2 Hanger configuration: to SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized or primed steel rods to the following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:

- .1 For steel joist: manufactured joist clamp or steel plate washer.
- .2 For steel beams: manufactured beam clamps.

Part 3 EXECUTION

3.1 GENERAL

- .1 Do work in accordance with SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.

3.2 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Safety Data Sheets (SDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 ANSI/SMACNA 006-2006 HVAC Duct Construction Standards - Metal and Flexible.

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 data sheet. Indicate the following:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Turning vanes.
 - .4 Instrument test ports.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .1 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's Field Reports: manufacturer's field reports specified.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 45 00.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.
 - .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.

Part 2 Products

2.1 GENERAL

- .1 Manufacture in accordance with ANSI/SMACNA 006-2006 HVAC Duct Construction Standards - Metal and Flexible.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40°C to plus 90°C, density of 1.3 kg/m².

2.3 ACCESS DOORS IN DUCTS

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
 - .2 301 to 450 mm: four sash locks complete with safety chain.
 - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
 - .4 Hold open devices.

2.4 TURNING VANES

- .1 Factory or shop fabricated double thickness with trailing edge, to recommendations of ANSI/SMACNA 006-2006 HVAC Duct Construction Standards - Metal and Flexible and as indicated.

2.5 INSTRUMENT TEST

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

2.7 WALL CAPS

- .1 Heavy duty, interchangeable from exhaust to intake. To comply with AMCA 511.
- .2 Exhaust caps to be complete with backdraft damper.

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 data sheet.

3.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .3 As indicated.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with recommendations of ANSI/SMACNA 006-2006 HVAC Duct Construction Standards - Metal and Flexible.
 - .5 When fan is running:
 - .1 Ducting on sides of flexible connection to be in alignment.
 - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
 - .1 Size:
 - .1 600 x 600 mm for person size entry.
 - .2 300 x 300 mm for servicing entry.
 - .3 200 x 200 mm for viewing.
 - .4 As indicated.
 - .2 Locations:
 - .1 Fire and smoke dampers.
 - .2 Control dampers.
 - .3 Devices requiring maintenance.
 - .4 Required by code.
 - .5 Reheat coils.
 - .6 Elsewhere as indicated.

- .3 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Install insulation port extensions as required.
 - .4 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
 - .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Departmental Representative.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.
 - .5 And as indicated.
- .4 Turning vanes:
 - .1 Install in accordance with recommendations of ANSI/SMACNA 006-2006 HVAC Duct Construction Standards - Metal and Flexible and as indicated.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

-
- .3 Schedule site visits, to review Work, at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.
 - .4 Obtain reports, within 3 days of review, and submit immediately to.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29 - Health and Safety Requirements
- .3 Section 01 45 00 - Quality Control
- .4 Section 01 74 20 - Construction / Demolition Waste Management and Disposal
- .5 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA 1966, HVAC - Duct Construction Standards - Metal and Flexible, 3rd Edition 2006.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 74 20.

- .2 Waste Management and Disposal:
 - .1 Construction Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

2.2 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100mm as indicated.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

2.3 MULTI-BLADED DAMPERS

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: as indicated.
- .4 Bearings: pin in bronze bushings.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

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 where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.
- .7 Corrections and adjustments conducted by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals
- .3 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-19a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.3 SUBMITTALS

- .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.
 - .2 Indicate the following:
 - .1 Performance data.
- .2 Closeout Submittals
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Waste Management Plan.

Part 2 PRODUCTS

2.1 MULTI-LEAF DAMPERS (ATMD)

- .1 Parallel blade type as indicated.
- .2 Extruded aluminum interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Operator: Electric actuator supplied by Division 23.
- .6 Performance:
 - .1 Leakage: in closed position less than 2% of rated air flow.
- .7 Insulated aluminum dampers:
 - .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
 - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

2.2 BACK DRAFT DAMPER (BD)

- .1 Minimum 15.24mm thick by 63.5mm deep extruded aluminum frame.
- .2 Minimum 15.24mm thick extruded aluminum blades.
- .3 Blade and side seals are extruded silicone, secured in integral slots within the aluminum extrusion.
- .4 Celcom bearings system rotating on zinc-plated steel pivot points.
- .5 Linkage system consists of hard aluminum alloy crank arms fastened to zinc-plated steel pivot rods and doubly secured within channel running along top blade. Large diameter (11/32") hard alloy aluminum linkage rod connects the crank arms by means of a zinked-plated steel trunnion.
- .6 Back draft dampers are wade to required size.
 - .1 Minimum section size 150mm wide x 150mm high.
 - .2 Maximum section size 900mm wide x 3600mm high.

- .7 Back draft damper with dimensions greater than maximum section size will be manufactured in multiple sections. Multiple sections are not interlinked or connected, each section must be individually fastened to a structural frame prepared on site.

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 where indicated.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Ensure dampers are observable and accessible.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 - Cleaning.
- .3 Section 23 05 48 - Vibration and Seismic Controls for HVAC.

1.2 REFERENCES

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA 99-2016, Standards Handbook.
 - .2 AMCA 204-20, Balance Quality and Vibration Levels for Fans
 - .3 ANSI/AMCA 210-2016/ (AMCA/ASHRAE 51-2016), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .4 ANSI/AMCA 300-2014, Reverberant Room Method for Sound Testing of Fans.
 - .5 ANSI/AMCA 301-2014, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Submit a sample of each proposed liner type.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Ensure emptied containers are sealed and stored safely.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

- .2 Capacity: flow rate, static pressure, bhp efficiency, revolutions per minute, power, model, size, sound power data and as indicated.
- .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA 99.
- .4 Sound ratings: comply with ANSI/AMCA 301, tested to ANSI/AMCA 300.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

2.2 FANS GENERAL

- .1 Motors:
 - .1 Sizes as indicated.
- .2 Factory primed before assembly in colour standard to manufacturer.
- .3 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .4 Vibration isolation: to Section 23 05 48.

2.3 SIDEWALL UPBLAST CENTRIFUGAL (EF-01)

- .1 Wheel
 - .1 Material type: aluminum
 - .2 Non-overloading, backward inclined centrifugal
 - .3 Statically and dynamically balanced in accordance to AMCA Standard 204.
 - .4 The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
- .2 Motor
 - .1 Motor enclosures: Open drip-proof
 - .2 Motors are heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
 - .3 Mounted on vibration isolators, out of the airstream
 - .4 For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants.
 - .5 Accessible for maintenance
- .3 Shaft and bearings
 - .1 Fan shaft shall be ground and polished solid steel with an anti corrosive coating
 - .2 Permanently sealed bearings or pillow block ball bearings

- .3 Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
- .4 Bearings are 100 percent factory tested
- .5 Fan Shaft first critical speed is at least 25 percent over maximum operating speed
- .4 Housing
 - .1 Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable.
 - .2 Housing shall have a rigid internal support structure.
 - .3 Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing.
 - .4 Windband to include an integral rolled bead for strength.
 - .5 Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable.
 - .6 Curb cap to have integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to curb.
 - .7 Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
- .5 Dampers:
 - .1 Type: Motorized
 - .2 Prevents outside air from entering back into the building when fan is off
 - .3 Balanced for minimal resistance to flow
 - .4 Galvanized frames with pre-punched mounting holes
- .6 Complete with drain trough to allow for one-point drainage of water, grease, and other residues
- .7 Complete with Birdscreen; construction of galvanized steel
- .8 To be complete with disconnect.
- .9 Capacity: As indicated on drawings.

2.4 RANGEHOOD (RH-01)

- .1 Stainless steel, 900mm wide, 600mm deep, 64mm high with 292mm x 292mm telescopic chimney from 521mm to 1016mm
- .2 HVI certified high-performance, ULC certified
- .3 3-speed fan

- .4 Push-button control with LCD interface
- .5 Time display and delay function
- .6 Professional-style aluminum filters, easy to clean
- .7 4 halogen bulbs 20 W (included)
- .8 150 round duct connection
- .9 212 L/s, 8.5 Sones, high speed
- .10 90 L/s, 2.5 Sones, low speed
- .11 325 W, 3.3 Amps, 120/1/60

2.5 CEILING FANS

- .1 FANS F-01 and F-02
 - .1 High performance ceiling fan. Size 1200 mm, three metal blades, forward and reverse function, 400mm downrod, 325 max RPM, 62 W at 120V.
 - .2 Complete with variable fan speed controller and heavy duty fan guard.
- .2 FANS F-03
 - .1 High performance ceiling fan. Size 1300 mm, three metal blades, forward and reverse function, low profile mounting suitable for 2,400mm ceiling height, 177 max RPM, 15.6 W at 120V.
 - .2 Complete with variable fan speed controller.

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 HVAC fans installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48, flexible electrical leads and flexible connections.
- .2 Provide sheaves and belts required for final air balance.

- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as required.

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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 74 20 - Construction / Demolition Waste Management and Disposal
- .5 Section 21 05 01 - Common Work Results for Mechanical.

1.2 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.3 SUBMITTALS

- .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.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
- .3 Quality assurance submittals: submit following in accordance with Section 01 45 00.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 74 20.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Waste Management Plan.

1.5 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 61 00.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

Part 2 PRODUCTS

2.1 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated. Dimensions are designed for the required air projection at a low noise level, no changes allowed without authorization. When two or more grilles or diffusers are connected to the same unit, and not provided with balancing damper, supply and install a balancing damper at the branch duct.
- .2 Concealed manual volume control damper operators.
- .3 Adjustable front blades:
 - .1 For supply grille at wall or on the side of exposed duct, adjust front blades upward to an angle between 15 and 20°.
- .4 Baked enamel finish, color and texture by architectural.

2.2 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

- .1 SR: Side wall single deflection grille
 - .1 Single deflection, steel core construction.
 - .2 Opposed blade damper.
 - .3 Refer to drawings for installation: Ceiling or Wall Mounted.

2.4 RETURN, EXHAUST AND TRANSFER GRILLES AND REGISTERS

- .1 RR: Louvered Face Return
 - .1 Single deflection, steel core construction.
 - .2 Opposed blade damper.
 - .3 Refer to drawings for installation: Ceiling or Duct Mounted.
- .2 DG: Door Grille
 - .1 Aluminum construction, sight proof.
 - .2 Size: As shown.

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 manufacturer's instructions.
- .2 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms and elsewhere as indicated.
- .5 General: provide balancing dampers where indicated and elsewhere in order to allow balancing of every grille and diffuser.
- .6 The installation requirements also apply to existing equipment.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00- Common Work Results for HVAC.

1.2 REFERENCES

- .1 ASTM International:
 - .1 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Agency Association (NFPA):
 - .1 NFPA 96-17 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 ANSI/SMACNA 006-2006,HVAC Duct Construction Standards
- .4 Society of Automotive Engineers (SAE).

Part 2 PRODUCT

2.1 LOUVERS

- .1 The installation and the supply of louvers are part of another section.
- .2 General:
 - .1 For fresh air intakes and exhaust air outlets, supply and install louvers with fixed blades.
 - .2 Profiled aluminum construction, alloy no. 6063-T5, with a minimum thickness of 2.06 mm (12 gauge).
 - .3 Corners of the frame, perfectly mitered and reinforced with blocking supports.
 - .4 Design the assembly of the blades to prevent their loosening and vibration, and to ensure that adequate expansion and contraction to prevent the blades from deforming, losing rigidity, or buckling.
 - .5 45° blades having a thickness of 0.53 mm.
 - .6 Louvers with type Z blades, H-frame with drip edge at the top and bottom.
- .1 50% minimum nominal opening.

- .3 Dimensions:
 - .1 Determine the exact dimensions of each louver on site with the manufacturer.
 - .2 Maximum tolerance of 6.4 mm along the perimeter.
- .4 Leak resistance:
 - .1 Seal between the wall and the air outlets and inlets, using an elastomeric seal of the same color as the louvers. Standard or special colours.
- .5 Finishes:
 - .1 Colours and luster of the Departmental Representative's choice.
 - .2 All bolts, screws, and other assembly accessories are to be aluminum. Paint the exposed parts of bolts and screws with two coats, the same colour as the louvers. Paint supplied by the louver manufacturer.
 - .3 Provide samples of colours and finishes.
- .6 Bird screens:
 - .1 Behind the fixed blades, a removable screen with standard folded frame and expanded aluminum screen with 12.7 mm no. 2 diamond mesh, wire diameter of 1.6 mm, open area of 80%.
- .7 Filling unused parts:
 - .1 All unused parts of the louvers must be sealed shut with a galvanized steel sheet, thickness of 1.311 mm (18 gauge). Also see the thermal insulation sections.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install the louvers, the air intakes, and the other vents according to manufacturer's recommendations and SMACNA.
- .2 Reinforce and brace the elements as indicated.
- .3 Securely fasten the elements to the opening. Caulk edges to ensure a good seal.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 00 - Cleaning.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/ Air Conditioning, Heating and Refrigeration Institute (ARI)
 - .1 ANSI/ARI 210/240-2008, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - .2 ARI 270-2008, Sound Rating of Outdoor Unitary Equipment.
- .2 Underwriters' Laboratories Inc. (UL)
 - .1 UL 1995-2011, Standard for Heating and Cooling Equipment.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B52-18, Mechanical Refrigeration Code.
 - .2 CSA C22.1 HB-18, Canadian Electrical Code Handbook.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association
 - .1 NFPA 90A-2018, Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

Part 2 PRODUCTS

2.1 GENERAL

- .1 Centralized, compact ventilation unit with heat recovery and integrated adaptive summer by-pass. Passivhaus certified.
- .2 Housing: made of galvanised or painted sheet steel, acoustically and thermally insulated.

- .3 Fans: DC fans with RadiCal impeller, flow ring and flow grid. Supply and exhaust fans can be controlled separately and can be precisely adjusted to within one percent by entering the balance air volume.
- .4 Enthalpy Core: PE-Copolymer cross counterflow heat exchanger with up to 95% heat recovery.
- .5 Filters: Front access. Exhaust air: MERV 8. Outdoor air: MERV 13
- .6 Modulating by-pass to control the exact degree of heat recovery. The modulating by-pass is guided by an optimum comfort temperature, which is determined on the basis of information from the temperature and humidity sensors as well as an intelligent algorithm.
- .7 Electric Preheater
- .8 Condensate drain: 32 mm
- .9 Sound power (min./max.): Exhaust air: 43.0 dB(A) / 61.0 dB(A) Supply air: 54.0 dB(A) / 75.0 dB(A)
- .10 Complete with temperature, humidity and pressure sensors on outdoor air, exhaust air out, supply air, exhaust air out.
- .11 Dimensions: 725mm wide x 570 mm deep x 850 mm high
- .12 Air duct connections: 4x 180 mm (7.1") on top
- .13 Provide base for floor mounting.

2.2 CAPACITY

- .1 165 L/s at 115 Pa
- .2 Power consumption without/with pre-heater: 350 W / 2,620 W
- .3 Current draw without/with pre-heater 2.77 A / 12.7 A at 208/1/60

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 manufacturers recommendations.
- .2 Install units on a flat surface level within 1/8 inch. Provide intermediate supports as recommended by the equipment manufacturer.

- .3 Provide certified wiring schematics to the electrical division for associated equipment and controls.
- .4 Provide all necessary control wiring as recommended by the manufacturer.

3.3 FIELD QUALITY CONTROL

- .1 Tests:
 - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00.
- .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 01 33 00 - Submittal Procedures.
- .2 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .3 Section 21 05 01 - Common Work Results for Mechanical.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration's, and Air-Conditioning Engineers (ASHRAE).
 - .1 ASHRAE 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .2 Air-Conditioning, Heating, and Refrigeration Institute (ARI).
 - .1 ARI 410-2001, Forced-Circulation Air-Cooling and Air-Heating Coils.
 - .2 ARI 430-2009, Central Station Air Handling Units.
- .3 American Society for Testing and Materials (ASTM).
 - ASTM E84-16a, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .4 Canadian Standards Association (CSA).
- .5 National Fire Protection Association (NFPA).
- .6 Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- .7 Underwriter's Laboratories of Canada (ULC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

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

Part 2 PRODUCTS

2.1 GENERAL

- .1 The units shall be listed by Electrical Laboratories (ETL) and bear the cETL label.
- .2 All wiring shall be in accordance with the National Electric Code (NEC).
- .3 Energy Star rated.

2.2 SYSTEM DESCRIPTION

- .1 The condensing unit is a direct expansion (DX), air cooled, single-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant.
- .2 Condensing unit shall be interconnected to indoor unit.

2.3 REFRIGERANT PIPING

- .1 Tubing
 - .1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
 - .2 Hard copper: to ASTM B280, type ACR.
 - .3 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.4 INDOOR UNIT

- .1 Units shall be designed for R-410A refrigerant, and be equipped with an electronic expansion valve.
- .2 Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition.
- .3 Indoor units shall be completely factory assembled and tested. Internal unit components shall be factory wired and piped, and complete with electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
- .4 Wall mounted unit:
 - .1 The indoor unit shall be completely factory assembled and tested.
 - .2 Both refrigerant lines shall be individually insulated from the outdoor unit.

- .3 Three auto-swing settings shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
- .4 The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with three fan speeds available.
- .5 The airflow rate shall be available in three settings.
- .6 The fan motor shall be thermally protected.
- .7 The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

2.5

CONDENSING UNIT

- .1 The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a swing compressor, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4 way valve, distribution headers, capillaries, filters, shut off valves, service ports and suction accumulator.
- .2 Both liquid and suction lines must be individually insulated between the outdoor and indoor units.
- .3 The outdoor unit can be wired and piped with outdoor unit access from left, right, front or rear.
- .4 The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for re-programming.
- .5 Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
- .6 The outdoor unit shall be capable of cooling operation at - 18°C dry bulb ambient temperature without additional low ambient controls.
- .7 The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
- .8 The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
- .9 The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
- .10 The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.

- .11 The swing compressor shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.

2.6 CONTROLS

- .1 Remote controllers shall be hard wired by installing contractor.
- .2 Controllers shall be able to function as follows:
 - .1 The controller shall have individual button prohibits
 - .2 The controller shall have a self diagnosis function that constantly monitors the system for malfunctions (total of 80 components).
 - .3 An LCD digital display will allow the temperature to be set in 1°C units.
 - .4 The controller shall be equipped with a thermostat sensor
 - .5 The controller shall have the ability to automatically changeover the mode of operation with dual or single setpoints.
 - .6 Controller shall have built-in 7 day, weekday plus Saturday Sunday (5+1+1), weekday plus weekend (5+2) and everyday (1) scheduler
 - .7 Controller shall have a simple display mode, displaying only the operation mode, the setpoint(s), and the room temperature.

2.7 ELECTRICAL

- .1 The power supply to the condensing unit shall be as scheduled.
- .2 Electrical power for condensing units shall be 208/230 volts, 1 phase, 60 hertz. The unit shall be capable of operating within the limits of 187 volts to 253 volts.
- .3 The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded 2 conductor cable.
- .4 The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.

2.8 PERFORMANCE

- .1 Rated cooling capacity: 3.5 kW

- .2 Sensible capacity: 2.7 kW
- .3 Rated cooling condition (DB/WB): Indoor: 26.7°C/19.4°C - Ambient: 35°C/23.9°C
- .4 Power supply:
 - .1 Outdoor unit: 208/60/1 - MCA 8.75 - MOP 15
- .5 Gas connection: 9mm
- .6 Liquid connection: 6mm
- .7 Condensate connection (indoor unit): 15mm
- .8 Sound pressure:
 - .1 Indoor unit: 45 dBA high speed
 - .2 Outdoor unit: 49 dBA

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install units in accordance with manufacturer's instructions and as indicated.
- .2 Install all the units within ceiling space. Avoid interference with existing services.

END OF SECTION

Part 1 GENERAL

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 - Cleaning.
- .3 Section 26 05 00 - Common Work Results for Electrical.
- .4 Section 26 05 21 - Wires and Cables (0-1000V).
- .5 Section 26 05 34 - Conduit, Conduit Fastenings and Conduit Fitting.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No. 1-15, Overhead Systems.
 - .3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
 - .4 CAN/CSA-C22.3 No.7-10 (R2015), Underground Systems.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC Y1-1, 1955 Performance Specification for Finishing Systems for Outdoor Electrical Equipment.
 - .2 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE 100-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
- .4 National Fire Protection Association:
 - .1 NFPA 70E-2018, Standard for Electrical Safety in the Workplace.
- .5 Electrical Safety Authority
 - .1 ESA OESC-2015, Ontario Electrical Safety Code, 26th Edition, Electrical Safety Authority 2015

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacture's instructions, printed product literature and data sheets for the following:
 - .1 Distribution equipment including panelboards, circuit breaker, disconnects and utility meter base.
 - .2 Generator and emergency distribution equipment including automatic transfer switch.
 - .3 Lighting Fixtures
 - .4 Lighting control system including devices
 - .5 Fire Alarm system equipment including devices
 - .6 Wiring devices including receptacles
 - .7 Wire basket / Cabeltray
 - .8 Heating Equipment
 - .9 As indicated in these specifications.
 - .3 Submit for review single line electrical diagrams under plexiglass and locate as indicated and as follows:
 - .1 Electrical distribution system in main electrical room.
 - .2 Electrical power generation and distribution systems in generator enclosure.
- .4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames at fire alarm control panel location.
- .5 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario as indicated in these specifications.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 If changes are required, notify Departmental Representative of these changes before they are made.

- .6 Certificates:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment or material is not available, submit such material or equipment to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .7 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data as follows:
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
 - .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
 - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
 - .4 Post instructions where directed.

- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.6 CARE, OPERATION AND START-UP

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and in accordance with 01 61 00- Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location, indoors, and off ground] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer and return of padding, packaging materials, crates, and pallets, as specified in Construction Waste Management Plan in accordance with Section 01 74 19- Waste Management and Disposal.

1.8 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235. Preferred Voltage Levels for AC Systems, 0 to 50 000 V.

- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.9 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
- .5 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative.

1.10 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

- .1 Seismic restraints are to be provided for all operational and functional components of building services in accordance with the Ontario Building Code, ASHRAE Standard "A Practical Guide to Seismic Restraint" and applicable codes and standards.
- .2 The Contractor shall utilize a Supplier familiar with the design of seismic systems to provide a comprehensive package of isolation and seismic restraint for the project. Provide detailed shop drawings showing the proposed restraint system for all required equipment, piping, and fixtures on the project. The shop drawings shall include calculations certified by the Seismic Engineer.
- .3 The Seismic Engineer shall be a Professional Engineer licensed in the Province of Ontario.
- .4 Cable restraint systems, rod stiffener clamps and seismic isolator capacities to be verified by an independent test laboratory. Connection materials and sit-specific designs to be by the Seismic Engineer. The Seismic Engineer may specify material and anchors provided by the contractor where this is appropriate. The Contractor is responsible for ensuring that the Seismic Engineers' requirements and specifications have been met.
- .5 The Contractor shall ensure his Bid Price includes all Seismic Protection required for electrical equipment and materials installed in this project. The qualified

Electrical Contractor is required to fully understand Seismic Protection requirements, with the assistance of the Seismic Engineer as necessary.

- .6 The Contractor shall submit a sealed letter from the Seismic Engineer to the Consultant. Under no circumstances is this requirement permitted to be waived, including such circumstances where the Seismic Engineer concludes that no Seismic Protection is required for electrical equipment and material installed as part of this project.

1.11 SINGLE LINE ELECTRICAL DIAGRAMS

- .1 Provide single line electrical diagrams in glazed frames as follows:
 - .1 Electrical power service generation and distribution systems: locate in main electrical room.
- .2 Drawings: 900 x 600 mm minimum size.

Part 2 PRODUCTS

2.1 SCOPE OF WORK

- .1 Provide complete power distribution system.
- .2 Provide complete exterior and interior lighting and lighting control system.
- .3 Provide fire alarm system
- .4 Provide heating devices as indicated.
- .5 Provide generator and emergency distribution system as indicated.
- .6 Provide complete raceways and pathways system for communication, audio-visual and security systems.
- .7 Provide demolition of existing buildings and associated coordination with local utility to complete work.
- .8 Provide temporary power requirements of Departmental Representative. Temporary power is required for temporary trailer to serve as base of operation for coast guard at the site. Ensure all required coordination with local utility to provide temporary installations.
- .9 Provide electrical site distribution as required to reinstate existing electrical services originating from building being demolished. Notify Departmental Representative of any circuits disconnected which are not indicated on plans.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with manufacturer's instructions.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .3 Factory assemble control panels and component assemblies

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Sections 26 05 21 and Section 26 05 34 except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Safety Authority and Departmental Representative.
- .2 Provide arc flash hazard warning signs on each item of electrical distribution, protection and control equipment. Include identification of hazard category and clothing in accordance with NFPA 70E.
- .3 Minimum size of warning sign -150 mm w x 75 mm h.
- .4 Provide warning signs in English and French.

2.5 WIRING TERMINATIONS

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

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:

- .1 Nameplates:

- .1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws. For emergency power and life safety equipment nameplates use white face with red core engraving sheet.

NAMEPLATE SIZES			
Size 1	10 x 30 mm	1 line	5 mm high letters
Size 2	25 x 75 mm	2 lines	6 mm high letters

NAMEPLATE SIZES			
		1 line	10 mm high letters
Size 3	25 x 100 mm	2 lines	6 mm high letters
		1 line	10 mm high letters

- .2 Minimum nameplate size shall be size 2 for all equipment cabinet, splitters and cabinets. Provide size 1 at all single gang outlet boxes.
- .2 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .3 Allow for average of twenty-five (25) letters per nameplate and label.
- .4 Identification to be in English.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved as and if directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.
- .10 Circuit numbers to be indicated on junction box covers using black marker.

2.7 WIRING AND RECEPTACLE IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.
- .5 Use clear self-adhesive labels with 3 mm high black letters for circuit ID on cover plates of receptacles.
- .6 Also identify computer dedicated receptacle (receptacle located beside a data outlet and/or orange receptacles), receptacles dedicated to photocopiers, printers, fridges,

microwaves and other equipment of such (receptacle affected by a "D")

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code all cable trays, conduits and metallic sheathed cables with plastic tape or paint at points where cable tray, conduit or cable enters wall, ceiling or floor, and at 15m intervals, unless otherwise indicated. Use colour strips 25 mm wide prime colour and 19mm wide auxiliary colours as indicated below. Indiscriminate spraying of cable trays conduits cables with paint will not be accepted.

Description	Prime	Auxiliary
<u>Feeders</u>		
- Up to 250 V	Brown	
<u>Lighting</u>		
- 120V lighting	Brown	Yellow
<u>Receptacles and Motors</u>		
- 120/208V power	Brown	Black
<u>Communications</u>		
- Voice/data	Blue	Blue
- Cable TV	Blue	White
- Audio Visual	Blue	Yellow
<u>Fire alarm and Security:</u>		
- Fire Alarm	Red	
- Intrusion and Access Control Systems	Pink	Pink
- CCTV surveillance	Pink	Pink

- .2 Identify all wires with permanent indelible identifying marking, either numbered or coloured plastic tape, at both ends and at all junction boxes, splitters, cabinets and outlet boxes. Colour code wiring in accordance with CSA-C22.1. Maintain phase sequence and colour coding throughout. Use colour coded wires for fire alarm and communication cables.
- .3 Colour code all junction boxes and pull boxes.

2.9 FINISHES

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

- .2 Paint outdoor electrical equipment "Equipment Green finish to EEMAC-Y1-1.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

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 work detailed in these specifications and associated drawings.
 - .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 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

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

3.4 CONDUIT AND CABLE INSTALLATION

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

3.5 LOCATION OF OUTLETS

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

3.6 MOUNTING HEIGHTS

- .1 Mounting height for all equipment and devices is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated, verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated or directed otherwise.
 - .1 Local switches, dimmer switches: 1220 mm.
 - .2 Wall receptacles, general: 400 mm.
 - .3 Wall receptacles in MTR and TR's: 150 mm.
 - .4 Receptacles above counters/ workbenches: 175 mm above top of back splash. Coordinate with millwork shop drawings.
 - .5 Receptacles in mechanical rooms: 900 mm.
 - .6 Panelboards: 1800 mm from the top of panel to floor. Bottom of panel, minimum 150 mm above floor. Where multiple panel boards are mounted together, align tops or trims of all panel boards, with highest panel board determining the height.
 - .7 General telecommunication outlets: 400 mm.
 - .8 General telecommunication outlets above counters/ workbenches: 175 mm above top of back splash. Coordinate with millwork shop drawings.
 - .9 Wall mounted telecommunication outlets: 1220 mm.
 - .10 Emergency lighting battery units and remote lighting heads: 2400 mm.
 - .11 Time switches: 1220 mm.
 - .12 Card readers, keypads: 1220 mm.
 - .13 Door contacts: top of door frame.
 - .14 Request to exit device: top of door frame.
 - .15 Thermostats: 1400 mm.

- .16 Individual starters: 1500 mm from top. Where multiple starters are mounted together, align the tops of all starters with the highest starter determining the height.
- .17 Unless otherwise noted in lighting fixture schedule, wall mounted luminaires in stairwells shall be mounted at 2130 mm above finished floor.

3.7 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- .2 Carry out and complete Short Circuit and Coordination and Arc Flash Study - submit for review to Departmental Representative.
- .3 Ensure all material & equipment includes the requirement as determined by the study. The study shall be performed under the direction of a 3rd Party Professional Engineer registered in Ontario. Arrange and pay for these Professional Engineering Services. Submit three (3) copies to the Departmental Representative for review and acceptance.

3.8 CONCRETE WORKS

- .1 Concrete works required for mechanical and electrical include the formwork, the reinforcing steel, meshing, concrete, casting, and concrete finishing.
- .2 These works include concrete bases and pads necessary for equipment and piping, such as chillers, air handlers, pumps, fans, compressors, transformers, generators, tanks, electrical conduits, lamp posts, electrical power distribution stations, etc.
- .3 Install all equipment, inertia bases, integral bases, electrical equipment, etc., on a concrete leveling base.
- .4 Anchor leveling bases to the structural slab. Unless otherwise specified, it must have a minimum thickness of 100 mm above the finished floor. The perimeter must extend at least 100 mm beyond the base of the equipment. The surface must be clean, smooth and level, and with 20 mm x 20 mm bevelled edges along the perimeter.
- .5 The bases should include, in addition to wire mesh, steel reinforcement bars as directed by the structural professional.
- .6 The concrete must have a minimum strength of 25 MPa after twenty-eight days.

- .7 Affix the equipment to the bases by means of anchor bolts and expansion shields (by the section providing the equipment). Use chemical anchors if required.
- .8 Each relevant mechanical and electrical Division should provide the details of its bases on their respective coordination drawings.
- .9 For details on the bases, see the description of all equipment in the respective specification sections or on the drawings. If necessary, consult with the structural professional.
- .10 Concrete works are the responsibility of the general Contractor with the coordination of requirements from the structural professional.

3.9 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentice program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Electrical contractor license as issued by the jurisdiction where the work is being constructed.
- .3 Conduct and pay for tests generally in accordance with General Commissioning (CX) Requirements and Section 26 05 00. Commissioning services include the following:
 - .1 Power service and distribution systems including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting systems and their control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Fire alarm system.
 - .6 Emergency generator system and transfer switches.
- .4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .5 Insulation resistance testing.

- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
- .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
- .3 Check resistance to ground before energizing.
- .6 Carry out tests in presence of Departmental Representative.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .8 Submit test results for Departmental Representative's review

3.10 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of work, report listing phase and neutral currents on panel boards, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

3.11 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 recycling or reuse in accordance with front end documents.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 This section includes:
 - .1 Equipment and accessories for cable and box connectors.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes
 - .2 CAN/CSA-C22.2 No.18.2-06(R2016), Nonmetallic Outlet Boxes
 - .3 CAN/CSA-C22.2 No.65-18, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit Shop Drawings for the following:
 - .1 Multi-port wire connectors for parallel conductor joints.
 - .2 Terminal blocks.
- .4 Interference Drawings:
 - .1 Interference drawings showing proposed locations and dimensions of junction boxes for distribution conductors (i.e. conductors between distribution equipment, not branch wiring).
- .5 Installation Sheet:
 - .1 Information required for Multit-port wire connectors for parallel conductor joints:
 - .1 Identification of junction box.

- .2 Quantity and size of conductors.
- .3 Model number of the connector used.
- .4 Tightening torque used.
- .5 Tightening marked.
- .6 Dielectric test results.
- .7 Infrared photo of the joint.

1.4 CLOSEOUT SUBMITTALS

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

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper or aluminum alloy sized to fit aluminum or copper conductors as indicated.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors to: EEMAC 1Y-2 and pertinent NEMA standards to consist of:
 - .1 Connector body and stud clamp for copper conductors.
 - .2 Clamp for copper conductors.
 - .3 Clamp for aluminum conductors.
 - .4 Stud clamp bolts.
 - .5 Bolts for copper conductors.
 - .6 Bolts for aluminum alloy conductors.
 - .7 Sized for conductors as indicated.
- .4 Clamps or connectors for flexible conduit, aluminum sheathed cable, armoured cable, mineral insulated cable, non-metallic sheathed cable and TECK cable as required to: CAN/CSA-C22.2 No.18.1 and CAN/CSA-C22.2 No.18.2.

2.2 WIRE CONNECTORS

- .1 Mechanical connectors for conductor size 8 AWG or less, use commercial grade electrical spring connectors or marette.
- .2 Mechanical connection for copper-to-copper conductors of size 6 AWG or larger, use type H split bolt connectors.

- .3 Mechanical connection for copper-to-Nual conductors of size 6 AWG or larger, use type APS split bolt connectors.
- .4 Mechanical connection for Nual-to-Nual conductors of size 6 AWG or larger, use type HPS split bolt connector.

2.3 MULTI-PORT WIRE CONNECTORS

- .1 Insulated mechanical connector for wire termination:
 - .1 Multi port connection block with clamping screw.
 - .2 Insulation rated to 600 V, 90 deg C.
 - .3 Removable port and screw plugs.
 - .4 Dual rated for copper or aluminum conductors.
 - .5 Pre-filled with oxide inhibitor.

2.4 WIRE TERMINATIONS

- .1 The contractor is responsible for coordinating the size of the equipment connection lugs with the conductor sized indicated on drawings. Where it is not possible to connect the conductors, the Contractor may use insulated compression reducing connectors.
- .2 Insulated Compression Reducer Connector:
 - .1 Offset connecting stem.
 - .2 Insulation rated to 600 V, 90 deg C.
 - .3 Dual rated for copper or aluminum conductors.
 - .4 Pre-filled with oxide inhibitor.

2.5 TERMINAL BLOCKS

- .1 All wire connection in junction boxes and panels for fire alarm, low-voltage lighting control, other low-voltage systems, etc., shall be made on terminal blocks in sufficient quantities for each wire connection.
- .2 Terminal blocks shall be from Wieland brand, model 9700B, 10 A, 300 V, complete with DIN rail, end plates, identification, extremity flanges and jumpers.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 TIGHTENING OF MECHANICAL CONNECTIONS

- .1 Use a torque wrench adjusted to the manufacturer's recommended torque value for all torque lug connections.
- .2 Mark terminals with a yellow paint marker or by other method after clamping.

3.3 INSTALLATION

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

3.4 CONDUCTOR JOINTS

- .1 Wrap connectors not having their own insulation with at least two (2) rows of approved electrical tape.
- .2 The dielectric characteristics of the joint wrapping shall not be less than that of the conductor insulation.

- .3 Gaskets and connectors that do not have a smooth surface must be wrapped with approved tape prior to being wrapped.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .3 Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM) .
 - .1 ASTM B33-10(2014), Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
 - .2 ASTM B172-17, Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors.
 - .3 ASTM B174-17, Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors
- .2 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No .0.3-09 (R2019), Test Methods for Electrical Wires and Cables.
 - .3 CAN/CSA-C22.2 No. 131-17, Type TECK 90 Cable.
- .3 Insulated Cable Engineers Association, Inc. (ICEA), National Electrical Manufacturer's Association (NEMA)
 - .1 ANSI/NEMA WC 70-2009/ICEA S-95-658-2009. Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy

Part 2 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: Copper, stranded for 8 AWG and larger. Minimum size: 12 AWG.
- .2 Aluminum conductors shall not be acceptable. All conductors shall be of copper material.

- .3 For feeders and branch runs protected at more than 50 Amperes copper conductors: size as indicated, with 600 or 1000 V insulation, as indicated, of chemically cross-linked thermosetting polyethylene material rated RW90 for interior and RWU90, for exterior and wet conditions.
- .4 For branch circuits protected at 50 amperes or less. Copper conductors: size as indicated, with thermoplastic insulation type TWU or TWH, as indicated, rated at 600 V.

2.2 ARMOURED CABLES

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

2.3 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V, as indicated.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 900 mm centers or cable tray, as indicated.
 - .3 Threaded rods: 6 mm dia. to support suspended channels, or cable tray.
- .8 Connectors:
- .9 Watertight approved for TECK cable

2.4 CONTROL CABLES

- .1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW with shielding of tape coated with paramagnetic material over all conductors and overall covering of PVC jackets or interlocked armour of flat galvanized steel and overall PVC jacket.
- .2 600 V stranded annealed copper conductors, sizes as indicated with PVC insulation type TW, where indicated, with shielding of magnetic tape over all conductors and overall covering of thermoplastic jacket with sheath of interlocked armour and jacket over sheath of PVC

2.5 FIRE ALARM SYSTEM WIRING

- .1 Conductors shall be solid copper; installed in separate conduit system.
- .2 Conductors shall conform to sizes indicated by manufacturer, but in any case, the minimum shall be:
 - .1 Insulated copper conductors - (FAS rated) installed in separate conduit system (EMT).
 - .2 To initiating circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
 - .3 To signal circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
 - .4 To speaker circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.
 - .5 To control circuits: 19 AWG minimum, and in accordance with manufacturer's requirements

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Perform test before energizing electrical system.
- .3 Tests shall be completed by competent personnel.
 - .1 Provide all materials and instruments necessary to complete the tests.
- .4 Check the phase of each conductor and identify the phase of each individual conductor for all circuit.

- .5 Check continuity of all circuits. Ensure all circuits are free from faults and leakage current.
 - .1 Ensure resistance to ground of each circuit is not less than 50 megohms or as recommended by cable manufacturer.
- .6 Splice Tests:
 - .1 After laying or pulling cables, but before splicing and connecting, measure the insulation resistance of each phase conductor using a 1000V megohmmeter.
 - .2 After the completion of each splice and / or connection, check the insulation resistance to ensure the distribution system is ready for the acceptance test.
- .7 Dielectric Strength Tests:
 - .1 Ensure all circuit terminations and all ancillary equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armor and conductors not being tested.
 - .3 Carry out dielectric strength tests in accordance with Manufacturer's recommendations.
 - .4 Measure dielectric value of circuits, power cables and equipment with a maximum voltage of 350 V using a 500 V megohmmeter.
 - .5 For the above noted test cases, ensure that the value of the grounding resistance prior to energization is not less than the manufacturer's requirements.
 - .6 Provide a certificate stating that all conductors have been tested and verified, and that all defective conductors have been replaced.
- .8 Completely remove and replace the total and complete length of cable which does not meet the test criteria.
- .9 Perform tests in the presence of Departmental Representative and local authority having jurisdiction over installation.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 33 71 73.02- Underground Electrical Service.
- .2 Lay cable in cable trays in accordance with Section 26 05 36- Cable Trays for Electrical Systems.
- .3 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - (0-1000 V).

- .4 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.
- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.
- .10 Provide and install all required conductors and cables for the connection of all electrical equipment and devices so that the systems are fully operational, even if the conductors or cables are not explicitly indicated.
- .11 Install all conductors or cables in conduits or metal sheaths as noted in this specification section.
- .12 Install a neutral conductor for each 120V branch circuit.
- .13** Use only approved lubricants approved by the cable manufacturer for pulling cables.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In underground ducts in accordance with Section 26 05 43.01.

3.4 INSTALLATION OF CONDUCTORS IN CONDUIT

- .1 Conductors:
 - .1 Minimum wire size shall be #12 AWG unless otherwise specified.

- .2 The current carrying capacity of the circuit conductors shall be equal to or better than shown on the drawings.
- .3 Neutral Wire: full capacity continuous throughout its length.
- .4 When load or breaker ratings are greater than 15A, the conditions shall be as indicated or of capacity equal to the load or breaker trip size as determined by the Canadian Electrical Code.
- .5 The wiring of the following circuits and systems shall be run in separate conduit systems:
 1. Wiring for Exit lights (120 Volt).
 2. Wiring for emergency lighting and exit lights (120V).
 3. Lighting
 4. Branch power
 5. Mechanical Equipment
 6. Control
 7. Distribution feeder
- .6 Provide pigtailed at all outlets for fixtures and wiring devices. All neutrals and branch circuits shall be connected in each outlet box to avoid a break in the neutral or the circuit wire when fixture or wiring device is disconnected.
- .7 All branch circuit connections shall be made with an approved connector applied with a proper tool.
- .8 Run a green insulated ground wire in all power and branch circuit conduits. At each junction, pull and outlet box make a 360° loop of the stripped insulation) uncut conductor under the ground screws.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible and support in accordance with the CEC.
- .2 Terminate cables in accordance with Section 26 05 20.

3.6 INSTALLATION OF TECK CABLE 0-1000V

- .1 Install cables in cable troughs.
- .2 Terminate cables in accordance with Section 26 05 20.

3.7 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit, cable troughs,
 underground ducts, as indicated.
- .2 Ground control cable shield.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 This section includes:
 - .1 Equipment and accessories for the installation of a continuous grounded system.
 - .2 Specific prescriptions for appropriate grounding and bonding of electrical systems.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCE STANDARDS

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-14, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 CSA Group (CSA)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CSA Z32-15, Electrical Safety and Essential Electrical Systems in Health Care Facilities.
- .3 Building Industry Consulting Service International (BICSI):
 - .1 Telecommunications Distribution Methods Manual (TDMM), 13th Edition, 2014.
- .4 American National Standards Institute/Telecommunications Industry Association:
 - .1 ANSI/TIA-606-C-2017 - Administration Standard for Telecommunications Infrastructure
 - .2 ANSI/TIA-607-D-2019 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit test results in accordance with 26 05 00.

- .3 Submit grounding compliance certificate complete with test results.
- .4 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for alumino-thermic welding kit, ground bus and lugs. Include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CLOSEOUT SUBMITTALS

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

Part 2 PRODUCTS

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Rod electrodes: copper clad steel, 19 mm diameter by minimum 3000 mm long.
- .3 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .4 Insulated grounding conductors: green, copper conductors, size as indicated.
- .5 All grounding conductors shall be minimum gauge 6 AWG.
- .6 High-conductivity wrought copper compression lug, electro-tin plated, 600 V certified, for copper conductors:
 - .1 One (1) hole for conductors smaller than 1/0AWG.
 - .2 Two (2) hole long barrel for 1/0 AWG conductors or larger.
 - .3 Silicone bronze or stainless steel bolts.
- .7 Ground bus: copper, complete with insulated supports, fastenings, connectors. Bus bar shall be minimum 103 mm wide by 6.3 mm thick. Length of bus bar shall be as follows:
 - .1 900 mm in electrical rooms
 - .2 600 mm in telecommunication rooms or closets
 - .3 Or as indicated.

- .8 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 Alumino-thermic welded type conductor connectors:
 - .1 Acceptable for buried connections between grounding conductors and between a grounding conductor and electrode.
 - .2 Installation shall be witnessed by Departmental Representative prior to backfill
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.
 - .7 Silicone bronze or stainless steel bolts.

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 grounding equipment 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.
- .2 Perform test in accordance with Section 26 05 00.
- .3 Verify the continuity of the grounding system across all joints and connections.
- .4 Measure and verify resistance to ground for all conductors to earth. Measure at ground bar using methods appropriate to local conditions. Resistance to ground must not exceed 5 ohms.
- .5 Perform all tests prior to energizing electrical system.
- .6 During testing, make all pertinent disconnections, such as a ground leakage indicator.

3.2 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories in accordance with Canadian Electrical Code.
- .2 Where EMT is used, run ground wire in conduit.
- .3 Install connectors in accordance with manufacturer's instructions.
- .4 Protect exposed grounding conductors from mechanical injury.
- .5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by aluminothermic process or permanent mechanical connectors, or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .7 Soldered joints not permitted.
- .8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .9 Install separate ground conductor to each outdoor lighting standard.
- .10 Install ground conductor in all PVC conduits.
- .11 Install a ground conductor in concrete encased metallic conduits installed in slab on grade.
- .12 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .13 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .14 Ground secondary service pedestals, fuel piping, fuel tanks, sanitary piping, rainwater piping and gas piping.
- .15 Ensure conductive continuity across any electrically insulated part of a metallic domestic water distribution system. Conductive continuity across backflow preventers, water meters, pumps or other equipment shall be assured using bonding conductors.
- .16 Ground metal structure of water fountains.

3.3 MAINTENANCE HOLES

- .1 Install conveniently located grounding stud connected to electrode with size as indicated stranded copper conductor in each maintenance hole.
- .2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

3.4 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water metre shunt.
- .3 Install rod electrodes and make grounding connections as indicated. Ensure rod electrodes are spaced no less than 3000 mm apart.
- .4 Bond separate, multiple electrodes together.
- .5 Use size 3/0 AWG copper conductors for connections to electrodes unless otherwise indicated.
- .6 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.5 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral at secondary of service. Only one connection between neutral and ground is permitted per system and subsystem.

3.6 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.
- .2 Ground motor frames or other vibrating equipment by installing a separate green insulated ground conductor in the flexible conduit servicing the equipment. Terminate the green insulated conductor to a rigid surface at each end of the flexible conduit.

3.7 GROUNDING BUS

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

3.8 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, security systems, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, security systems, intercommunication systems as indicated.

3.9 ALUMINO-THERMIC WELDING

- .1 Perform alumino-thermic welding in accordance with manufacturer's recommendations and instruction.
- .2 Welding molds shall be appropriately dried prior to use according to manufacturer requirements.
- .3 Conductors are to be cleaned and dried at weld locations.
- .4 During welding, conductors shall be held in place and correctly positioned in the mould.
- .5 Re-use welding molds in accordance with manufacturer recommendations. Do not use the same mold more than fifty (50) times.
- .6 Clean mold prior to each use.
- .7 All alumino-thermic welds shall be verified by the Departmental Representative prior to backfill. All welds shall undergo stress test to verify weld integrity (light kick of steel toe boot).
- .8 The contractor shall provide all necessary equipment to perform the welds at no additional cost.

3.10 LAY-IN MECHANICAL GROUND CONNECTOR

- .1 Make connections using clamps as recommended by the manufacturer.
- .2 Use clamps or suitable size for size and type of mechanical piping.

3.11 FIELD QUALITY CONTROL

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

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 This section includes:
 - .1 U shape support channels for surface mounting, suspended installation or recessing in concrete walls or ceilings.

1.2 REFERENCE STANDARDS

- .1 CSA International:
 - .1 CSA G164-18 - Hot Dip Galvanized of Irregularly Shaped Articles
- .2 ASTM International:
 - .1 ASTM B221-00 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings for:
 - .1 U shape support channels
 - .2 Channel supports (sleepers)

Part 2 PRODUCTS

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, set in poured concrete walls and ceilings or suspended.
 - .1 Material and Finish:
 - .1 Interior installations: Pregalvanized zinc coated steel (mill galvanized).
 - .2 Temporary exterior installations: Hot-dipped galvanized steel in accordance with CSA G164-18
 - .3 Permanent exterior installations: Aluminum. In accordance with ASTM B221-00

- .2 U shape support channels shall be slotted type.
- .3 Fasteners used for exterior installations or damp locations shall match material and finish of support channels.

2.2 CHANNEL SUPPORTS (SLEEPERS)

- .1 Supports for conduits and cabling for rooftop installation:
 - .1 No rooftop penetrations required.
 - .2 Material: Recycled rubber or thermoplastic
 - .3 UV resistant
 - .4 Through bolted to accommodate U shape support channel
 - .5 Minimum uniform load capacity of 2.22 kN per unit.

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 hangers and supports installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 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.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support two (2) or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two (2) or more conduits use channels at 1 m intervals to the centerline of channel.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 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.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Coat (touch-up) all scratched, altered or cut surfaces with a galvanized coating product.
- .15 Channel Supports (Sleepers):
 - .1 For conduits and cables installed on rooftops, install a system of supports made of U-channels in an inverted trapezes configuration and secured to channel supports (sleepers). Spacing of channel supports (sleepers) shall not exceed 1.5 m.
 - .2 Installation height of trapezes shall be minimum 150 mm from top of roof, or as indicated on plans.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 This section includes:
 - .1 Specification and installation requirements of splitters, junction boxes, pull boxes and cabinets.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.40-17, Junction and Pull Boxes
 - .3 CSA C22.2 No.76-14(R2019), Splitters

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings for splitters, pull boxes, and cabinets in accordance with Section 01 33 00.
- .4 Interference Drawings:
 - .1 Show location and dimensions of junction and pull boxes in submission of interference drawings. Identify circuit number or feeder identification.

Part 2 PRODUCTS

2.1 SPLITTERS

- .1 Construction: minimum 1.63mm (14 gauge) sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: connection blocks to match required size and number of incoming and outgoing conductors as indicated.

- .3 Spare Terminals: minimum three spare terminals on each connection or lug block sized less than 400 A.
- .4 For splitters rated 800 A or larger, provide continuous bus splitter trough (bus gutter) with lug connections. Bus shall be of copper material.

2.2 JUNCTION AND PULL BOXES

- .1 Construction: minimum 1.63mm (14 gauge) welded steel enclosure, coated with electrostatically applied paint, dimensions as required by the Electrical Code or as indicated.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted:
 - .1 Screw-on-flat covers for boxes sized less than 400 mm square.
 - .2 Flat covers on hinges for boxes sized 400 mm square or larger.
 - .3 Flat covers on hinges for boxes housing terminal blocks.
- .4 Without knockouts, factory made openings for FS and FD type boxes
- .5 Steel angle framing to form rigid assembly for boxes sized larger than 600 mm square. Integral keyed handle at two (2) locations; top and bottom.
- .6 Purpose-built boxes for communication and security systems, when necessary, shall adhere to the dimensions below:

Largest diameter of conduit intercepted by pull box mm (in)	Dimension of Pull Box			Increase width by listed amount for each additional conduit intercepted by the pull box: mm (in)
	Width mm (in)	Length mm (in)	Depth mm (in)	
21 (¾)	100 (4)	300 (12)	75 (3)	50 (2)
27 (1)	100 (4)	400 (16)	75 (3)	50 (2)
35 (1¼)	150 (6)	500 (20)	75 (3)	75 (3)
41 (1½2)	200 (8)	675 (27)	100 (4)	100 (4)
53 (2)	200 (8)	900 (36)	100 (4)	125 (5)

Largest diameter of conduit intercepted by pull box mm (in)	Dimension of Pull Box			Increase width by listed amount for each additional conduit intercepted by the pull box: mm (in)
	Width mm (in)	Length mm (in)	Depth mm (in)	
63 (2½)	250 (10)	1 050 (42)	125 (5)	150 (6)
78 (3)	300 (12)	1 200 (48)	125 (5)	150 (6)
91 (3½)	300 (12)	1 350 (54)	150 (6)	150 (6)
103 (4)	375 (15)	1 500 (60)	200 (8)	200 (8)

- .7 Purpose-built boxes for electrical systems shall be constructed of minimum 1.63mm (14 gauge) with hinged covers. Include dividers to segregate circuits as required by the Canadian Electrical Code.

Part 3 EXECUTION

3.1 SPLITTER INSTALLATION

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

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
 .2 Install a pull box to intercept underground conduits transitioning to a building's interior space. Only Flush-mounted pull boxes for finished areas.
 .3 Only particular junction and pull boxes are indicated, the noted locations and dimensions are indicative only. The Contractor is solely responsible for placing and sizing junction boxes and pull boxes as required. Install additional junction boxes and pull boxes as required by CSA C22.1.
 .4 Install all junction boxes and pull boxes indicated on plans.

3.3 IDENTIFICATION

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

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 This section includes:
 - .1 General and specific requirements regarding outlet boxes, conduit boxes and associated accessories / appurtenances.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00- Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.2 No.18.1-13(R2018), Metallic Outlet Boxes.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

Part 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 Minimum 102 mm square outlet boxes unless indicated otherwise. Larger outlet boxes as required.
- .3 Minimum 14 gauge steel construction.
- .4 Minimum box depth shall be 40 mm
- .5 Gang boxes where wiring devices are grouped.
- .6 Blank cover plates for boxes without wiring devices.
- .7 347 V outlet boxes for 347 V switching devices.
- .8 Combination boxes with barriers where outlets for more than one system are grouped.
- .9 All surface mounted boxes located at less than 2400 mm above finished floor shall be FS type.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster wall or tile.

2.3 MASONRY AND GYPSUM BOARD BOXES

- .1 Electro-galvanized steel masonry multi gang boxes for devices flush mounted in exposed block walls or gypsum board.
- .2 Minimum 12.5 mm plaster ring.
- .3 Low-profile single gang boxes for installation in exterior walls with vapor barrier.

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 73 mm for receptacles and communication outlets.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep.
- .3 Integral levelling support legs and adjustable top.

2.6 CONDUIT BOXES

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

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

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

2.8 CEILING BOXES

- .1 102 mm diameter surface mount octagonal box, depth as required.
- .2 102 mm diameter flush mount box, depth as required.

2.9 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.10 SERVICE FITTINGS

- .1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for two duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated .
- .2 Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate two telecommunication jack connectors.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 For flush installations on a wall with two (2) finishes of varying thickness (for example: tile and plaster in a washroom), do not place an outlet on the boundary line between the two (2) finishes.

- .5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .6 Group in one box switches, outlets, and other devices placed side by side. For two devices or more, use pre-ganged outlet boxes with compatible plaster ring.
- .7 Outlet boxes indicated as 'back-to-back' shall be separated by 300 mm minimum along the linear path of the wall.
- .8 Attach outlet boxes to metal studs in gypsum walls as indicated.
- .9 For outlet boxes installed at exterior walls or ceilings, install low-profile outlet box without damaging the vapor barrier. If the vapor barrier is punctured, install a minimum 300 mm x 300 mm sheet of the same material as existing over the damaged area. Ensure the vapor barrier is restored and functions as intended.
- .10 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .11 Identify systems for outlet boxes as per Section 26 05 00.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-C22.2 NO. 18.1-13(R2018), Metallic Outlet Boxes.
 - .2 CSA-C22.2 NO. 18.2-06(R2016), Non-metallic Outlet Boxes.
 - .3 CSA-C22.2 No. 18.3-12(R2017), Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
 - .4 CSA-C22.2 No. 18.4-15, Hardware for the Support of Conduit, Tubing, and Cable.
 - .5 CSA C22.2 No. 45.1-07(R2017), Electrical Rigid Metal Conduit - Steel.
 - .6 CSA C22.2 No. 45.2-08(R2018), Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel (Tri-National Standard, with NMX-J-576-ANCE and UL 6A).
 - .7 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .8 CSA C22.2 No. 83.1-07(R2017), Electrical Metallic Tubing - Steel (Tri-National Standard, with UL 797 and NMX-J-536-ANCE-2007).
 - .9 CSA C22.2 No. 211.2-06(R2016), Rigid PVC (Unplasticized) Conduit.
 - .10 CSA C22.2 No. 227.3-15(R2019), Non-Metallic Mechanical Protection Tubing (NMPT).

Part 2 PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, steel.

2.2 CONDUIT FASTENINGS

- .1 One-hole steel straps to secure surface conduits 50 mm and smaller. 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 oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified.
Coating: same as conduit.
- .2 Factory "ells" where 90E bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT for surface and exposed applications. Provide steel set-screws for concealed installations only.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT AND EMT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Features include:
 - .1 Body materials - Steel
 - .2 Reducer and gland nut materials - Steel
 - .3 Packing materials - PTFE composite.
 - .4 Washer and bushing material - Steel
 - .5 Gasket material - Vellum
 - .6 Ground spring material - Phosphor bronze.

2.5 FISH CORD

- .1 Polypropylene.

2.6 FIRESTOPPING

- .1 Provide fire stop material at firewall penetrations. Wall opening to be steel framed with 14 gauge steel sleeve. After cabling installation is complete fill all voids and cavities with fire blocks or pillows. Refer to Architectural drawings to confirm location and rating of all fire separations.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Surface mount conduits except in finished areas with suspended ceiling spaces and wall cavities.
- .3 Use rigid galvanized steel threaded conduit for exposed conduits where subject to mechanical injury.
- .4 Use electrical metallic tubing (EMT) except in cast concrete and not subject to mechanical injury.
- .5 Use rigid and heavy walled PVC conduit underground and cast in concrete.
- .6 Use flexible metal conduit for connection to motors in dry areas and connection to recessed fluorescent fixtures and work in movable partitions.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend rigid steel conduit over 19 mm dia.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Run 3-35 mm spare conduits up to ceiling space and 3-35 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.
- .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.
- .16 Support conduits to meet all seismic requirements.
- .17 Provide expansion fitting at all building expansion joints.

3.2 SURFACE CONDUITS

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

3.3 CONCEALED CONDUITS

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

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use fireproof material between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .4 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CAN/CSA-Z809-16, Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2018, FSC Principles and Criteria (P&C) for Forest Stewardship (FSC-STD-01-001 V5-2).
- .3 Insulated Cable Engineers Association, Inc. (ICEA)
- .4 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2015-2019 Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .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, in dry location and off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cables from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated, coloured.
- .2 Concrete encased as indicated.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 Cedar post type markers: to CAN/CSA-Z809 or FSC or SFI 89 x 89 mm, 1.5 m long, pressure treated, coloured.
 - .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

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 cable 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 BURIED CABLES

- .1 Underground cable splices not acceptable.
- .2 Cable separation:
 - .1 Maintain 75 mm minimum separation between cables of different circuits.
 - .2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.

- .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
- .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
- .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.

3.3 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.4 MARKERS

- .1 Mark cable every 150 m along duct runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Install concrete cable markers within 180 m from each side of runway centreline.
- .5 Install cedar post type markers.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 01 45 00.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.

- .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.6 CLEANING

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

3.7 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 50 00 - Lighting.

1.2 REFERENCES

- .1 CSA C22.2 No.184.1-15, Solid-State Dimming Controls
 (Bi-national standard with UL 1472).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .3 Submit product data in accordance with Section 01 33 00-
 Submittal Procedures.
- .4 Product Data: Manufacturer's data sheets on each product to
 be used, including:
 - .1 Catalog sheets and specifications.
 - .2 Ratings, configurations, standard wiring diagrams,
 dimensions, colors, service condition requirements,
 and installed features.
 - .3 Storage and handling requirements and recommendations.
 - .4 Installation instructions.
- .5 Shop Drawings: Wiring diagrams a for the various components
 of the System specified including:
 - .1 Composite wiring and/or schematic diagram of each
 control circuit as proposed to be installed.
 - .2 Show location of all devices, including at minimum
 sensors, load controllers, and switches/dimmers for
 each area on reflected ceiling plans.
 - .3 Provide room/area details including products and
 sequence of operation for each room or area.
 Illustrate typical acceptable room/area connection
 topologies.
 - .4 Network riser diagram including floor and building
 level details. Include network cable specification.
 Illustrate points of connection to integrated systems.
 Coordinate integration with mechanical and/or other
 trades.
 - .5 Load schedule indicating actual connected load, load
 type, and voltage per circuit, circuits and their
 respective control zones, circuits that are on
 emergency, and capacity, phase, and corresponding
 circuit numbers.
- .6 Manufacturer's Certificates:

- .1 Certify products meet or exceed specified requirements.
- .2 Meets specification via an alternate means and indicate the specific methodology used.
- .7 Closeout Submittals:
 - .1 Project Record Documents: Record actual installed locations and settings for lighting control devices.
 - .2 Operation and Maintenance Manual:
 - .1 Include approved Shop Drawings and Product Data.
 - .2 Include Sequence of Operation, identifying operation for each room or space.
 - .3 Include manufacturer's maintenance information.
 - .4 Operation and Maintenance Data: Include detailed information on device programming and setup.
 - .5 Include startup and test reports.

1.2 QAULITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- .2 Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.
- .3 System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.3 COORDINATION

- .1 The installing contractor shall be responsible for a complete and functional system in accordance with all applicable codes and electrical authority having jurisdiction.
- .2 Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
- .3 Coordinate the placement of wall controls with actual installed door swings.
- .4 Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.
- .2 Lighting control system must be protected from dust and debris during installation.
- .3 Do not install products under environmental conditions outside manufacturer's absolute limits.

1.5 WARRANTY

- .1 Manufacturer Lighting Control System Components
 - .1 Five (5) years:
 - .1 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue
 - .2 24 hour on-site field service response time.
 - .2 Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.

Part 2 Products

2.1 GENERAL

- .1 Provide hardware that is designed, tested, manufactured, and warranted by a single manufacturer.
- .2 Network Lighting Controls System: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.
- .3 Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
- .4 Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- .5 Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
- .6 Devices within a lighting control zone shall be connected with low voltage cabling in any order.

- .7 Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
- .8 Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- .1 Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
 - .1 Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system for power and data to room devices.
 - .2 Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
 - .3 Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
 - .4 Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
 - .5 Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.

2.3 0-10v DIGITAL LIGHTING LOAD CONTROLLER (10VLC)

- .1 Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features

- .2 On/Off/0-10V Dimming Enhanced Room Controllers shall include:
 - .1 Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
 - .2 Built in real time current monitoring
 - .3 One, two or four relays configurations
 - .4 One dimming output per relay
 - .1 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- .1 Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 - .1 Digital calibration and pushbutton configuration for the following variables:
 - .1 Sensitivity, 0-100 percent in 10 percent increments
 - .2 Time delay, 1-30 minutes in 1 minute increments
 - .3 Test mode, Five second time delay
 - .4 Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - .5 Walk-through mode
 - .2 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 - .3 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
 - .4 Device Status LEDs, which may be disabled for selected applications, including:
 - .1 PIR detection
 - .2 Ultrasonic detection
 - .3 Configuration mode
 - .4 Load binding
 - .5 Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 - .6 Manual override of controlled loads.

- .7 All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
- .2 Units shall not have any dip switches or potentiometers for field settings
- .3 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

2.5 DIGITAL WALL SWITCHES

- .1 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
 - .1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - .2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - .3 Configuration LED on each switch that blinks to indicate data transmission.
 - .4 Load/Scene Status LED on each switch button with the following characteristics:
 - .1 Bi-level LED
 - .2 Dim locator level indicates power to switch
 - .3 Bright status level indicates that load or scene is active
 - .4 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 - .5 Programmable control functionality including:
 - .1 Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
 - .2 Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
 - .6 All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- .2 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local

network. No additional configuration shall be required to achieve multi-way switching.

- .3 Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
 - .1 Individual button function may be configured to Toggle, On only or Off only.
 - .2 Individual scenes may be locked to prevent unauthorized change.
 - .3 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - .4 Ramp rate may be adjusted for each dimmer switch.
 - .5 Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.6 DIGITAL DAYLIGHTING SENSORS

- .1 Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
 - .1 Closed loop sensors measure the ambient light in the space and control a single lighting zone.
 - .2 Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
 - .3 Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone

Part 3 EXECUTION

3.1 PREPARATION

- .1 Do not begin installation until measurements have been verified and work areas have been properly prepared.
- .2 If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

- .1 Install system in accordance with the approved system shop drawings and manufacturer's instructions.

-
- .2 Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
 - .3 CABLING:
 - .1 0-10V dimming control cabling shall be installed in separate conduits from line-voltage conductors
 - .1 Control conductors are to be Class 2 FT-4 and shall be kept separate from line-voltage conductors.
 - .2 Lighting controllers shall have separate conduits for line-voltage power and control wiring.
 - .2 The control cables may be routed in free air where concealed above accessible ceilings. Cables routed in free air shall conform to the following installation requirements:
 - .1 Dimming control cables are to be Class 2 FT-6.
 - .2 Cabling shall be supported at a maximum of 5-foot intervals utilizing "J-Hook" or "Bridle Ring" supports anchored to ceiling concrete, piping supports or structural steel beams.
 - .3 Cabling shall be neatly run at right angles and be kept clear of other trades work.
 - .4 Cabling shall be secured within 300mm of direction change or termination.
 - .5 Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical or communications conduit.
 - .6 Do not place cable directly on the ceiling grid or attach cable in any manner to the ceiling grid supports.
 - .3 At each luminaire, separate openings (either manufactured knock-outs or punched openings) shall be used for the line-voltage power and the dimming control wiring. Use a cable connector at the opening for the 0-10V wiring. 0-10V conductors entering and within a luminaire enclosure shall maintain a minimum separation of 6 mm
 - .4 All line voltage connections shall be tagged to indicate circuit and switched legs.
 - .5 Test all devices to ensure proper communication.
 - .6 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

- .7 Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 - .1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 - .2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 - .3 Load Parameters (e.g. blink warning, etc.)
- .8 All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- .9 Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- .2 Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
 - .1 Verify Class I and II wiring connections are terminated properly by validating system performance.
 - .2 Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
 - .3 Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
 - .4 Verify that the control of each space complies with the Sequence of Operation.
 - .5 Correct any system issues and retest.
- .3 Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
 - .1 Date of test or inspection.
 - .2 Loads per space, or Fixture Address identification.
 - .3 Quantity and Type of each device installed
 - .4 Reports providing each device's settings.
- .4 Demonstrate, in the presence of the Departmental Representative all dimming system operations and functions & make all adjustments as directed.

- .5 Demonstrate that the dimming systems together with occupancy sensor operates as intended and that there are no problems in starting lamps, or in keeping them lit and flicker-free at any setting of dimming intensity control.
- .6 Demonstrate that no audio, radio or TV interference is carried by system.
- .7 Record setup settings and include report of operation tests and setup results in the Operation and Maintenance Manuals.
- .8 Demonstrate performance of all local occupancy sensors.
- .9 Demonstrate performance and operation of photoelectric control relay contactor and all controlled lighting circuits

3.4 PRODUCT SUPPORT AND SERVICE

- .1 Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C61869-1-14 (R2019), Instrument transformers - Part 1: General requirements.
 - .2 CSA C61869-2-14 (R2019), Instrument transformers - Part 2: Additional requirements for current transformers.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for control and signal transformers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Products

2.1 POTENTIAL TRANSFORMERS

- .1 Potential transformers: to CSA C13, dry type for indoor-outdoor use, with following characteristics:

- .1 Nominal voltage class: as indicated.
 - .2 Rated frequency: 60 Hz
 - .3 Basic impulse level: 10 kBIL
 - .4 Voltage ratio: as indicated.
 - .5 Accuracy rating: as indicated
- .2 Potential transformers fused with separate fuse block.
Fuses: as required by Manufacturer .

2.2 CURRENT TRANSFORMERS

- .1 Current transformers: to CSA C13, dry type for indoor-outdoor use with following characteristics:
- .1 Nominal voltage class: as indicated.
 - .2 Rated frequency: 60 Hz
 - .3 Basic impulse level: 10 kV full wave
 - .4 Metering accuracy rating: revenue class
 - .5 Rated primary and secondary current: as indicated.
- .2 Positive action automatic short-circuiting device in secondary terminals.

2.3 MOUNTING BRACKETS

- .1 Potential transformers with channel type mounting brackets.
- .2 Fabricate brackets and channels from electrogalvanized code gauge painted steel.

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 control and signal transformers installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of *Departmental Representative*.
 - .2 Inform *Departmental Representative* of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from *Departmental Representative*.

3.2 INSTALLATION

- .1 Install instrument transformers and ensure accessibility.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .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 - Cleaning.
- .3 Waste Management: separate waste materials for recycling, reuse in accordance with Section 01 74 20 - Construction/ Demolition Waste Management and Disposal.
 - .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 control and signal transformers installation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .4 Section 26 05 00 - Common Work Results for Electrical.
- .5 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.29-15(R2019), Panelboards and Enclosed Panelboards.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings 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 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect panelboard from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan, Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.

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 Include transient voltage surge protection with overcurrent protection at panelboard A, the main service panelboard.
- .3 Ensure paneboard A is rated for main service entry.
- .4 250 V panelboards bus and breakers rated for minimum available fault of 18,000 A rms symmetrical available fault or as indicated.
- .5 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.
- .6 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .7 Two keys for each panelboard and key panelboards alike.
- .8 Copper bus. Provide neutral of same rating for 250 Volt panels.
- .9 Mains: suitable for bolt-on breakers.
- .10 Panelboards for surface mounting throughout
- .11 Isolated Ground Bus.

- .12 Include grounding busbar with 3 of terminals for bonding of conductor equal to breaker capacity of the panelboard.
- .13 Trim with concealed front bolts and hinges.
- .14 Trim and door finish: baked grey enamel.
- .15 All panelboards and associated moulded case breakers shall be fully rated as it pertains to the minimum available fault rating (Amps RMS Symmetrical. Series rated combinations shall not be acceptable

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.
- .3 Nameplate for each circuit in distribution panelboards size 2.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections of Contract 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 wall mounted panelboards on channels fastened with suitable anchors. Provide suitable channel frame supports and floor plates with braces and anchors where installed on the open floor area.
- .3 Install plywood backboards in accordance with carpentry sections behind panelboards. Plywood to be 2hr fire rated, ensure that fire rating is visible after panelboard installation.
- .4 Install wall-mounted panelboards at 1950 mm above finished floor to top unless indicated otherwise on the drawings.
- .5 Connect loads to circuits.
- .6 For 250 Volt panels connect neutral conductors to common neutral bus with respective neutral identified.

3.3 PROTECTION

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

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 recycling in accordance with Section 01 74 20.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.
- .2 All devices must be minimum "specification grade".

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .4 Section 26 05 00 - Common Work Results for Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.42-10(R2015), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA C22.2 No.42.1-13(R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55:15(R2020), Special Use Switches.
 - .4 CAN/CSA C22.2 No.111-18, General-Use Snap Switches (Trinational standard with UL 20 and NMX-J-005-ANCE).
 - .5 CSA C22.2 No. 46-13 Electric Air Heaters

1.4 PRODUCT DATA/ SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Submit product data sheets for heating units. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Mounting methods.
 - .4 Physical size.
 - .5 kW rating, voltage, phase.
 - .6 Cabinet material thicknesses
 - .7 Limitations.
 - .8 Colour and finish.

- .3 Submit product data sheets for unit heaters and baseboard convectors.
 - .1 Include product characteristics, performance criteria, physical size, limitations and finish.
- .4 Manufacturer's Instructions: Provide to indicated special handling criteria, installation sequence and cleaning procedures.

1.5 CLOSEAOUT SUBMITTALS

- .1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 SWITCHES

- .1 15 or 20 A, as indicated, 120 V, and 250V single pole, double pole, three-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.

- .3 Toggle operated, horse power rated, low power; 120 V circuits where required.
- .4 Switches of one manufacturer throughout project.
- .5 Integral dimmer as indicated.

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 White urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and riveted grounding contacts.
- .2 Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, 'T' slot, U ground, with following features:
 - .1 White urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and riveted grounding contacts.
- .3 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Black urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
- .4 Receptacles for A/V electrical outlets:
 - .1 125 volt 15A duplex receptacle with integral surge suppression device; blue colour.
- .5 Other receptacles with ampacity and voltage as indicated.
- .6 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 In all finish areas provide stainless steel (1 mm thick).
- .3 Cover plates from one manufacturer throughout project.
- .4 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

- .5 Sheet metal cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.4 ELECTRICAL BASEBOARD HEATERS

- .1 Commercial perimeter wall mounted baseboard heater. Contractor shall provide product to meet Architect's aesthetic satisfaction
- .2 Fabricated from 22 gauge steel; approximate dimensions 65 mm deep x 150 mm high; length as indicated by Wattage; inlet grill bottom front; outlet grill top front; smooth back for direct to wall mounting.
- .3 Continuous, full length wireway.
- .4 Standard Watt density - 250 Watts per linear foot, single phase; voltage as indicated.
- .5 Element - singular tubular stainless steel sheathed with boxed aluminum fins, fastened at centre supported with nylon sleeves along its length.
- .6 Built in thermal protection cut off.
- .7 Integral Control through built in single pole line voltage thermostat.
- .8 Finish: Manufacturer's standard.

2.5 UNIT HEATERS

- .1 Commercial/ Industrial unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers and protective screen, finished to match cabinet.
- .2 Heavy duty 18 gauge steel cabinet.
- .3 Voltage: 208V, 3-ph. Or as indicated
- .4 Built in control circuit with control transformer and relay for control connection from remote wall mount, 120 V single pole thermostat.
- .5 Fan type unit heaters with built-in high-heat limit protection, fan-delay switches.
- .6 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount.
 - .1 Built-in fan motor thermal overload protection.
- .7 Elements: mineral insulated copper coated steel sheath or nickel/ chrome with brazed fins.
- .8 Cabinet finish: Phosphatized and finished with coats baked enamel; manufacturer's standard colour.

- .9 Support: Hangers and brackets for ceiling or wall mounting; finish to match cabinet.
- .10 Built in integral control circuit.

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 in accordance with Section 26 05 00.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .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 Baseboard Heater Installation:
 - .1 Concealed wiring - connect from rear mounted junction box through rear knock out to unit connection box.
 - .2 Surface wiring - where indicated connect from surface conduit on wall at top mounted knockout to unit connection box.
- .5 Cabinet Heater Installation:
 - .1 Concealed wiring - connect from rear mounted junction box through rear knock out to unit connection box.
 - .2 Surface wiring - where indicated connect from surface conduit on wall at top mounted knockout to unit connection box.
- .6 Unit Heater Installation:
 - .1 ceiling or mount on wall to achieve 2500 mm height from floor to centre of cabinet.

- .2 Make power and control connections.
- .7 Testing and Commissioning:
 - .1 Check and verify that finishes are intact.
 - .2 Verify connections are correct
 - .3 Verify fan and heating element operation.
 - .4 Verify thermostat operation.
 - .5 Verify circuit protection.
 - .6 Perform tests in accordance with Section 26 05 00 -
Common Work Results for Electrical.
 - .7 Test cut-out protection when air movement is
obstructed, fan shutdown for unit heater test.
 - .8 Test fan delay switch on unit heaters to assure
dissipation of heat after element shut down.
 - .9 Ensure heaters and controls operate correctly.

3.2 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 26 05 00 - Common Work Results with Electrical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide fuse performance data characteristics for each fuse type and size above 5A.
- .3 Shop Drawings:
 - .1 Provide shop drawings in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in moisture free location.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 20.

1.4 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00.
- .2 Six spare fuses of each type and size installed up to and including 600 A.

Part 2 PRODUCTS

2.1 FUSES - GENERAL

- .1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

- .1 Class L fuses.
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.
- .2 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.
- .3 Class R -R fuses.
 - .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
 - .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 Class C fuses.

2.3 FUSE STORAGE CABINET

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

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
 - .1 Install rejection clips for Class R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.
- .5 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials for moulded-case and accessory high-fault protectors for installation in switchboards (switchgear), panelboards, motor control centres (MCC) or when individually mounted in enclosures.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 26 24 16.01 - Panelboards Breaker Type.
- .5 Section 26 29 10- Motor Starters to 600 V.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.2 No. 5-16, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and product data 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.
 - .2 Without exception, shop drawings are required for the following items:
 - .1 All circuit breaker types covered by this section.
- .3 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit three (3) copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local

manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

- .1 Production certificate of origin must be submitted to Consultant.
- .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
- .3 Any work of manufacturing, assembly, or installation to begin only after acceptance of production certificate of origin by Consultant. Unless complying with this requirement, Consultant reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
- .4 Production certificate of origin must contain:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
 - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
 - .3 Contractor's name and address and person responsible for project.
 - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
 - .5 Name and address of building where circuit breakers will be installed:
 - .1 Project title (title indicated in specifications or on plans)
 - .2 End user's reference number

1.5 DELIVERY, STORAGE AND HANDLING

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

- .3 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Circuit breakers, Moulded-case circuit breakers and accessory high-fault protectors, 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. Do not use single pole circuit breakers interconnected through an interlocking pin, or similar arrangement, for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from three (3) to (eight) 8 times current rating.
- .5 Circuit breakers rated 400 A or greater to include electronic trip unit.
- .6 Circuit breakers with interchangeable trips as indicated.
- .7 Circuit breakers to have minimum interrupting capacity as indicated.
- .8 For branch panelboards installed in dwelling units, install:
 - .1 Moulded case circuit breakers (plug-in type), with thermal magnetic trip unit, single handle for multi-pole application.
 - .2 Integral arc fault protection (AFP) for branch circuits servicing outlets in bedrooms and as indicated.
- .9 Minimum short-circuit current rating (SCCR) of circuit breakers:
 - .1 120/208 V : 18 kA or as indicated
 - .2 120/240 V : 18 kA or as indicated

2.2 THERMAL MAGNETIC BREAKERS

- .1 For general protection and control application. 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.

2.3 BREAKERS FOR MOTOR PROTECTION

- .1 Breakers where required in motor protection and control devices shall have instantaneous trip units for short circuit protection only; circuit overload protection provided by motor protection and control device.

2.4 ELECTRONIC TRIP UNIT

- .1 Integral current and voltage sensors, built-in electronic processor and solenoid release mechanism for opening of circuit breaker.
- .2 Adjustment of LSIG trip characteristics using electronic keypad or adjustable dials. Adjustable trip characteristics to include:
 - .1 Long-time Pick-up (LP)
 - .2 Long-time Delay (LD)
 - .3 Short-time Pick-up (SP)
 - .4 Short-time Delay (SD)
 - .5 Instantaneous Pick-up (IP)
 - .6 Ground Fault Pick-up (GP)
 - .7 Ground Fault Delay (GD)
- .3 Digital display unit to indicate measured power, amperage and voltage.
- .4 Functional capability to communicate measured values to Owner BMS or other system via Modbus TCP/IP or equivalent system. Use of gateway to convert from one protocol to Owner's protocol is acceptable. If a gateway is required, then ensure the device is installed in separate low-voltage compartment of distribution board.
- .5 Adjustable setting available on backlit display.
- .6 Adjust all circuit breaker setting on site as per requirements of Device Coordination Study. Refer to drawings or specification appendix for additional details.

2.5 ENCLOSURE

- .1 NEMA 1 housing.

2.6 SOLID STATE TRIP BREAKERS

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time instantaneous short time tripping for ground and phase fault short circuit protection.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers in panelboards, as indicated.

3.2 TESTING

- .1 Using the manufacturers proprietary test set check breakers and test to confirm operation within published tolerances and set each breaker in accordance with the co-ordination study.
- .2 Visual and mechanical inspection:
 - .1 Inspect circuit breaker for proper mounting.
 - .2 Operate circuit breaker to insure smooth operation.
 - .3 Check tightness of bolted connections and/or cable connections by calibrated torque-wrench method in accordance with manufacturer's published data.
- .3 Electrical Tests - general for breakers 400A fame and larger:
 - .1 Perform a contact resistance test.
 - .2 Perform an insulation-resistance test at 1000 Volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.
- .4 Perform all testing in the presence of the Departmental Representative. Provide test results report and include copies in the Operation and Maintenance Manuals.

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.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .5 Section 26 05 00 - Common Work Results for Electrical.
- .6 Section 26 29 10 - Motor Starters to 600 V.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.2 No.4-2016, Enclosed and Dead-Front Switches.
 - .2 CSA C22.2 No.39-13(R2017), Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect disconnect switches from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Operations and Maintenance Manual (O&M): Provide operating and maintenance instructions to be incorporated into the O&M Manual.

Part 2 PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 *Heavy Duty* Fusible, non-fusible, disconnect switch in CSA Enclosure type 1, size or as indicated.
- .2 Provision for padlocking in off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position. Interlock may be defeatable-type for use by qualified electrician.
- .4 Fuses: size as indicated.
- .5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.
- .8 Fuses: size as indicated, in accordance with Section 26 28 13.01-Fuses - Low Voltage.

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 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused.

Installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable.
- .2 Install disconnects on fire rated plywood in unfinished rooms such as mechanical and electrical service rooms. Ensure rating of plywood is visible after installation.
- .3 Install disconnects on a self-supporting frame constructed using U-channels. Provide frame for disconnects when connected to motors in outdoor installation, or in mechanical rooms where no wall space is available at indicated location.
- .4 Ensure required clearance of 1 m is provided in front of disconnects.

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 recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

1.2 RELATED REQUIREMENTS

- .1 Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
- .2 Section 26 05 00 - Common Work Results for Electrical.
- .3 Section 26 29 10 - Motor Starters to 600V.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.14-13, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 1-2000 (R2015), Industrial Control and Systems: General Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect control devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan, Waste Reduction Workplan related to Work of this section and in accordance with Section 01 74 20 - Construction /Demolition Waste Management and Disposal.

Part 2 PRODUCTS

2.1 AC CONTROL RELAYS

- .1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.
- .2 Convertible contact type: contacts field convertible from NO to NC, types as indicated as follows: electrically held; permanent magnet latched; double-voltage type with sliding barrier to permit access to contacts only or coil only; with solid state timer. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.
- .3 Sealed contact type: electrically held permanent magnet latched with poles and front mounted contact block to provide additional poles. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.
- .4 Universal pole type: electrically held mechanically held latch type with poles, convertible from NO to NC by changing wiring connections. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.
- .5 Fixed contact plug-in type: general purpose or low coil current heavy duty with multiple poles. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.

2.2 RELAY ACCESSORIES

- .1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 SOLID STATE TIMING RELAYS

- .1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.
- .2 Operation: on-delay or off-delay.
- .3 Potentiometer: self contained to provide time interval adjustment.
- .4 Supply voltage: as indicated, AC, 60 Hz.
- .5 Temperature range: minus 20°C to 60°C.

.6 Output contact rating: maximum voltage 300 V AC or DC.
Current: NEMA ICS 1 - 10 A minimum.

.7 Timing ranges: minimum 0.1 s, maximum 60s.

2.4 INSTANTANEOUS TRIP CURRENT RELAYS

.1 Enclosure: CSA Type 1 or open type in custom or motor control equipment.

.2 Contacts: NO, NC automatic reset with adjustable tripping point.

.3 Control: 3 wire, with provision for shorting contacts during accelerating period of motor.

.4 Contact rating: NEMA ICS 1 - 10 A minimum.

2.5 PUSHBUTTONS

.1 Illuminated, heavy duty oil tight. Operator recessed with 1-NO and 1-NC 120 V contacts rated at 10 A, AC, labels as indicated. Stop pushbuttons coloured red, provision for padlocking in depressed position labelled "stop". Emergency stop with red mushroom head.

2.6 SELECTOR SWITCHES

.1 Maintained 2 or 3 position labelled as indicated; heavy duty oil tight; operator's standard knob, contact arrangement as indicated, rated 10 V, 120 VA, AC.

2.7 INDICATING LIGHTS

.1 Heavy duty oil tight, transformer LED type, push-to-test, lens colours: as indicated, supply voltage, lamp voltage and V, labels as indicated.

2.8 CONTROL AND RELAY PANELS

.1 CSA Type 1 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identify terminals.

2.9 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 60 Hz ac and secondary voltages as indicated.

.3 Rating: as indicated or required for control circuit burden.

.4 Secondary fuse: select for short circuit protection.

- .5 Close voltage regulation as required by magnet coils and solenoid valves.

2.10 TERMINAL STRIPS

- .1 For installation in terminal cabinets
- .2 Terminals strips to be heavy duty industrial screw-type rated 600 volts, mechanical pressure type with self-locking provision
- .3 Material: current carrying parts - copper; phenolic base

2.11 THERMOSTAT (LINE VOLTAGE)

- .1 Wall mounted, for exhaust fan control.
- .2 Full load rating: 10 A; 120 Volt minimum or as indicated.
- .3 Temperature setting range: as indicated.
- .4 Thermometer Range: 0°C to 50°C.
- .5 Markings in 5° increments.
- .6 Differential temperature fixed at 2°C.

2.12 PROGRAMABLE DIGITAL TIME CONTROLS

- .1 Four (4) channel unit.
- .2 LCD display
- .3 Seasons: 1 to 4 different daily schedules
- .4 Holidays: 1 to 24 individual dates
- .5 Clock format: AM/PM
- .6 Contact rating: 10A (general purpose).
- .7 Independent momentary outputs (on and off): two (2) per channel
- .8 Voltage: 120 VAC.
- .9 Dry Contact type: SPDT (unpowered).
- .10 Battery backup for unit programming.

2.13 GAS DETECTION SYSTEM

- .1 General:
 - .1 Location and number of detection points:
 - .1 The number and location of the detection points indicated on the drawings only as a

reference. The manufacturer will need to supply drawings indicating the exact location of those points.

.2 Verification and calibration:

.1 The work includes the supply and services of a technician, accessories and calibrating gas containers for the verification and calibration of the sensors and transmitters every six (6) months (four times) from the final completion date.

.2 Following every technician site visit, a verification and calibration report must be submitted to the owner certifying the system is fully operational.

.2 CO and NO₂ detectors:

.1 Supply and install as per plans, all CO detection equipment and NO₂ analog sensors.

.2 Wall or duct installation, BACnet MS/TP network addressable carbon monoxide (CO) and nitrogen (NO₂) detectors, standalone single or double gas system installation.

.3 Each detector analyses selective toxic gas concentration. Detection through electrochemical cell technology.

.4 The detectors must be installed at a specific height to efficiently detect the toxic gas. The CO detectors will be installed at a height of 3 to 5' from the floor and the NO₂ at a height of 1 to 3' from the ceiling.

.5 The system will be supplied complete with a data processing panel, with two alarm levels and able to manage two sensors.

Gas	Resolution	Range	Alarm A	Alarm B
CO	1 ppm	0-250 ppm	25 ppm	200 ppm
NO ₂	0.1 ppm	0-16 ppm	0.7 ppm	2 ppm

.6 Where the detector is installed on a duct, supply the required enclosure.

.7 With visual and audible alarm.

Part 3 Execution

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .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 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 20 - Construction /Demolition Waste Management and Disposal.
- .4 Remove recycling containers and bins from site and dispose of materials at appropriate facility

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 The specified unit shall be designed, manufactured, tested and installed in compliance with the following standards:
- .2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE Standard 1100-2005 - IEEE Recommended Practice for Powering and Grounding Electronic Equipment.
 - .2 ANSI/IEEE C62.1-1989 IEEE Standard for Surge Arresters for Alternating-Current Power Circuits.
 - .3 ANSI/IEEE C62.11-2012 - IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV).
 - .4 ANSI/IEEE C62.41.1-2002 IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
 - .5 ANSI/IEEE C62.41.2-2002 IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
 - .6 ANSI/IEEE C62.45-2002 - IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
- .3 National Electrical Manufacturer's Association (NEMA)
 - .1 NEMA LS1-1992 (R2000), Low Voltage Surge Protection Devices.
- .4 Underwriters' Laboratories Inc. (UL)
 - .1 UL 1449-2014, Transient Voltage Surge Suppressors Edition, 1996.
 - .2 UL 1283-2017, Electromagnetic Interference Filters - Revision 2.
 - .3 UL 248-1-2011, Low-Voltage Fuses - Part 1: General Requirements.
- .5 The unit shall be UL 1449 Second Edition Listed and CUL approved as a Transient Voltage Surge Suppressor and UL 1283 listed as an Electromagnetic Interference Filter.

1.3 ENVIRONMENTAL REQUIREMENTS

- .1 Operating Temperature. Operating temperature range: -40°C to +60°C.

- .2 The unit shall be capable of operating up to 4,000 meters above sea level.
- .3 There shall be no appreciable magnetic fields generated by the SPD unit.

1.4 SHOP DRAWINGS SECTION

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

1.5 OPERATION MANUALS

- .1 Refer to Section 01 33 00 - Submittal Procedures.
- .2 Include all test reports and commissioning data sheets in manual.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Provide SDP units in main switchboard and branch distribution panels immediately downstream of transformers, as indicated on drawings.
- .2 Rating of SPD unit to be suitable for protection of distribution equipment connected.
- .3 Nominal line voltages:
- .4 120/208 V, 3 phase, 3 wire, grounded wye.
- .5 Monitoring Display:
 - .1 Surge counter
 - .2 All phase voltage display
 - .3 G voltage and current display
 - .4 Audible alarm
 - .5 Dry contacts
 - .6 All phase LED's monitoring
- .6 Protection Modes:
 - .1 WYE configures systems providing line-to-ground and line-to-line protection.
- .7 Maximum continuous operating voltage (MCOV) shall be greater than 115% of nominal voltage.
- .8 Operating frequency range shall be 47 to 63 Hertz.

- .9 Units shall include an engineered solid-state high performance suppression system utilizing arrays of non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance and proven reliability. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads.
- .10 The unit shall include a high frequency extended range power filter and shall be UL 1283 listed as an Electromagnetic Interference Filter. The filter shall reduce fast rise-time, high frequency, error-producing transients and electrical line noise to harmless levels. The filter shall provide minimum noise attenuation as specified herein.
- .11 Internal Connections:
 - .1 All full magnitude transient current shall be conducted utilizing low-impedance copper bus bar. No plug-in component modules or quick-disconnect terminals shall be used in surge current-carrying paths.
- .12 Field Connections:
 - .1 The unit shall include mechanical or compression lugs for each phase, neutral and ground.
 - .2 Units supplied in a separate NEMA 4 metal enclosure or mounted within distribution equipment enclosure. Flush mounted.

2.2 SPD UNITS

- .1 TYPE 1
 - .1 Rated Single Pulse Surge Current Capacity:
 - .1 The rated single pulse surge current capacity, in Amps, for each mode of protection of the unit shall be no less than:

L-G	150,000 A
L-L	150,000 A
 - .2 Wave forms (μ s) 10/350

.2 Testing:

In compliance with NEMA-LS-1, the unit shall have single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL 1449 Second Edition surge to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current. To complete the test another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL 1449 surges does not vary by more than 10%.

.3 Minimum Repetitive Surge Current Capacity:

Per ANSI/IEEE C62.41- Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits and ANSI/IEEE C62.45- EEE Guide on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.

.4 Clamping voltages for 208V, 3-phase, 3-wire system:

	B3 Ring Wave 6 kV, 500A	B3/C1 Comb. Wave 6kV/3kA	C3 Comb. Wave 20 kV, 10 kA	UL 1449 2 nd Edition SVR
L - G	1245	1960	2760	1800
L - L	1060	2260	2950	1800

.5 High Frequency Extended Range Power Filter: Filter system EMI-RFI noise rejection, or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1.

.6 Overcurrent Protection:

- .1 Each suppression element shall be individually fused to ensure that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode, or product, deficient by more than 10%.
- .2 All fuses and overcurrent/fault current protection devices shall consist of self arch-quenching, sand-encapsulated UL248-1 Recognized fuse arrays. Each fuse shall be individually sealed in a manner that eliminates cross arching.

.7 Transient Conduction Path:

All full magnitude transient current shall be conducted on low-impedance solid copper bussing. If printed circuit boards are utilized in surge current paths, no single trace shall be allowed to conduct more than the proportional current share of the connected SPD component.

.2 TYPE 2

.1 Rated Single Pulse Surge Current Capacity:

.2 The rated single pulse surge current capacity, in Amps, for each mode of protection of the unit shall be no less than:

L-G 150,000 A
 L-L 150,000 A

.3 Wave forms (µs) 8/20

.4 Testing:

.1 In compliance with NEMA-LS-1, the unit shall have single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. The test shall include a UL 1449 Second Edition surge to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current. To complete the test another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL 1449 surges does not vary by more than 10%.

.5 Minimum Repetitive Surge Current Capacity:

Per ANSI/IEEE C62.41- Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits and ANSI/IEEE C62.45- IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.

.6 Clamping voltages for 600V, 3-phase, 3-wire system:

	B3 Ring Wave 6 kV, 500A	B3/C1 Comb. Wave 6kV/3kA	C3 Comb. Wave 20 kV, 10 kA	UL 1449 2 nd Edition SVR
L - G	1245	1960	2760	1800
L - L	1060	2260	2950	1800

- .7 High Frequency Extended Range Power Filter: Filter system EMI-RFI noise rejection, or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1.
- .8 Overcurrent Protection:
 - .1 Each suppression element shall be individually fused to ensure that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode, or product, deficient by more than 10%.
 - .2 All fuses and overcurrent/fault current protection devices shall consist of self arch-quenching, sand-encapsulated UL248-1 Recognized fuse arrays. Each fuse shall be individually sealed in a manner that eliminates cross arching.
- .9 Transient Conduction Path:

All full magnitude transient current shall be conducted on low-impedance solid copper bussing. If printed circuit boards are utilized in surge current paths, no single trace shall be allowed to conduct more than the proportional current share of the connected SPD component.

2.3 ACCEPTABLE MANUFACTURER

- .1 Accepted Equivalent Manufacturer:
 - .1 Tomas & Betts
 - .2 Eaton
 - .3 Leviton
 - .4 Siemens.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Refer to single line diagram for locations.
- .2 Install as per manufacturers recommendations.
- .3 Keep conductors short as possible, angle must be >90°.stall pushbutton stations, control and relay panels, control devices and interconnect.

3.2 DOCUMENTATION

- .1 The manufacturer shall provide data showing UL 1449 Second Edition product listing and certified documentation of applicable Location Category Testing in full compliance with NEMA LS-1.

3.3 FIELD QUALITY CONTROL

- .1 Refer to Section 01 45 00 - Quality Control and Section 26 05 00 - Common Work Results for Electrical.
- .2 Pay all costs for manufacturers technical representative to perform installation field tests.
 - .1 Perform unit self-diagnostic test.
 - .2 Start-up testing includes:
 - .1 Voltage measurement at installation.
 - .2 Impulse injection to confirm system suppression tolerances (off-line).
 - .3 Visually inspect grounding.
 - .3 Visual inspection of all wiring and ground connections.
 - .4 Confirm indication lamp operation.
 - .5 Record surge counter number.
- .3 Provide written report of all test results. Perform all tests in the presence of the Departmental Representative and include copies of test results in the Operation and Maintenance Manuals.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 26 05 00 - Common Work Results for Electrical.
- .4 Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .5 Section 26 28 23 - Disconnect Switches Fused and Non-Fused
- .6 Section 26 29 03 - Control Devices.

1.2 REFERENCES

- .1 International Electrotechnical Commission (IEC)
 - .1 IEC 60947-4-1 Ed. 3.0 b: 2018, Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters.
- .2 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.14-18, Industrial Control Equipment.
- .3 Electrical and Electronic (Equipment) Manufacturers Association of Canada (EEMAC)
 - .1 EEMAC E14-1-1983, Standard for Industrial Controls and Systems

1.3 PROTECTION, CONTROL AND CONNECTION REQUIREMENTS

- .1 In general, there are categories of starting equipment for single phase motors.
 - .1 Integral Mounted Starters: Some items of mechanical equipment such as boilers, waste water pump control panels, and grinder control panels, have the starter(s) mounted as part of the equipment. For this equipment, supply line side feeder protection and wire to the terminals of the equipment.
 - .2 Separately Mounted Starters: For motors without integral mounted starters, supply separately mounted starters as indicated on the Drawings and wire the equipment.
- .2 Provide manual starters for all single phase motors unless otherwise indicated on the motor schedule.
- .3 Provide interlocking between starters where required.

- .4 Provide all starter accessories such as pilot lights, Hand-Off-Auto, Start-Stop, etc. whether integrally or remote mounted. These shall be heavy duty oil tight, unless otherwise specified.
- .5 Provide isolating disconnect devices at motors.

1.4 SHOP DRAWING AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.5 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00.
- .2 Include operation and maintenance data for each type and style of starter.
- .3 Include all test reports and commissioning data sheets.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Starters: EEMAC E14-1.
 - .1 Half-size starters not acceptable.
 - .2 Starters to CSA C22.2 No.14.
- .2 Provide Motor Circuit Protectors (MCP) in all starters.
- .3 Provide adjustable (0-5 min) starting time delay timer in all starters.

2.2 ENCLOSURES

- .1 All individually mounted motor starters shall be enclosed in a general purpose sheet steel enclosure sprinkler proof; unless in wet areas where they shall be watertight NEMA3.

2.3 FULL VOLTAGE NON-REVERSING (FVNR) MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated rapid action type.
 - .2 Motor overload protective device in each phase manually reset from outside enclosure.
 - .3 Power and control terminals.
 - .4 Wiring and schematic diagram inside starter enclosure in visible location.
 - .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
 - .6 Control transformer.
- .2 Combination type starters to include motor circuit interrupter with operating lever on outside circuit interrupter and provision for:
 - .1 Locking in "OFF" position with up to three (3) padlocks.
 - .2 Locking in "ON" position.
 - .3 Independent locking of enclosure door.
 - .4 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
 - .1 Selector switches: for each starter or contactor, heavy duty labelled HAND, OFF, AUTO, or ON; OFF to suit the application.
 - .2 Indicating lights: LED type, oil-tight, one green OFF, one red ON for each starter or contactor.
 - .3 2-N/O and 2-N/C spare auxiliary magnetic contacts unless otherwise indicated.
 - .4 Individual control transformers with primary and secondary fuse protection.
- .4 Microprocessor based motor control where indicated shall be Cutler Hammer IT Series or equal.

2.4 MANUAL MOTOR STARTERS

- .1 Single phase manual motor starters of size, type, rating and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One overload heater manual reset, trip indicating handle

- .2 Three phase manual motor starters of size, type, rating and enclosure type as indicated, with component as follows:
 - .1 Switching mechanism, quick make and break
 - .2 One overload heater manual reset, trip indicating handle
- .3 Accessories:
 - .1 Toggle switch heavy duty labeled as indicated.
 - .2 Indicating light: heavy duty type and colour as indicated.
 - .3 Locking tab to permit padlocking on "ON & "OFF position.

2.5 CONTROL TRANSFORMERS

- .1 Provide individual control transformers for each starter. Refer to Section 26 29 03 for description.
- .2 Control transformer shall be complete with primary and secondary fuse protection.

2.6 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00.
- .2 Magnetic starter designation label, black plate, white letters, Size 1 engraved as indicated on the motor control schedule.

2.7 MOTOR STARTER SCHEDULE

- .1 Refer to drawing for the Motor Starter Schedule.

Part 3 EXECUTION

3.1 STARTER VERIFICATION

- .1 Field check motor starters and variable frequency drives, supplied prior to commissioning equipment. As a minimum, verify the following:
 - .1 Check of control circuits
 - .2 Verify that overload relay installed is correctly sized for motor used
 - .3 Record overload relay size and motor nameplate amperage
 - .4 Ensure all connections are tight.

- .2 Measure and record motor amps, under load conditions and compare with full load amps and motor service factor. Report any excessive readings and unbalance. Measure voltage as close to motor terminals as possible while motor is running
- .3 Set all motor circuit protectors to the minimum level which will consistently allow the motor to start under normal starting conditions.

3.2 OVERLOAD RELAYS

- .1 For starters provided, select overload relays in accordance with relay and motor manufacturers' recommendations, considering motor service factors, ambient temperature, temperature differences between motor and starter locations. Monitor motor operation during startup to ensure motor operation is satisfactory and relays provide proper protection. For side inlet fans and other long acceleration time loads, provide special overload relays to suite the start-up condition. Provide manufacturers' curves and data sheets where necessary to provide supporting data for motor protection.

3.3 INSTALLATION

- .1 Install starters, variable frequency drives, connect power and control as indicated.
- .2 Ensure correct overload devices elements installed.
- .3 Provide a complete system of wiring to motors and controls as specified herein and as shown on the drawings.
- .4 Unless specifically noted otherwise, wire and leave in operation all electrically operated equipment supplied under all contracts related to this project. Examine the drawings and shop drawings of all Divisions for the extent of electrically operated equipment supplied under other contracts.
- .5 All control wiring diagrams shown on the drawings illustrate typical control circuits applicable to the equipment. Control circuits may vary with different manufacturers of equipment. Verify all control circuits with the suppliers of the equipment and make any corrections that may be required.
- .6 Unless specifically noted otherwise, supply all pushbuttons, relays, starters, etc., necessary for the operation of equipment. Check all starters, relay coils and thermal elements to ensure that they provide the necessary protection for motors.
- .7 Do not operate motors and controls until approval is obtained from the trade providing equipment.

- .8 Examine drawings and shop drawings of other Divisions to obtain exact location of motors and equipment shown on drawings. Where necessary, obtain conduit locations from other trades' drawings and shop drawings.
- .9 Assist in placing in operation all mechanical equipment having electrical connections.
- .10 Provide three phase starters with fused 120 volt control transformers and overload relays.
- .11 Provide all power wiring for all motors and control wiring as indicated on the drawings.
- .12 In general, wiring for freezestats, firestats, E.P. switches, P.E. switches, dampers, temperature controllers, flow switches, solenoid valves, etc., for heating and ventilating equipment. Provide terminals in starters and MCCs for control wiring and extend starter control circuits to all field devices.
- .13 Provide isolation disconnect switches adjacent to all motors.
 - .1 3-phase motors:
 - .1 Provide non-fused heavy duty industrial switches as specified in Section 26 28 23.
 - .2 Use EEMAC 4 enclosures outdoors and EEMAC 1 indoors.
 - .3 Switches to be horsepower rated.
 - .2 120 volt single phase motors: provide manual starter without overload relay.
 - .3 208 volt single phase motors: provide manual starter without overload relay.

3.4 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, variable frequency drives, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 46-13, Electric Air-Heaters.
 - .2 CSA C22.2 No. 141-15, Emergency Lighting Equipment.
 - .3 CSA B139 Series:19, Installation Code for Oil Burning Equipment.
 - .4 CSA C282:19, Emergency Electrical Power Supply for Buildings.
 - .5 CAN/CSA C22.2 No. 61010-1-12(R2017) - Safety Requirements for Electrical Equipment for Measurement Control and Laboratory Use. Part 1: General Requirements. (Adopted IEC 1010-1:1990 with modifications), Includes Update No. 1 (2015), Update No. 2 (2016).
 - .6 CSA C22.1 18, Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 329, Recommended Practice for Handline Releases of Flammable and Combustible Liquids and Gases, 2010 Edition
- .4 Underwriter's Laboratories Inc. (UL)
 - .1 UL508A-2001, Industrial Control Panels.
- .5 Underwriter's Laboratories of Canada (ULC).
 - .1 ULC S601-14, Standard for Shop Fabricated Steel Aboveground Steel Tanks for Flammable and Combustible Liquids.
 - .2 ULC S602-14, Standard for Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.
 - .3 ULC S652-16, Standard for Tank Assemblies for the Collection, Storage and Removal of Used Oil.
- .6 American National Standards Institute (ANSI) National Electrical Manufacturers Association (NEMA).
 - .1 ANSI/NEMA MG 1-16, Motors and Generators.

- .7 International Organization for Standardization (ISO)
 - .1 ISO 3046-1-2002, Reciprocating internal combustion engines - Performance - Part 1: Declarations of power, fuel and lubricating oil consumptions, test methods
 - .2 ISO 3046-4-2009, Reciprocating internal combustion engines - Performance - Part 4: Speed governing

1.2 DESCRIPTION OF SYSTEM

- .1 Emergency Power Generation Propane System shall consist of:
 - .1 Propane engine,
 - .2 Alternator,
 - .3 Engine/alternator control equipment,
 - .4 Engine cooling system including unit-mounted radiator,
 - .5 Starting system, including battery charger and battery,
 - .6 Exhaust system (silencer and flex connections),
 - .7 Structural steel mounting base and vibration isolators,
 - .8 Remote emergency stop button.
- .2 The system shall be designed to operate as an unattended automatic unit for designated systems loads.

1.3 MATERIALS AND EQUIPMENT

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the Electrical Safety Authority. CSA Labels shall be visible and legible after equipment is installed.

1.4 OPERATION AND MAINTENANCE DATA

- .1 The work of this section includes fabrication, assembly, factory testing, delivery, installation, field assembly, connections related to assembly, on-site testing, start-up and warranty of the system, and operating staff training instructions.
- .2 Installation, assembly and field connections shall include all interconnecting power and control wiring to terminals within the system, battery system, and installation of vibration isolation to unit and floor slab.

1.5 SHOP DRAWINGS AND PRODUCTION INFORMATION

- .1 Submit detailed shop drawing and product information for the generator system along with skin-tight enclosure.

.2 Generator:

- .1 Information for generator shall include:
 - .1 Submit complete and detailed information on the step load capability of the emergency generator, alternator and engine combination being supplied. Refer to 2.2.4 for step-load transient response capabilities.
 - .2 Dimensioned outline drawings showing all connections and components on the unit, including vibration isolators, exhaust system, drip trays and total weight.
 - .3 Exhaust silencer drawings and selection criteria.
 - .4 Engine make and model with performance curves including brake horsepower versus rated speed curves.
 - .5 British (ISO) standard rating of engine.
 - .6 Governor make and model.
 - .7 Fuel consumption information.
 - .8 Fuel Cooler design and flow calculations
 - .9 Heat rejection, combustion air, cooling air requirements.
 - .10 Starting battery, rack drawings and battery selection criteria.
 - .11 Battery charger drawings.
 - .12 Flow diagrams for propane fuel, lubricating oil, cooling air and engine cooling system.
 - .13 Complete wiring diagrams for control and power wiring with identified terminal numbers for all interconnection between components, including all connections external to the system.
 - .14 Alternator make and model.
 - .15 Alternator damage curves.
 - .16 Alternator short-circuit decrement curves plotted against main breaker curve to show proper co-ordination over the full range of alternator output.
 - .17 Load Bank breaker and load bank cable connections
 - .18 Schematic block diagrams showing all components and identifying electrical and mechanical field connections including control and status wiring.
- .2 Calculations for full load output at 0.8 PF lagging with engine capacity calculated for site conditions based on CSA standard.
- .3 Provide calculations for standby rating.
- .4 Descriptive set operation including:

- .1 Automatic starting and transfer to load and back to normal power, including time in seconds from the start of cranking until the unit reaches the rated voltage and frequency.
- .2 Manual starting.
- .3 Automatic shutdown.
- .5 Engine alternator control panel: dimensioned layout, details and wiring diagrams with the make and type of all devices.
- .6 Drawings and information on the complete vibration mounting assembly.
- .7 Exact static and dynamic loading weights with dimensions shall be provided for the propane generator set assembly in the wet and dry conditions and including enclosure weights. These shall be submitted with the shop drawings.
- .3 Skin-tight enclosure:
 - .1 Submit shop drawings including all design calculations, stamped and signed by a qualified Professional Engineer registered or licensed in the Province of Ontario for fabricator designed assemblies, components, and connections.
 - .2 Indicate plans and grid lines, structural members and connection details, bearing and anchorage details including point loads on the enclosure pad, enclosure cladding, framed openings, accessories, schedule of materials and finishes, camber and loadings, fasteners and welds. In addition, indicate on plans design loads for enclosure top, sides and overall structure (gravity, wind and seismic loads).
 - .3 Clearly indicate:
 - .1 Acoustic performance.
 - .2 Mounting and anchoring requirements.
 - .3 Ventilation requirements and clearances.
 - .4 Connection points for electrical power, control and alarm feed system.
 - .5 Enclosure construction details.
 - .6 Location of all equipment inside enclosure, i.e. generator, exhaust silencer, plumbing works, electrical components, etc.
 - .7 Approximate dimensions.
 - .4 Indicate detailed description of mechanical, electrical and other systems in Work.
 - .5 Describe requirements of other systems of components related to this Work but provided by others

- .1 Obtain necessary information required to detail this Work including methods of integration and securing.
- .6 Indicate erection dimensions and methods.

1.6 OPERATION AND MAINTENANCE MANUAL

- .1 Provide data in a separately bound operation and maintenance manual for the complete system.
- .2 Operation and Maintenance Manual to include instructions for the particular unit supplied and not a general description of units manufactured by the supplier and:
 - .1 Operation and maintenance instructions for engine, alternator, control panel, battery charger, battery, fuel system, exhaust system and accessories to permit effective operation, maintenance and repair.
 - .2 Technical data:
 - .1 Illustrated parts lists with parts catalogue numbers.
 - .2 Schematic diagram of electrical controls.
 - .3 Flow diagrams for:
 - .1 fuel system,
 - .2 lubricating oil,
 - .3 cooling system, and
 - .4 certified copy of factory test results.
 - .4 Include a complete one-line power drawing with all components and operating descriptions.
 - .5 Include a schematic drawing of engine lubrication system, illustrated drawings, and complete electric schematics and wiring diagrams of all equipment and controls. Also include a list of all parts used in the propane generator and control cubicles and a list of tools. The source of all parts shall be stated.
 - .3 Include copies of completed data sheets and test results.

1.7 TRAINING

- .1 The propane generator set supplier shall provide a qualified service representative for a period of two days to instruct the operating personnel in the correct operation and maintenance of the set. Include all costs in this contract.

1.8 FACTORY WITNESS TEST

- .1 Factory test the generator set, including engine, alternator, controls and accessories.

- .2 Notify the Departmental Representative 15 days in advance of date of the factory test.

- .3 Test procedures:
 - .1 Prepare blank forms and check sheet with spaces to record data.
 - .2 Mark check sheet and record data on forms in duplicate as test proceeds.
 - .3 The Departmental Representative and manufacturer's representative signature on the completed forms to indicate concurrence in results of the test.
 - .4 Provide test equipment to demonstrate all generator systems characteristics described in this specification. Equipment to include but not limited to:
 - .1 Power analyzers, to record and print voltage, current and frequency during tests,
 - .2 Digital true rms ammeter / voltmeter,
 - .3 Tachometer,
 - .4 Vibration analyzer,
 - .5 Sound level analyzer, and
 - .6 Infrared digital thermometer (non contact).

- .4 Testing - General:
 - .1 Before starting the load test, perform the following:
 - .1 Verify calibration of all instrumentation (meters and gauges) using proper calibration equipment for speed, temperature, pressure, frequency, voltage and current (AC and DC).
 - .2 Verify approved and calibrated load bank is provided.
 - .3 Demonstrate the protection and operation of the low lube oil-pressure switch and over-temperature switch. The supplier shall identify methods that will be utilized to test the operation of each of these safety devices to ensure that the generator will shut down in the event that one of these devices operate.

- .5 Load test:

- .1 With 100% rated load and at 40°C ambient temperature, operate set for 4 hours continuously taking readings at 15-minute intervals. At the end of the fourth (4th) hour test, operate the propane generator assembly at 110% rated load for one hour, taking readings at 15-minute intervals. Record the following:
 - .1 Time of reading,
 - .2 Running time,
 - .3 Ambient temperature (measured at engine air intake),
 - .4 Lube oil pressure,
 - .5 Lube oil temperatures (inlet and outlet),
 - .6 Engine coolant temperatures (inlet and outlet),
 - .7 Exhaust stack temperatures (before and after turbo),
 - .8 Manifold pressure
 - .9 Alternator voltage, Phases 1, 2 and 3,
 - .10 Alternator current, Phases 1, 2 and 3,
 - .11 Power in kW,
 - .12 Frequency in Hz,
 - .13 Power factor,
 - .14 Battery charging current (Disconnect battery charger and record generator output current every minute for the first ten minutes after starting and every two minutes for the next 20 minutes.),
 - .15 Battery voltage,
 - .16 Alternator stator temperature,
 - .17 Ambient air temperature inside panel with all doors closed.
 - .18 Vibration displacement.
 - .19 Number of starts, and
 - .20 Using the infrared thermometer, record the highest surface temperature of each of the following:
 - .1 Alternator,
 - .2 Engine,
 - .3 Exhaust pipe,
 - .4 Cooling pipes,
 - .5 Fuel pipes, and
- .6 Demonstrate overvoltage and under-frequency safety shutdowns by adjusting the voltage regulator and governor.

- .7 Provide accurate means for determining fuel and lubricating oil consumption. Measure and record total consumption and record fuel consumption rate.
- .8 Demonstrate all safety functions and alarms to be in compliance with the listed performance herein.
- .9 Prior to commencing the full load test use a power analyzer to record frequency and voltage variations on three phases during load switching procedures. From a cold start, no load to full load, the transient response shall not exceed voltage and frequency capabilities in 2.2.5 - Voltage Regulation/Control. Each load change delayed until steady state conditions exist. Switching increments to include:
 - .1 No load to 100% full rated load to no load.
 - .2 No load to 75% rated load to no load.
 - .3 No load to 50% rated load to no load.
 - .4 No load to 25% rated load to no load.
 - .5 Record battery voltage drop during crankings
- .10 Demonstrate:
 - .1 Automatic starting of set.
 - .2 Automatic shut down of engine.
 - .3 That the battery charger reverts to the high rate charge after cranking.
 - .4 Test and record:
 - .1 Time delay on start,
 - .2 Cranking time until engine starts, and
 - .3 Time required to achieve steady state condition.
 - .5 Demonstrate all devices and status indications including alarms and shutdowns:
 - .1 Overcranking,
 - .2 Low engine temp. alarm,
 - .3 High engine temp. alarm,
 - .4 High engine temp. shutdown,
 - .5 Low lube oil pressure alarm,
 - .6 Low lube oil pressure shutdown,
 - .7 Overspeed,
 - .8 Low fuel level,
 - .9 Emergency supply to load,
 - .10 Control switch not in auto,
 - .11 Low battery voltage,
 - .12 Lamp test,
 - .13 Common alarm in remote and local,

- .14 Audible alarm silencing,
 - .15 Alternator overvoltage,
 - .16 Under frequency,
 - .17 Combustion air shutdown damper,
 - .18 Radiator low coolant level,
 - .19 Output breaker open alarm, and
 - .20 Output breaker trip.
- .11 Carry out vibration testing - use qualified mechanical vibration analysis technician using instrumentation designed for the purpose.
- .1 Measure and record machine vibration levels at a minimum of 12 positions, under the following conditions:
 - .1 100% Full Load - No Load
 - .2 75% Load - No Load
 - .3 50% Load - No Load
 - .4 25% Load - No Load
 - .2 Maximum allowable vibration 5 mils peak to peak amplitude for vibration frequency from 0 to 1800 CPM.
- .12 Measure audible noise at 7 m around the generator.
- .13 Generator Enclosure Testing:
- .1 Conduct a sound level test at the factory utilizing a sound level meter which meets or exceeds standards of ANSI S1.4 type 2 and relevant Sections of IEC 651 utilize a windshield.
 - .2 Sound level testing to be carried out by an independent expert. Submit certified report with results.
 - .3 Sound level testing shall be carried out with the engine/generator operating at full load.
 - .4 Take measurements at locations to demonstrate conformance with the noise level requirements.
 - .5 Carry out tests in dry weather with wind velocity below 15 kph, and temperatures within the sound level meter performance range.
 - .6 Measurements recorded shall be overall dBA at slow response.
 - .7 Test result shall be documented and included the following information:
 - .1 Acoustic environmental
 - .2 Meteorological conditions

- .3 Instrumentation - including manufacturers model number, serial number and calibration date
- .4 The sound level measurements taken
- .5 The background ambient sound level

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION AND OPERATION

- .1 The emergency power system shall consist of a complete operating propane electric generator unit with all necessary controls and auxiliary support equipment.
- .2 The complete system shall provide regulated 60 Hz AC power to building loads, life safety lighting, fire pump, booster pumps, motors, elevators and other loads. It shall be capable of starting, attaining stable voltage and frequency and be connected to all of the loads within 10 seconds following a power failure.
- .3 The complete Generator assembly shall be prototype tested as an assembly and the complete system shall be CSA approved as a complete assembly. Individual component CSA approvals are not considered as a CSA approved system.
- .4 All equipment shall have sprinkler-proof construction.

2.2 SYSTEM CHARACTERISTICS

- .1 Ratings:
 - .1 Standby Power Rating: 40 kW/50 kVA
- .2 Output Voltage:
 - .1 Nominal: 120/208 V, 3ph, 4w.
 - .2 Maximum Harmonic Content: 5% THD, 3% any single harmonic, at any load condition.
- .3 Step-load transient response capability - with the engine generator running at no load at 1800 rpm with rated output voltage.
- .4 Step-load capability as follows:
 - .1 The complete unit shall be capable of meeting the following transient load conditions with a base load of 20 kW and a step load of 20 kW at 0.9 power factor:
 - .2 Voltage limit: maximum deviation 25% recovery to steady state band within five seconds.

- .3 Frequency limit: maximum deviation, 10% recovery to state band within five seconds.
- .5 Voltage Regulation/Control:
 - .1 Steady state
 - .2 No load to full load: $\pm 0.5\%$
 - .3 Stability at any fixed load: $\pm 0.5\%$ of RMS value
- .6 Frequency:
 - .1 Regulation: isochronous
 - .2 Nominal: 60 Hz at 1800 rpm
 - .3 Maximum frequency change between no load and full load, not to exceed 0.5% of rated frequency.
 - .4 Steady state deviation $\pm .25\%$.
- .7 Maximum audible noise: 50 dBA @ 7 m at 100% load.

2.3 PROPANE ENGINE

- .1 The propane engine shall be of compression ignition type, four-cycle, turbocharged, and inter-cooled.
- .2 The engine shall start reliably without any delay or manual priming at an ambient temperature of 0° C, and shall be capable of delivering full output within 15 seconds from normal power failure.
- .3 It shall be possible to perform a top overhaul on the engine, including replacement of pistons and piston rings without removing the engine from its base or disturbing its alignment.
- .4 The continuous minimum net brake horsepower of the engine at the flywheel shall include losses to all engine driven accessories including the fan, silencer and exhaust stack back pressure, overload, site conditions, alternator power and efficiency.
 - .1 Site conditions are as follows:
 - .1 Altitude: 100 meters above sea level.
 - .2 Ambient temperature: 40°C.
 - .3 Relative humidity: 60%
 - .2 For purposes of the BPH calculation, use actual alternator efficiency.
- .5 The brake horsepower rating and specific fuel consumption of the engine shall be stated and shall be certified by the manufacturer in accordance with ISO 3046 and shown in published data, as permissible for heavy-duty industrial applications.

- .6 Engine shall be rated as EPA Tier 3 rated.
- .7 Break Mean Effective Pressure (BMEP) shall be in the range of 1000 to 1500 kPa
- .8 Fuel-oil system:
 - .1 Provide all flexible braided stainless steel connections for fuel piping on the unit.
 - .2 High pressure fuel injection pipes shall be double skin shielded type.
 - .3 Engine shall operate on commercial grades of propane fuel oil.
 - .4 Engine shall be equipped with engine driven fuel transfer pump.
 - .5 Fuel filters shall have fire-resistant metal bowl and replaceable elements that can be easily removed without disturbing other parts of the engine. Filters to be duplex arrangement.
 - .6 The fuel system shall include a particulate and coalescing type water separator fuel filter with visual inspections means. The filter system shall remove 98% of the water and filter 95% of the contaminants down to five microns in size. Fuel filter(s) shall be equipped with a drain valve of water drainage. The fuel system shall provide an automatic means for removal of air from the fuel system without disconnecting fuel lines.
 - .7 Fuel oil system shall include fuel coolers completely installed and pre-piped.
- .9 Air Intake
 - .1 Provide one or more heavy-duty high-efficiency dry-type air filters of a type recommended by the engine manufacturer, mounted on the engine with dust-tight connections to the engine air intake manifold.
- .10 Lube Oil System:
 - .1 Oil pump, engine driven gear type, with strainer and adjustable pressure relief valve, full pressure lubrication.
 - .2 The mounting of the engine on the base shall be such that the sump can be removed without requiring a depression in the floor. Sump drain pipe with gate valve and plug to extend 75 mm beyond bed plate.
 - .3 Provide first on site replacement of lubricating oil shipped in containers to replace oil used at factory test.

- .4 Provide a one-piece oil-drip tray. The drip tray shall be the complete size of the propane engine.
 - .5 Engine oil temperature shall not exceed 88°C. Provide external oil cooler to maintain lube oil temperature below 88°C. The fuel Cooler shall be designed to suit the engine flow rates to maintain the temperature.
- .11 Cooling System:
- .1 The system shall be capable of cooling the engine with an ambient temperature of 40°C with 100% full load.
 - .2 The engine water jacket shall be cooled by means of a water to air radiator and engine-driven cooling fan. The radiator shall be vibration free, mounted on the electric set base furnished with:
 - .1 Filler cap with pressure valve,
 - .2 Self-air bleed off,
 - .3 Core-encased in protective shell,
 - .4 Duct adapter on outlet side of radiator,
 - .5 Push type fan, belt driven from pulley on engine crankshaft with a minimum of two (2) "V" belts, each capable of driving the fan if one belt fails.
 - .6 Belt adjusting mechanism (Charging alternator not to be used for belt adjustment),
 - .7 Sealed fan hub bearings that do not require lubrication,
 - .8 Safety guard for fan,
 - .9 Fan shroud,
 - .10 First fill of 50/50 mixture of glycol, and
 - .11 Low-level alarm switch.
- .12 Block Heater
- .1 A suitable electric engine block heater and means for connecting thereto shall be supplied. A thermostat shall be provided to operate the heater. The heater shall be adequate size to maintain the coolant in the cylinder jackets at a minimum temperature of 21°C with an ambient air temperature of -18°C. Block heater shall be connected from 120/208 V, three-phase emergency panel and wired through a breaker in the control panel (identify source of supply and provide power on light on control panel).
- .13 Guards

- .1 Provide adequate guards to protect the operating personnel from exposed moving parts. Provide blankets for exhaust manifolds and turbochargers. Guards to be located to permit normal maintenance inspections without their removal.

2.4 EXHAUST SYSTEM

- .1 The exhaust system must be designed to meet the requirements of the Authority Having Jurisdiction.
- .2 Provide a critical grade exhaust silencer with flanges drain plug and clean out, bottom inlet type.
- .3 Provide flexible stainless steel exhaust connections. Flexible connections shall have close pitch corrugations and flanged ends. The flexible hose connections shall be capable of taking up 38 mm movement of propane engine, plus pipe expansion of horizontal run between propane engine and anchor point on horizontal run. Flexible hose connections shall have sufficient length to handle the movement specified and to handle expansion between anchors in the piping plus not less than 25% safety factor, from 0°C, ambient temperature to corresponding exhaust gas temperature.
- .4 The flue will extend 1m above skin-tight enclosure.
- .5 The Generator manufacturer shall provide backpressure calculations and confirm operation of the generator based on at least a 10m length of the Chimney complete with two (2) 45 degree angles. Provide pyrometers for turbo-in and turbo-out.

2.5 ELECTRONIC GOVERNING SYSTEM

- .1 Electronic Governing System to operate with the alternator/voltage regulator and engine to be capable of achieving specified steady state and transient performance.
- .2 System to provide isochronous type operation.

2.6 STARTING SYSTEM

- .1 Positive shift, gear-engaging starter. The motor voltage shall be as recommended by the engine manufacturer.
- .2 Cranking limiter to provide for one or more cranking cycle.

- .3 Batteries: Storage batteries shall be 24 Volts comprising 12 cells lead calcium in flame-retardant jars and covers. Cells to be complete with flame arrester type vent caps and lead-plated copper intercell connectors battery to have sufficient capacity to provide a total of 120 seconds cranking time at 0° C, consisting of 3-10-second cranking attempts with 15-second rest between each attempt and with a battery end voltage of not less than 80% voltage. Voltage measured at terminals at end of 60 seconds cranking, with cranking current flowing, to be not less than 1.75 V per cell. Size battery on the basis of the engine and battery manufacturer's published data. Batteries to be dry charged, specific gravity of electrolyte 1.220 when fully charged at 27° C.
- .4 Provide battery stand fabricated from angle iron coated with acid-resistant paint. Provide clear battery cover. Stand to be same width and length as battery. Height of stand 300mm.
- .5 Provide necessary battery cables and connectors, select cable wire size on the basis of allowing not more than 5% voltage drop at time of peak load.

2.7 BATTERY CHARGER

- .1 Battery charger shall be a silicon controlled rectifier type (thyristor) for automatic float charge operating from 120 Volts, single phase, 60 Hz supply. Charger shall be automatic two-rate type with the following components and features.
 - .1 Float and equalizer voltage adjustments.
 - .2 Adjustable current limit control.
 - .3 Equalize circuit.
 - .4 Overload protected input switch.
 - .5 D.C. output breaker.
 - .6 D.C. ammeter.
 - .7 D.C. voltmeter.
 - .8 Short-circuit current limit protection.
 - .9 Reverse polarity protection.
 - .10 Temperature compensation.
 - .11 Dry contacts for remote supervision of alarm condition.
- .2 Output Voltage, 24 V DC, within +/- 0.5% steady state - with input voltage variation +/- 10% from 10% to 100% load.
- .3 Alarm/Status - Indicating annunciator with indicators for:

- .1 AC power on - status only.
 - .2 AC power off - alarm.
 - .3 Float and equalize - status only.
 - .4 Reverse polarity- alarm.
 - .5 Voltage Limit - alarm.
 - .6 Current Limit - alarm.
- .4 Alarm contacts, provide two (2), for remote monitoring of battery system alarms.
- .5 The battery charger shall be capable of recharging the battery when completely discharged to 80% of capacity within four hours and to full capacity within 12 hours.
- .6 Battery charger shall be wall mounted in ventilated enclosure.

2.8

ALTERNATOR

- .1 Alternator: to ANSI/NEMA MG1 together with additional features as herein listed.
- .2 The balanced line-to-line Telephone Influence Factor (TIF) shall be max. 50 and meet NEMA and EEMAC Standards. Total harmonic content - 5% maximum. Voltage waveform deviation - 3% maximum.
- .3 Provide a single-bearing type alternator designed to be bolted directly to the engine flywheel. The generator shall be self-ventilated and of drip-proof construction.
- .4 The alternator shall be three-phase brushless revolving field synchronous machine of salient pole construction with damper windings. Alternator insulation shall be class H or better. When operating continuously at full load the average winding temperature in °C measured by resistance shall not exceed 105°C at an ambient of 40°C.
- .5 Connect each phase and the neutral point of generator windings to fully insulated terminals in the terminal box. The terminal box shall be extra large, suitable for terminating the output cables.
- .6 Identify generator windings with metal tags.
 - .1 Bring windings to insulated terminals in metal junction box mounted on side or top of generator.
 - .2 Size junction box to permit mounting of engine and generator low voltage controls and wiring terminals blocks.

- .3 Provide barrier in junction box to separate low and high voltage wiring.
- .4 The generator shall come with a primary, factory installed, 100% rated line circuit breaker of 200 that is UL2200 listed. Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts for monitoring. Breaker shall be complete with trip unit with adjustable LSI settings.
- .5 The generator shall also be equipped with a load bank connection point, factory installed, and 100% rated line circuit breaker of 200 amps that is UL2200 listed. Load side of breaker connected to 200A splitter trough for connection of load bank. The load bank circuit breaker shall include a shunt trip. The load bank breaker shall shunt trip when it receives a signal from the ATS upon loss of normal power.
- .7 An automatic static voltage regulating system shall be provided which will operate automatically in conjunction with the brushless exciter to maintain the generator output voltage within specified limits from no load to full load at 0.8 power factor. The air gap shall be separately excited by a permanent magnet rotating generator. The regulator adjustment shall be based on the average of the three-phase voltages.
- .8 A control shall be provided to adjust the stabilizing or anti-hunt circuit which controls overshoot or undershoot of the alternator voltage on load changes.
- .9 A current-forcing circuit shall be provided supply a minimum of 300% of nominal alternator output for at least 10 seconds to allow proper co-ordination of the system's protective devices. Supply decrement and damage curves plotted against breaker trip curves to show proper co-ordination over the full range of alternator output.
- .10 A manual control shall be provided to allow for adjustment of the automatically regulated generator voltage by $\pm 10\%$. Control to be mounted inside control panel - screwdriver adjustable with locking nut.
- .11 The static voltage regulating system shall be mounted in the control panel. The rectifier input shall be protected by a surge suppressor.

2.9 MOUNTING

- .1 A complete mounting assembly shall be provided. The engine generator shall be mounted on a common fabricated steel base. This frame shall be mounted on adjustable spring isolators. The spring isolators shall be fastened to a steel baseplate. The baseplate shall be mounted on three thicknesses of ribbed neoprene. These pads shall be loaded at 200 - 350 MPa unless otherwise specified by the manufacturer. Isolation efficiency not to be less than 95%.
- .2 Levelling shims to be used only beneath generator feet.
- .3 The steel base shall be provided with hooks, hubs, etc., for the attachment of slings. These shall be suitable for moving the unit with the engine wet or dry.
- .4 Supply all foundation bolts suitable for securing the vibration mounts to the concrete foundation.

2.10 PAINTING

- .1 Paint the complete propane generator set including, but not limited to, the alternator, engine, radiator and base with two (2) coats of oil and heat resistant paint. Colour to be the manufacturer's standard colours.
- .2 Supply 0.5 L of touch-up enamel.

2.11 CONTROL PANEL

- .1 The control unit shall be wall-mounted and shall contain, but not be limited to, the following devices:
 - .1 Microprocessor engine control and monitoring unit.
 - .2 Auxiliary breakers.
 - .3 Alarm annunciator.
 - .4 Digital metering unit.
 - .5 Lamp-testing facility.
 - .6 Gauges and instruments.
- .2 Gauges and instruments:
 - .1 The following instruments shall be mounted on the generator controller.
 - .2 All gauges shall be electric, compatible with sensor units installed in engine. Each instrument assembly shall have minimum accuracy of 2%:
 - .1 Run-off auto switch,
 - .2 Emergency stop button,

- .3 Tachometer,
- .4 Lube oil pressure gauge,
- .5 Lube oil inlet temp. gauge,
- .6 Lube oil outlet temp. gauge,
- .7 Engine coolant inlet temp.
- .8 Engine coolant outlet temp.
- .9 Exhaust pyrometer (to read each bank) before and after turbo,
- .10 Running time meter (non-resettable),
- .11 Combustion air intake temp.
- .12 Battery voltage,
- .13 Turbo boost pressure for all banks,
- .14 Number of starts counter (non-resettable),
- .15 Turbo oil pressure,
- .16 Battery charging current (from engine mounted DC generator), and
- .17 Alternator stator temp,
- .18 Solid State Generator output metering package.
 - .1 Current
 - .2 Voltage
 - .3 kW/kVA

- .3 Microprocessor programmable generator controller shall provide automatic starting of the propane upon closing of an auxiliary contact in the automatic transfer switches and required alarms and shutdowns.
- .4 Safety shutdown and alarms: The panel shall contain all components required to provide status indication, automatic shutdown and alarm. Alarm shall be maintained with manual reset and audible alarm with silence button and ring back.
- .5 Alarm annunciators for the indicated conditions (all indication lights shall be LCD and LED type):

Indication/Function Status	Shutdown	Alarm
- Overcrank, after 3 cranking periods of 10 sec. duration on 10 sec off crank cycles	X	X
- Low engine temperatures (i.e. too low for reliable start)		X
- High engine temperature prealarm (105%)		X
- High engine temperature (115%)	X	X
- Low lube oil pressure prealarm (80%)		X

Indication/Function Status		Shutdown	Alarm
- Low lube oil pressure (40%)	X	X	
- Overspeed (105%)	X	X	
- Low fuel level (contact from level measurement unit)		X	
- Emergency generator supplying load			X
- Control switch not in automatic position		X	
- Battery low voltage		X	
- Low coolant level		X	
- Alternator over-voltage (110%)	X	X	
- Under speed (95%)	X	X	
- Generator output breaker open		X	
- Generator output breaker trip	X	X	
- Alternator under voltage (90%)	X	X	
- Remote emergency stop activated	X	X	
- High alternator temperature	X	X	
- Output breaker trip		X	

- .6 Alarms which would create nuisance signals during start-up and shutdown shall be supervised by suitable time delay contacts.
- .7 Each status indication and alarm shall have a separate indicating light. Provide a common audible signal. For each alarm or shutdown, provide auxiliary contacts connected together in parallel for supervised wiring from a remote location. The alarm, and where applicable, shutdown circuits shall be powered from the engine start battery.
- .8 Provide remote annunciation of following conditions to a remote annunciator panel and the building fire alarm system as indicated:
 - .1 Propane generator running, (remote annunciator and fire alarm panel)
 - .2 Generator failed to start, (remote annunciator and fire alarm panel)
 - .3 Propane generator in alarm condition, (remote annunciator and fire alarm panel)
 - .4 Engine start switch not in auto, (remote annunciator and fire alarm panel)
 - .5 High engine temperature - pre-alarm, (remote annunciator)
 - .6 Low lube oil pressure, (remote annunciator)
 - .7 Low fuel level, (remote annunciator)

- .8 Battery low voltage, (remote annunciator)
- .9 Battery charger failure, (remote annunciator)
- .10 Common trouble, (remote annunciator)
- .9 The electronic controller shall be supplemented as necessary, with an auxiliary alarm panel to incorporate those alarms, which are unavailable on the controller.
- .10 Normal shutdown: The shutdown of the engine shall be affected automatically by the starting panel upon opening of auxiliary contacts on the automatic transfer switch. A timer shall keep the engine running for 1 - 30 minutes (adjustable) after signal from the transfer switch indicating restoration of normal power. After normal shutdown of the engine is initiated, its auxiliaries and controls shall be in the position to allow immediate restarting so that if the utility source power fails during rundown period, a normal automatic start sequence can be initiated.
- .11 Provide auxiliary contacts to operate the following systems when the propane starts:
 - .1 Operate generator dampers.
- .12 All wiring shall be suitably numbered and all internal components shall be identified. All connections shall be wired to identified terminals on terminal strips.
- .13 Provide Remote Emergency Stop station connected to the Generator control panel and mounted at the exit door of the Generator enclosure.

2.12 SKIN-TIGHT ENCLOSURE

- .1 Design requirements:
 - .1 Design members to withstand the following loads and combinations of loads in accordance with OBC within acceptable deflection limitations:
 - .1 Snow load
 - .2 Wind load
 - .3 Earthquake load
 - .4 Self-weight of structure, dead loads including ceilings, roofing including electrical cable conduit, cable tray, mechanical piping and mechanical units. Ensure that the roof structure is designed to carry all suspended electrical and mechanical systems loads.
 - .5 Live loads.

- .2 In addition to uniform live load, design members for full live load on leeward half of enclosure frame and zero live load on windward half.
- .3 Design anchorage of enclosure to the new foundation slab in accordance with OBC requirements.
- .4 Exterior to interior sound attenuation to be not less than STC 40, shall meet 55dBA at 7m.
- .5 Design, assemble and secure building elements to building frame to ensure stresses in sealants and seals are within sealant manufacturer's recommended maximum.
- .6 Design enclosure assembly to permit easy replacement and disassembly of components.
- .7 Allow for ceiling, piping, conduit and other interior dead loads imposed on the structure.
- .2 General:
 - .1 Design and construct the enclosures to support the weight of the equipment they contain. The roof structure of the enclosure must be able to support any seismic loads acting on that equipment and all specified requirements included in this specification section Reinforce the roof as required.
- .3 Walls:
 - .1 All structural members shall be sized and positioned to adequately support the imposed loads in the area.
 - .2 Ensure Wall joint between units are properly sealed from the elements, as well as maintaining air barrier, joint to allow for movement.
 - .3 Provide a 450 mm square-hinged door in wall on the North wall of the enclosure to allow for the installation of test Load Bank conductors at 300 mm above floor and in line with load bank breaker on generator. The door shall be equipped with a continuous Stainless steel hinge to allow door to open 180 degrees, the door shall be framed fitted with weatherproof seals and pad lockable latch.
- .4 Roof and ceiling:
 - .1 The roof sheets shall provide a watertight system including relevant slope so that the exterior surface drains.
 - .2 The roof shall have a shallow, single pitch and the overhangs shall be minimized so as not to interfere with lifting and placing of the unit by crane.

- .3 The roof structure shall be adequate to support the snow loads, roof assemblies - electrical conduit, mechanical piping and any buckling loads that would be encountered during lifting and transporting of the enclosure.
- .4 Ensure Roof joints between units are properly sealed from the elements, as well as maintaining air barrier, joint to allow for movement.
- .5 Insulation and interior sheets:
 - .1 The walls, roof and floor shall be insulated in conformance with the requirements of the Ontario Building Code.
- .6 Air intake and discharge assemblies:
 - .1 Provide sufficient air flow to meet the ventilation requirements of the generator.
 - .2 Include modulating dampers to maintain the preset room temperatures where equipment is operating or not.
 - .3 Provide means to prevent ingress of birds.
 - .4 Provide means to prevent the entrapment of either wind or snow.
- .7 Exhaust Louvres:
 - .1 Construction: welded with exposed joints ground flush and smooth.
 - .2 Material: extruded aluminum alloy 6063-T5.
 - .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
 - .4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
 - .5 Mullions: at 1500 mm maximum centres.
 - .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
 - .7 Backdraft damper Aluminum.
 - .8 Screen: 12 mm exhaust mesh, 19 gauge wire aluminum birdscreen on inside face of louvres in formed U-frame.
 - .9 Finish: factory applied enamel. Colour to match enclosure.
- .8 Intake shall be with an intake hood.

- .9 Multi-leaf dampers:
 - .1 Opposed blade type as indicated.
 - .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
 - .3 Pressure fit self-lubricated bronze bearings.
 - .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
 - .5 Performance:
 - .1 Leakage: in closed position less than 2% of rated air flow at 1000 Pa differential across damper.
 - .2 Pressure drop: at full open position less than 5.0 Pa differential across damper at 5 m/s.
 - .6 Insulated aluminum dampers:
 - .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
 - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.
- .10 Electric damper actuator:
 - .1 Requirements:
 - .1 Electric or electronic type motor.
 - .2 Proportional or on/off type as indicated.
 - .3 Direct mount with U-bolt type clamp and anti-rotation bracket. Provide all additional mounting brackets, accessories or adaptors required for damper shaft coupling.
 - .4 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
 - .5 Size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater. Torque requirements to be 50% greater than theoretical requirements.
 - .6 Operating range: 0-10 V or 4-20 mA.
 - .7 For fan interlocks: On/Off, 120VAC.
 - .2 Fast-acting actuators:
 - .1 For applications requiring quick opening or closing, "Fire and Smoke" type actuator, fully opens or closes in less than 15 seconds. Refer to drawings for quantity and locations.

.11 Heating:

- .1 The enclosure shall be equipped at least two (2) 4kW electric unit heater at 208V to maintain a minimum ambient temperature of at least 10°C à inside during winter time as required by CSA-C282.
- .2 Unit heater
 - .1 Unit heater: to CSA C22.2 No.46, vertical discharge complete with adjustable louvers finished to match cabinet.
 - .2 Fan type unit heaters with built-in high-heat limit protection and fan-delay switches.
 - .3 Fan motor: totally enclosed type with resilient mount.
 - .1 Built-in fan motor thermal overload protection.
 - .4 Hangers: Suspend unit heaters from ceiling or mount on wall.
 - .5 Elements: 4 kW mineral insulated stainless steel sheath with single brazed fins.
 - .6 Cabinet: steel 2 mm thick, fitted with brackets for rod or wall mounting.
 - .1 Phosphatized and finished with two (2) coats baked enamel in beige colour.
- .3 Controls:
 - .1 Wall mounted thermostats: type line voltage, Energy Star certified.

.12 Finishes:

- .1 Standard Factory Finish.

.13 Enclosure electrical:

- .1 125A, 120/208V, 3ph, 4W, electrical branch panel c/w bolt-on breakers, to supply the generator and enclosure accessories such as : bloc heater, battery charger, unit heaters, damper motors, lighting, emergency lighting, duplex receptacles, etc.
- .2 Two (2) 4kW unit heater at 208 V to maintain a minimum ambient temperature of at least 10°C inside during winter time as required by CSA C282.
- .3 Emergency battery (additional to the battery starting the generator) c/w remote heads to provide at 50 lux for 2hr, to CSA C22.2 No 141.
- .4 Two (2) 15/20A, 125V, specification grade duplex receptacles, mounted on each side of the generator.

- .5 One 15/20A, 125V, GFI specification grade duplex receptacles c/w while in use weatherproof cover mounted outside near door.
- .6 A 120 V specification grade light switch.
- .7 Four (4) LED vapor tight luminaire inside.
- .8 Two (2) LED wall pack above each door with photocell operation.
- .9 Connection of motorized dampers.
- .10 Connection of battery charger.
- .11 A red mushroom type emergency power off button located close to or on the control panel.
- .12 All these elements shall be prewire in factory. Only the feeder to the electrical branch shall be done on site.
- .14 Enclosure fire alarm :
 - .1 In addition to the supervision modules required on the generator control panel and main breaker, two(2) fire alarm pull station (one at each door), a smoke detector and two (2) combination strobe/horn shall be installed on site.
- .15 Signs:
 - .1 Provide a lamicoid plate identifying the room content.
 - .2 Plates sized to suit.
 - .3 Letters 38 mm high, colour white: plate colour: black.
 - .4 Attach to door with permanent screw fasteners.
- .16 Workmanship:
 - .1 Manufacture and construct equipment free from blemishes, defects, burrs and sharp edges; accuracy of dimensions and marking of parts and assemblies; thoroughness of welding, brazing, painting and wiring, alignment of parts and tightness of assembly screws and bolts.
 - .2 Accurately fit and rigidly frame together joints, corners and mitres.
 - .3 Match components carefully to produce continuity of line and design.
 - .4 Make joints and connections toward exterior weather tight.
 - .5 Provide hairline joints for materials in contact.
 - .6 Coordinate location of visible joints.

Part 3 EXECUTION

3.1 GENERAL

- .1 The complete systems shall be factory assembled, wired, completed and ready for factory acceptance testing after assembly.
- .2 Delivery to site upon successful factory acceptance test.
- .3 Deliver the enclosures complete with all equipment as complete units.

3.2 SHIPPING

- .1 Protect emergency power system equipment during shipping.

3.3 START-UP PREPARATION

- .1 Before starting the unit, a manufacturer technician shall carry out a thorough mechanical and electrical inspection of the equipment. Do the following checks and adjustments:
 - .1 Disconnect the battery cables from the batteries to prevent accidental starting.
 - .2 Turn the engine several revolutions by means of hand-barring devices to ensure that all parts are free and there are no obstructions to its running.
 - .3 Check engine/generator alignment readings to ensure they match readings attained at the time of manufacture.
 - .4 Check vibration isolator adjustment.
 - .5 Check all fluid levels and top up as necessary. Pre-lubricate the engine and turbochargers as recommended by the engine manufacturer. Install drip pan beneath engine.
 - .6 Check that the cooling system antifreeze is effective to at least minus 40°C.
 - .7 Check belts for correct tension and adjust as necessary.
 - .8 Check and grease all grease points.
 - .9 Check and tighten properly all nuts, bolts, etc.
 - .10 Ensure all safety guards are in place and properly secured.
 - .11 Check all linkages for damage and freedom of movement.
 - .12 Check the fuel supply system for leakage.
 - .13 Verify type of fuel.
 - .14 Ensure the fuel supply and fuel injection systems are properly primed.

- .15 Check air cleaner.
- .16 Check engine exhaust system.
- .17 Check and verify temperature and pressure sensors.
- .18 Check electrical wiring and tighten properly all connections.
- .19 Check starting battery electrolyte level specific gravity and for proper installation.
- .20 Check battery charger for proper operation and adjust as necessary.
- .21 Carry out generator winding insulation resistance test. If the reading is unacceptable, carry out recognized drying procedure. Do not start the unit until a satisfactory reading has been achieved.
- .22 Check the jacket coolant heater for proper operation.
- .23 Check and verify tools and spares (site only).

3.4 START-UP AND PERFORMANCE CHECK

- .1 On completion of the start-up preparations, take the following action:
 - .1 Have at hand, during initial start-up, the means for choking off the air supply to the engine air induction manifold in the event of the engine run away or other emergency.
 - .2 Reconnect the starting battery cables to the starting battery.
 - .3 Start the unit only in the presence of the Departmental Representative and allow to warm up. Stop the unit if abnormal conditions are encountered.
 - .4 Check for any leakage from the exhaust system, fuel system, cooling system and lubricating oil system.
 - .5 Adjust vibration isolators.
 - .6 Observe and ensure that the lubricating oil pressure and coolant temperatures are within limits and no harmful vibration or sounds are evident.
 - .7 Ensure that the voltage is within the operating parameters and that the automatic voltage regulator is operating correctly.
 - .8 Ensure that the manual voltage control is operating correctly.
 - .9 Ensure that the frequency is within the operating parameters and that the electronic governor is operating correctly.
 - .10 Check the engine air ventilation system for proper operation.

- .11 Check the operation of all engine-mounted protective sensing devices and adjust as necessary.
- .12 Check the phase sequence of the normal power supply and of the emergency power supply; ensure that they are in the same sequence.
- .13 Check the operation of the electronic controller protection, transfer, timing, metering, and annunciator functions and adjust as necessary.
- .14 Check the operation and calibration of the analog metering and adjust as necessary.
- .15 Apply the electrical load, read the meters, and correlate these readings.
- .16 Remove load, allow cool down period, shut the unit down and allow minimum 30 minutes, prior to operational tests.

3.5 ENCLOSURE SUPPORTING SYSTEMS CHECK

- .1 Carry out testing electrical power, lighting, heating, cooling, ventilating and fire suppression systems at the site. Record results on check list.
- .2 Verify correct operation by measurement and functional tests.
- .3 Do electrical system tests:
 - .1 Check power distribution system - including phase balancing, voltage levels, grounding.
 - .2 Verify all circuits and outlets and circuit identification at panelboards.
 - .3 Operate breakers.
 - .4 Insulation resistance tests (meggar).
 - .5 Verify motor and heater operation, rotation and control.
 - .6 Check transformer voltages, phases and set taps.
- .4 Lighting systems:
 - .1 Measure and verify lighting levels, normal and emergency.
 - .2 Verify lighting controls - normal and emergency.
- .5 Heating, Ventilation and Controls
 - .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
 - .2 Confirm proper thermal overload protection in place for electrical equipment.

- .3 Check air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Correct fan rotation.
 - .4 Fire, smoke, volume control dampers installed and open.
 - .5 Coil fins combed, clean.
 - .6 Access doors, installed, closed.
 - .7 Outlets installed, volume control dampers open.
- .6 Carry out Testing, Adjustment and Balancing (TAB). And submit report with results in SI units.
- .7 Air systems TAB report shall include:
 - .1 Design characteristics:
 - .1 Identification
 - .2 Air flows
 - .3 Fan's static pressure
 - .4 Motor size (kW)
 - .5 Brake horse power
 - .6 Fan speed.
 - .2 Characteristics of installed equipment:
 - .1 Manufacturer, model, serial number
 - .2 Unit size
 - .3 Arrangement
 - .4 Motor nameplate:
 - .1 Power
 - .2 Tension
 - .3 Number of phases
 - .4 Frequency
 - .5 FLA
 - .6 Speed
 - .3 Test results:
 - .1 Fan speed
 - .2 Power reading at motor connections (tension and current for each phase).
 - .3 Pressure at fan's suction and discharge.
 - .4 Measured air flow.
 - .5 Fan curve indication operating point as per measurements.
 - .4 Additional information:
 - .1 Dimension and number of belts.
 - .2 Dimension of pulleys.

- .3 Motor speed at full load.
- .4 Adjustment of overload protections.
- .5 Systems schematics.
- .8 Operate heating and ventilating system controls and confirm system performance:
 - .1 Operate cooling systems with heat rejection systems operating at normal load and demonstrate cooling capacity.
 - .2 Verify control sequence and confirm integrated operation between heating, cooling and ventilation under all operating conditions.

3.6 SITE TESTS

- .1 Site tests to be done by manufacturer's site technician.
- .2 Repeat all factory tests on site for 12 hours with 100% load of the standby rating.
- .3 Provide resistive load banks to suit and all required cabling and connections.
- .4 Check and verify installation at the job site, including all electrical and mechanical connections provided by the Contractor. Ensure correct phase rotation of generator prior to final connection to system.
- .5 If necessary, adjustments shall be made to the control circuitry and tests shall be repeated until it is proven to the Departmental Representative that the system operates correctly. The system will not be accepted until all tests are successfully completed.
- .6 Provide all the required test equipment to conduct the acceptance tests. Refer to 1.8 - Factory Witness Test.
- .7 Upon completion of load test, run the unit connected for a minimum period of two hours to show load carrying ability, stability of voltage and frequency, and satisfactory performance of the engine cooling system.
- .8 At the end of the test run, check the battery voltage to demonstrate the battery charger has returned to fully charged state.
- .9 The manufacturer's site technician shall be prepared to remain on site until all defects that may occur in the installation are corrected. Include all costs in this contract.

- .10 Provide copy of test results to Departmental Representative and make additional copies as required to include in Operation and Maintenance Manual.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 26 05 00 - Common Work Results for Electrical.
- .4 Section 26 32 13.01 - Power Generation Diesel.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.2 No.5-16, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489).
 - .2 CSA C22.2 No.178.1-14(R2019), Automatic Transfer Switches.
 - .3 CSA C61869-1-20, Instrument Transformers. Part 1: General requirements (Adopted IEC 61869-1:2017, first edition 2017-12, with Canadian deviations)
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 2-2000 Part 8 (R2008) , Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC, Part 8: Disconnect Devices for Use in Industrial Control Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for transfer switches and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate on drawings:
 - .1 Make, model and type.
 - .2 Single line diagram showing controls and relays.
 - .3 Description of equipment operation including:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.

- .3 Manual control.
- .4 Automatic shutdown.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for transfer switches for incorporation into manual.
- .3 Detailed instructions to permit effective operation, maintenance and repair.
- .4 Technical data:
 - .1 Schematic diagram of components, controls and relays.
 - .2 Illustrated parts lists with parts catalogue numbers.
 - .3 Certified copy of factory test results.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Automatic load transfer equipment to:
 - .1 Monitor voltage on phases of normal power supply.
 - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below pre-set adjustable limits for adjustable period of time.
 - .3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.
 - .4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.
 - .5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

2.2 MATERIALS

- .1 Instrument transformers: to CSA C61869-1.
- .2 Contactors: to NEMA ICS2.
- .3 ATS Enclosure shall be rated NEMA 3R.

2.3 CONTACTOR TYPE TRANSFER EQUIPMENT

- .1 Contact Type Transfer Equipment: to CSA C22.2 No.178.1.

- .2 Three (3) pole contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, with CSA enclosure, single motor solenoid operated.
- .3 Rated: 208V, Amperage as indicated, 60 Hz, 3 Phase, 4 wire, solid neutral.
- .4 Main contacts: silver surfaced, protected by arc disruption means.
- .5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of pane without removal of switch panel or disconnection of drive linkages and power conductors.
- .6 Auxiliary contact: silver plated, to initiate emergency generator start-up on failure of normal power.
- .7 Fault withstand rating: rating 18 kA
- .8 Lever to operate switch manually when switch is isolated.
- .9 Neutral bar, equal to phase conductor ampacity, non-switched.
- .10 Complete with neutral position.
- .11 Transfer switches operation to include an adjustable delay feature on the solenoid operation of the transfer to achieve a null position in the transfer. This feature is required to allow the residual field in transformers and the back EMF in motors to decay transient to reduce current and voltage affects due to load transfer.

2.4 CONTROLS

- .1 Selector switch - four (4) position: "Test", "Auto", "Manual", "Engine start".
 - .1 Test position - normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
 - .2 Auto position - normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
 - .3 Manual position - transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.
 - .4 Engine start position - engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.
- .2 Control transformers: dry type with 120 V secondary to isolate control circuits from:
 - .1 Normal power supply.

- .2 Emergency power supply.
- .3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
 - .1 Voltage sensing: 3 phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2 V minimum undervoltage protection.
 - .2 Time delay: normal power to generator, adjustable solid state, 0 to 60 s.
 - .3 Time delay on engine starting to override momentary power outages or dips, adjustable solid state, 3 to 20 s delay.
 - .4 Time delay on retransfer from standby to normal power, adjustable 0 to 60 s.
 - .5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable solid state 20 s intervals to 10 minutes.
 - .6 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches pre-set adjustable values.
 - .7 Neutral disconnected position delay: allow time for motors to delay between live sources, adjustable, 0 to 5 s.
 - .8 Inhibit to transfer from emergency to normal when input from load is activated, i.e. UPS on bypass or other signal (medical equipment).
 - .9 Output to elevator controller to indicate pre-transfer from normal to emergency and emergency to normal. Contactors for set of four (4) elevators.
- .4 Solid state electronic in-phase monitor.

2.5 ACCESSORIES

- .1 Full digital display.
- .2 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel; auxiliary terminals for remote.
- .3 Auxiliary relay to provide 4 N.O. and 4 N.C. contacts fore remote alarm indication of transfer switch position.
- .4 Instruments:
 - .1 Meter - multi-function Digital true RMS, indicating type 2 % accuracy, flush panel mounting:
 - .1 Voltmeter: ac, scale 0 to 750V.
 - .2 Ammeter: ac, scale 0 to 25 % above rated current.
 - .3 Frequency meter: scale 55 to 65 Hz.

- .5 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labelled "OFF-Phase A-Phase B-Phase C".
- .6 Potential transformers - dry type for indoor use:
 - .1 Ratio: 600 to 120.
 - .2 Rating: 750 V, 60Hz, BIL 10 kV.
 - .3 Accuracy rating: revenue metering.
- .7 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF - Phase A - Phase B - Phase C".
- .8 Current transformers - dry type for indoor use:
 - .1 Ratio: Amperage to suit metering.
 - .2 Rating: 750 V, 60Hz, BIL 10 kV
 - .3 Accuracy rating: revenue metering
 - .4 Positive action automatic short- circuiting device in secondary terminals.
- .9 Manual maintenance bypass and isolator: to both supplies, normal and emergency.
- .10 Manual maintenance bypass operation cannot cause a service outage longer than 10 s.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00.
- .2 Control panel:
 - .1 For selector switch and manual switch: size 4 nameplates.
 - .2 For meters, indicating lights, minor controls: use size 2 nameplates.
 - .3 Nameplates to include: Identification nomenclature as indicated, Voltage, Ampacity, Phase, Wire.

2.7 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of the Construction Manager.
- .2 Notify Construction Manager ten (10) days minimum in advance of date of factory test.
- .3 Tests:
 - .1 Operate equipment both mechanically and electrically to ensure proper performance.

- .2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.
- .3 Check voltage sensing and time delay relay settings.
- .4 Check:
 - .1 Automatic starting and transfer of load on failure of normal power.
 - .2 Retransfer of load when normal power supply resumed.
 - .3 Automatic shutdown.
 - .4 In-phase monitor operation.

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Services of the manufacturer / supplier qualified field technician are required on site to assist throughout period of integrated systems testing.
- .3 Include training of operations staff (minimum 4 hours)
- .4 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.
- .5 Set selector switch in "Manual" position and check to ensure proper performance.
- .6 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .7 Set selector switch in "Auto" position and open normal power supply disconnect. Generator should start, come up to rated voltage and frequency, and then load should transfer to generator. Allow to operate for 10 minutes, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
- .8 Repeat, at 1 hour interval, transfer switch test again.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/ National Electrical Manufacturers Association (NEMA)
 - .1 ANSI C82.1-2004(R2020), American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts.
 - .2 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE C62.41-2002, IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 - .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM F1137/F1137M-19, Standard Specification for Phosphate/Oil Corrosion Protective Coatings for Fasteners.
 - .4 United States of America, Federal Communications Commission (FCC)
 - .1 CFR 47CFR All Parts, Code of Federal Regulations - Title 47 all Parts - Telecommunications. (FCC).

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 LAMPS FIXTURE MOUNTED - LED BOARD

- .1 LED
 - .1 Wattage: as indicated
 - .2 Lumen output: as indicated
 - .3 Colour Temp: as indicated
 - .4 CRI: as indicated

- .5 Life expectancy: 60,000 hr (min) at 70% lumen output (L70)
- .6 Compliance: LM79 photometric test results, LM80+TM-21 lumen maintenance
- .7 Efficacy: as indicated
- .8 Photometry: IES photometric data file
- .9 Warranty: 5 years (min)

2.2 LED DRIVERS

- .1 LED drivers to meet the following:
 - .1 Rating: 120 V as indicated - 60 Hz input
 - .2 Suitable for use with manufactures fixture lamp combination.
 - .3 Solid state design - high energy efficiency
 - .4 Dimming:
 - .1 0-10V or Triac dimming control as indicated.
 - .2 Coordinate dimming requirements will lighting control provider.
 - .5 Constant output driver set at 80% output throughout life of LED/driver installation.
 - .6 Dimming range 10% to 100% or as indicated in Lighting Fixture Schedule.
 - .7 Rated 50,000 hours (min) - case temperature equal to or less than 70°C.
 - .8 Class A sound level rating.
 - .9 Minimum operating temperature: -40°C.
 - .10 Maximum THD: 20%
 - .11 Minimum Power Factor of 0.9.
- .2 Mounting: Integral to luminaire where possible. External drivers to be furnished with metal enclosures.
- .3 All lighting fixtures, supplied from normal power sources, shall be provided with quick disconnect connectors mounted on fixture body for fixture branch wiring and control wiring.

2.3 FINISHES

- .1 Baked enamel finish:
 - .1 Conditioning of metal before painting:
 - .1 For corrosion resistance conversion coating to ASTM F1137/F1137M.
 - .2 For paint base, conversion coating to ASTM F1137/F1137M.

- .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel to give smooth, uniform appearance, free from pinholes or defects.
- .3 Reflector and other inside surfaces finished as follows:
 - .1 White, minimum reflection factor 85%.
 - .2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-o-meter not to exceed 0.05.
 - .3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.
 - .4 Gloss not less than 80 units as measured with Gardner 60E gloss meter.
 - .5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.
 - .6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

2.4 LUMINAIRES

- .1 Refer to fixture schedule.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated. Refer to architectural drawings for dimensional locations of lighting fixtures.
- .2 Provide adequate support to suit luminaires. Retain the services of a structural engineer registered in the Province of Ontario to provide details and certification of the installation of the support system and associated boxes in conjunction with the luminaire installation. Pay all costs associated with the required installation and support system inspection.
 - .1 Upon completion of the installation the engineer shall compete an inspection of the installation and provide a report confirming acceptance.

- .3 Luminaire restraints:
 - .1 Provide No. 12 gauge wire attached to structure for all suspended fixtures and fixtures installed in suspended ceilings.
 - .2 For fixtures weighing less than 10 lbs, provide one No. 12 gauge wire from fixture housing to structure above.
 - .3 For fixtures weighing more than 10lbs and less than 56lbs, provide two No.12 gauge wire at opposite corners of fixture, from fixture housing to structure above.
 - .4 Wire for fixture restraint to structure may be slack.
- .4 Provide all required appurtenances for mounting of the luminaire.
- .5 Install luminaires using appropriate fasteners for construction materials.
- .6 Adjust and aim luminaires in accordance with the manufactures requirements.

3.2 WIRING

- .1 Connect luminaires to lighting circuits using minimum 12 AWG wiring in EMT conduit. Provide armoured cable or flexible metal conduit to for final connection to luminaire. Provide armoured cable to interconnect luminaires, length not to exceed 2.5 meters.
- .2 Provide separate conduit and knock-outs for control wires (0-10v, DALC, DMX... etc)

3.3 LUMINAIRE ALIGNMENT

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 01 74 20 Construction/Demolition Waste Management and Disposal.
- .5 Section 01 78 00 - Closeout Procedures.
- .6 Section 26 05 21 - Wires and Cables (0-1000 V)
- .7 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCE STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA C22.2 No.141-15(R2019), Emergency Lighting Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management highlighting recycling and salvage requirements.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions 01 61 00.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.6 WARRANTY

- .1 For batteries in this Section 26 52 13.13, 12 months warranty period is extended to 120 months.

Part 2 PRODUCTS

2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V, AC.
- .3 Output voltage: 24V DC.
- .4 Operating time: 60 minutes.
- .5 Battery: sealed, maintenance free.
- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .7 Solid state transfer circuit.
- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10 Lamp heads: remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

- .12 Finish: white
- .13 Auxiliary equipment:
 - .1 Ammeter.
 - .2 Voltmeter.
 - .3 Test switch.
 - .4 Time delay relay.
 - .5 Battery disconnect device.
 - .6 AC input and DC output terminal blocks inside cabinet.
 - .7 Shelf.
 - .8 Cord and plug connection for AC.
 - .9 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT as specified in Section 26 05 34.
- .2 Conductors: sized per manufacturer's recommendations 26 05 21 and in accordance with manufacturer's recommendations.
- .3 Remote heads shall be MR-16 type.

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 emergency lighting installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.

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 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 emergency lighting installation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 01 74 20 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.141-15(R2019), Emergency Lighting Equipment.
 - .2 CSA C860-11(R2016), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101-2018, Life Safety Code.
- .3 International Organization for Standardization (ISO)
 - .1 ISO 3864-1:2011, Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings.
 - .2 ISO 7010:2019, Safety colours and safety signs - Registered safety signs.

1.3 ACTION AND INFORMATIONAL 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.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 PRODUCTS

2.1 STANDARD UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.
- .3 Face plates: extruded aluminum.
- .4 Lamps: multiple - 24 V, LED-12W, over 500,000 hours.
- .5 Downlight: translucent acrylic in bottom of unit.
- .6 Graphics: Green pictogram and white graphical symbol and directional arrows to ISO 3864-1. Dimensions to ISO 7010.
- .7 Face plate to remain captive for relamping.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA-101 and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Lock exit light circuit breaker in on position.

3.3 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 05 28 - Grounding: Secondary.

1.2 REFERENCES

- .1 Alliance for Telecommunication Industry Solutions (ATIS)
 - .1 ATIS J-STD-607-A-2002 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- .2 Telecommunications Industries Association (TIA)
 - .1 TIA 606-2012, Administration Standard for the Commercial Telecommunications Infrastructure.

1.3 SYSTEM DESCRIPTION

- .1 Telecommunications grounding and bonding system consist of grounding busbars, bonding backbones, and other bonding conductors.
- .2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.
- .3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

Part 2 PRODUCTS

2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- .1 Predrilled copper busbar, electrotin plated with holes 8mm diameter for use with standard-sized lugs to: ATIS J-STD-607.
- .2 Dimensions 6 mm thick, 100 mm wide, 300 mm long to: ATIS J-STD-607.

2.2 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- .1 Predrilled copper busbar, electrotin plated with holes 8mm diameter for use with standard-sized lugs to: ATIS J-STD-607.

- .2 Dimensions 6 mm thick, 50 mm wide, 300 mm long to: ATIS J-STD-607.

2.3 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

- .1 3/0 AWG copper conductor, green insulated to: ATIS J-STD-607.

2.4 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

- .1 3/0 AWG copper conductor, green insulated to: ATIS J-STD-607.

2.5 WARNING LABELS

- .1 Non-metallic warning labels in English to: ATIS J-STD-607.
- .2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

Part 3 EXECUTION

3.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

- .1 Install TMGB in main telecom room on insulated supports 50 mm high.
- .2 Install 3/0 AWG copper bonding conductor from TMGB to main equipment ground.

3.2 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

- .1 Install TGB in all telecom rooms.
- .2 Install 3/0 AWG copper bonding conductor from TGB to TMGB.

3.3 BONDING CONDUCTORS GENERAL

- .1 When placed in ferrous metallic conduit or EMT longer than 1 m, bond to each end of conduit or EMT using grounding bushing 6 AWG copper conductor.

3.4 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

- .1 Install bonding conductor for telecommunications from TMGB to service equipment (power) ground.
- .2 Use approved 2 hole compression lugs, 2 hole non-twisting lugs for connection to TMGB.

3.5 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

- .1 Install TBBs from TMGB to each TGB as indicated.
- .2 Use approved 2 hole compression lugs, 2 hole non-twisting lugs for connection to TMGB and TGBs.

3.6 BONDING TO TMGB

- .1 Bond metallic raceways in telecommunications entrance room to TMGB using #6 AWG green insulated copper conductor.

3.7 BONDING TO TGB

- .1 Bond metallic raceways in telecommunications room to TGB using #6 AWG green insulated copper conductor.

3.8 LABELLING

- .1 Apply warning labels to telecommunications bonding and grounding conductors.
- .2 Apply additional administrative labels to: TIA 606.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical.
- .2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits, cable trays, pull boxes, sleeves and caps, fish wires and ducts.

2.2 MATERIAL

- .1 Conduits: EMT type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Junction boxes: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

- .3 Outlet boxes and fittings: in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .4 Fish wire: polypropylene type, 5 mm.
- .5 Main Telecom Room - Cable trays:
 - .1 Basket type:
 - .1 1.5 mm tubular steel, welded construction.
 - .2 450 mm Width and 150 mm depth or as indicated.
 - .3 229 mm rung spacing.
 - .2 Accessories:
 - .1 T-junction splice kits at each corner.
 - .2 Cable radius drop at each rack.
 - .3 Wall support bracket (triangle shape) on 1,000 mm spacing

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install empty raceway system, including, fish wire, outlet boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, miscellaneous and positioning material to constitute complete system.

3.2 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for recycling for recycling in accordance with Section 01 74 20 - Construction /Demolition Waste Management and Disposal.

3.3 PROTECTION

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Abbreviations:
 - .1 Electronic Access Control (EAC): control of people through entrances and exits of controlled area. Security utilizing hardware systems and specialized procedures to control and monitor movements within a controlled area.
 - .2 CPVX: Central Station Burglar Alarm Systems.
 - .3 DRS: Door Release System.
 - .4 PIN: Personal Identification Number.

- .2 Reference Standards:
 - .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
 - .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S301-2018, Standard for Signal Receiving Centre Burglar Alarm System and Operations
 - .2 CAN/ULC-S302-14, Standard for Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults.
 - .3 CAN/ULC-S304-2016, Signal Receiving Centre and Premise Burglar Alarm Control Units.
 - .4 CAN/ULC-S310-M91(R1999), Installation and Classification of Residential Burglar Alarm Systems.
 - .5 ULC-S318-96(R2016), Standard for Power Supplies for Burglar Alarm Systems.
 - .6 ULC-C634-[86], Guide for the Investigation of Connectors and Switches for Use with Burglar Alarm Systems.
 - .3 Underwriters' Laboratories (UL)
 - .1 UL 294-[2013], Access Control System Units.
 - .2 UL 603-[2008], Power Supplies for Use with Burglar Alarm Systems.
 - .3 UL 681-[2014], Installation and Classification of Burglar and Holdup Alarm Systems.
 - .4 UL 827-[2014], Central-Station Alarm Services.
 - .5 UL 1023-[2009], Household Burglar Alarm System Units.
 - .6 UL 1076-[2005], Safety for Proprietary Burglar Alarm Units and Systems.
 - .7 UL 1641-[2015], Safety for Installation and Classification of Residential Burglar Alarm Systems.
 - .4 National Fire Protection Association (NFPA)
 - .1 NFPA 70-2017, Article [517], National Electric Code.
 - .2 NFPA 101-2015, Life Safety Code.

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 access controls and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit electronic copy of WHMIS SDS.
 - .3 Submit:
 - .1 Functional description of equipment.
 - .2 Technical data for all devices.
 - .3 Device location plans and cable lists.
 - .4 Devices mounting location detail drawings.
 - .5 Typical devices connection detail drawings.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Shop drawings to indicate project layout, including details.
 - .1 Shop drawings to indicate, mounting heights and locations, wiring diagrams.
 - .2 Submit zone layout drawing indicating number and location of zones and areas covered.
 - .3 Submit wiring diagrams.
 - .4 Submit complete equipment list.
 - .4 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit 1 sample of each component proposed for inclusion into system. Components will be returned for incorporation into work.
 - .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit ULC/UL Product Safety Certificates.
 - .2 Submit verification Certificate that service company is ULC/UL List alarm service company.
 - .3 Submit verification Certificate that monitoring facility is ULC/UL "Listed central station".
 - .4 Submit verification Certificate that security access system is "Certified alarm system".
 - .6 Test and Evaluation Reports:
 - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .7 Manufacturer's Instructions: submit manufacturer's installation instructions.
 - .8 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
 - .9 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and

salvage requirements.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for access controls and equipment for incorporation into manual.
 - .1 Include:
 - .1 System configuration and equipment physical layout.
 - .2 Functional description of equipment.
 - .3 Instructions of operation of equipment.
 - .4 Illustrations and diagrams to supplement procedures.
 - .5 Operation instructions provided by manufacturer.
 - .6 Cleaning instructions.

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, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect access controls and equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 20.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.5 WARRANTY

- .1 For all materials the 12 month warranty period prescribed in subsection GC3.13 of General Conditions is extended to 60 months.
- .2 Manufacturer's Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Design Criteria:
 - .1 Design access control and security access systems using only ULC/UL

- listed products.
- .2 Design security access system using ULC/UL listed alarm service company, company specializing in security access systems.
 - .3 Design security access system for ULC/UL listed central station an alarm monitoring facility having capability to provide specified service.
 - .4 Design security access system as a ULC/UL certified alarm system.
 - .5 Design system as type: central.
 - .6 Central Station Burglar Alarm Systems (CPVX): to CAN/ULC-S301. Design operation of electrical protection circuits and devices for signaled automatically to, recorded in, maintained and supervised from central station with arming and disarming supervised by central station.
 - .1 System description:
 - .1 Type of system: premise.
 - .7 Provide 5 year service contract.
 - .8 Extent of protection: defined by UL 681, Level 4, complete.
 - .9 Area covered: Entire building comprising of Residence and Garage.
 - .10 Alarm sounding device: none.
 - .11 Remote monitoring:
 - .1 Monitoring location: to be within 60 km of site.
 - .2 System with no investigator response.
 - .3 Monitoring Company to contact call-back list when alarm is triggered.
 - .12 Design access control systems to meet safety requirements to UL 294.
 - .13 Design system to provide ease of operation, servicing, maintenance, testing and expansion of additional services.
 - .14 Door activation units:
 - .1 Fully complement and function and match door manufacturer's magnetic controls and hardware.
 - .2 Fully function with OEM supplied door controls and hardware to activate system in routine and emergency conditions.
 - .3 Fully function within supplied electrical supervision circuits as specified.
 - .15 Control Panel:
 - .1 Fully compatible, compliment and operate door magnets provided by door manufacturer of system or OEM supplied door operating hardware.
 - .2 Complete with electronic key pad to release and secure each door.
 - .3 Identify each door control function with lamp electronically identified on panel or associated display unit.
 - .4 Permanently label (paper labels are not acceptable) or electronically identified each door location on panel or associated display unit.
 - .5 Fully function within supplied electrical supervision circuits as specified.
 - .16 Control Signal Standards:
 - .1 Input and Output Signal: 0.0 dBmV + 1.0 dBmV Level.
 - .2 Input and Output Signals: terminated on each control unit.
 - .3 Input and Output Impedance: 120 Ohms, BAL.
 - .4 Channel Bandwidth:
 - .1 Data: 300 Hz to 3.5 kHz (9.6 kilo bits per second rate).
 - .2 DC: 0.5 Hz to 100 Hz, + 5.0%, MIN.
 - .5 S/N Ratio: 60 dBmV + 1.0 dBmV.

- .17 Door Bell Answering System:
 - .1 Design door answering system with door and interior stations including door release in C.O. Office 1.03.
 - .2 System to be complete with system calls, with privacy handsets, audio and video, and mounting requirements as specified.
 - .3 Door chimes to be located in:
 - .1 Living Room 1.04
 - .2 Fitness 1.08
 - .3 Workshop 1.11
 - .4 Corridor 2.11
- .2 Door controls items and panels:
 - .1 Include standard "off the shelf" equipment items to form a complete and operating DRS system.
 - .2 Include: equipment cabinets, equipment panels, AC power strips, power line conditioner, system power supply, junction box, door control panels, door activation units, electronic supervising master panel, electronic supervising remote panel, system connectors, and system cables.
- .3 Provide system cables including coaxial cable, multiconductor control cable, audio and AC power cable required.
- .4 Power supplies: to CAN/ULC-S318.
- .5 Connectors and switches: to ULC-C634.
- .6 Basic System Criteria:
 - .1 Card readers:
 - .1 Type: swipe proximity.
 - .2 Quantity of card readers required: as per door and door hardware schedule.
 - .3 Proximity technology.
 - .4 Fitted with LED indicator light.
 - .5 Reading distance 50 - 200 mm.
 - .6 Compatible with access card model.
 - .2 Cards: plastic, credit-card size, sealed and highly resistant to normal handling and weather, fitted with vertical slot punched hole.
 - .1 Quantity of cards required: box of 200. Departmental Representative to be able to program onsite.
 - .2 Guaranteed for 5 years against all defects and protected against:
 - .1 Magnetic encoded cards.
 - .2 Metal objects including coins and keys.
 - .3 Communication equipment.
 - .3 Coding:
 - .1 Designed with highly secure codification of card information.
 - .2 Card life: minimum period of 10 years for cards in same family.
 - .3 Use 1 series of cards for all areas protected by access control system.
 - .4 CCTV system. One CCTV camera to be installed on existing one storey frame building near pier. System to be able to be viewed from C.O.

- Office 1.03.
- .5 Quantity of alarm monitoring points required:
 - .1 As per door and door hardware schedule.
 - .2 At every window.
 - .3 Water leak sensors in:
 - .1 Washroom 1.02.
 - .2 Kitchen 1.06.
 - .3 Utility Room 1.07.
 - .4 Workshop 1.11.
 - .5 Laundry Room 2.05.
 - .6 Washroom 1.06.
 - .7 Washroom 1.07.
 - .6 Operating system: Windows.
 - .7 Connection: remote dial up.
 - .8 Language: English
 - .9 Off site monitoring of alarm conditions.
- .7 Accessory Software Features:
 - .1 Time and attendance reporting.
 - .2 Features:
 - .1 Local.
 - .2 Graphics.
 - .3 CCTV integration.
 - .4 Intrusion integration.
 - .5 Badging/photo ID integration.
- .8 System Accessories:
 - .1 Electric Exit Device: to ANSI/BHMA A156.3, Grade 1; mortise lock exit device, electric latch retraction. As per section 08 71 00.
 - .2 Power supplies:
 - .1 Continuous low-voltage operation output.
 - .2 Equipped with secondary protection for each output.
 - .3 Individual outputs for connection of devices.
 - .4 AC power failure output.
 - .5 DC power failure output and low battery output.
 - .6 Fitted with tamper contact.
 - .7 Wall mounted cabinet with locked door complete with 2 keys.
 - .3 Magnetic Door Contacts:
 - .1 Standard Doors and Windows:
 - .1 Provide 19mm rare earth magnet, wide gap.
 - .2 Colour to match door frames, and identical throughout the installation.
 - .3 Provide connection to Access Control System.
 - .4 Provide one magnetic door contact per leaf.
 - .4 Voltage: 12 volt DC.
 - .5 Conduit by Division 26.
- .9 Security Control/Communications Panel to be located in Utility Room 1.07.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for access control system 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: BURGLAR ALARM SYSTEM

- .1 Section 26 (Electrical) to provide back boxes, conduits complete with pull wires and for all access control systems and related hardware as required. Install all door hardware operation devices at no less than 900mm and no more than 1200mm above the floor as per the N.B.C.
- .2 Provide tamperproof unobtrusive dual gang receptacle back box with stainless steel cover plate where door release items installed in areas with suspended ceiling, fixed tile, plaster, or concrete walls, and/or metal door frames.
- .3 Fully enclose external cables in conduit or flexible protective armor, from activating unit location's enclosure receptacle back box to and above ceiling wall mounted junction boxes.
- .4 Provide tamperproof attachments for each activation unit cover plate to receptacle back box.
- .5 Enclose in conduit for associated junction box to remaining system locations, from junction box to above ceiling master conduit routes.
- .6 Securely fasten all components to wall, ceiling, or other substrate or structure.

3.3 INSTALLATION: SECURITY ACCESS

- .1 Install security access systems and components in accordance with CAN/ULC-S302.
- .2 Install components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .3 Install components secure to walls, ceilings or other substrates.
- .4 Install required boxes in inconspicuous accessible locations.
- .5 Conceal conduit and wiring.

3.4 SITE TEST AND INSPECTION

- .1 Perform verification inspections and test in presence of Departmental Representative.
 - .1 Provide all necessary tools, ladders and equipment.
 - .2 Ensure appropriate subcontractors , and manufacturer's representatives and security specialists are present for verification.
- .2 Pretesting procedure:
 - .1 Verify (utilizing an approved spectrum analyzer and test equipment) that system is fully operational and meets all system performance requirements of this specification.
 - .2 Measure and record, control (and/or voice) carrier levels of every system channel at each of following points in the system:
 - .1 Door located actuating devices.
 - .2 Door control panel functions.
 - .3 Electronic supervisory control units inputs and outputs.
 - .4 Distribution system input and output.
 - .5 Telephone system interface input and output.
 - .3 Submit to Departmental Representative 2 copies of recorded system pretest measurements, along with pretest certification.
- .3 Performance testing:
 - .1 Test procedure: perform test on a "go-no-go" basis.
 - .1 Make only operator adjustments required to show proof of performance.
 - .2 Test to demonstrate and verify that installed system complies with installation and technical requirements of this specification under operating conditions.
 - .3 Test results to be evaluated by Departmental Representative as either acceptable or unacceptable using following procedures.
 - .2 Documentation review:
 - .1 This review will determine if information provided is sufficient to meet requirements of this specification.
 - .2 Provide for review all System manuals, as installed drawings, pretest forms, antenna radiation pattern[s], equipment cabinet pictorials, antenna pictorial, antenna mount pictorial, video and audio equipment details.
 - .3 Mechanical inspection:
 - .1 Departmental Representative and Contractor to tour areas to insure that Systems and Subsystems are installed in place for proof of performance testing.
 - .2 Take system inventory at this time. Verify following items before beginning proof of performance tests:
 - .1 Electrical power circuits designated for system equipment are properly labeled, wired, phased, protected and grounded.
 - .2 Conductor ends are protected by heat shrink wrap; audio spade lugs, barrier strips and punch blocks are used.
 - .3 Dust, debris, solder splatter, etc. are cleaned and removed from site.
 - .4 Equipment is properly labelled.
 - .5 Equipment identified in system's equipment lists are in-place and properly installed.

- .6 Each lightning and System ground method are installed in accordance with manufacturer's instructions and this specification.
- .4 Subsystem functional test:
 - .1 Conduct operational testing after review of documentation and mechanical inspection completed. Proceed as follows.
 - .1 Perform operational test of each Subsystem to verify that all equipment is properly connected, interfaced and is functionally operational to meet requirements of this specification.
 - .2 Control units:
 - .1 Take S/N readings from control unit's input and output in manual (and/or automatic) mode. Check output of DC/Data converter for S/N. Evaluate entire signal quality at baseband connector output of control unit and remote equipment.
 - .3 Audio:
 - .1 Take S/N readings from transmitter input and receiver output with equipment placed in manual gain mode. Check output of the audio converter, modulator or demodulator for S/N. Evaluate entire audio signal at baseband connector input and output of control unit.
 - .4 Distribution (or interface) system:
 - .1 Check each door utilizing a volt/ohm (or signal level) meter to confirm each function and to insure that system meets all performance requirements.
 - .2 Test each interconnection point (i.e.: door unit, junction box "cross connection", control unit, etc.) to ensure compliance with this specification.
 - .5 Total system test:
 - .1 Proceed with testing when system and subsystems are functionally tested and accepted. Total system tests to verify that requirements have been met for DC (and/or audio), sub carrier, and control signals in accordance with this specification.
 - .6 Safety:
 - .1 Demonstrate with documentation that access control system meets safety requirements specified in UL 294.
- .5 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
 - .1 Sturdiness of equipment fastening.
 - .2 Non-existence of installation related damages.
 - .3 Compliance of device locations with reviewed shop drawings.
 - .4 Compatibility of equipment installation with physical environment.
 - .5 Inclusion of all accessories.
 - .6 Device and cabling identification.
 - .7 Application and location of ULC approval decals.
- .6 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
 - .1 Validate sensitivity of readers and applicability and application of cards.
 - .2 Connecting joints and equipment fastening.

.3 Compliance with manufacturer's specification, product literature and installation instructions.

- .7 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
- .1 Operation of each device individually and within its environment.
 - .2 Operation of each device in relation with programmable schedule and or/specific functions.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer Services:
- .1 Manufacturer of products, supplied under this Section, to review Work involved in the handling, installation/application, protection and cleaning, of its product] and submit written reports, in acceptable format, to verify compliance of Work with Contract.
 - .2 Manufacturer's Field Services:
 - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.
 - .2 Submit 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 Ensure manufacturer's representative is present before and during critical periods of installation and testing.
 - .4 Schedule site visits to review Work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .1 Remove protective coverings from accessories and components.
 - .2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.
 - .3 Clean components free from dirt and fingerprints.
- .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.

3.7 PROTECTION

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

END OF SECTION

Part 1 GENERAL

- .1 This section supplements the requirements of Divisions 01 and 26.

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 79 00 - Demonstration and Training.
- .4 Section 26 05 00 - Common Work Results for Electrical.
- .5 Section 26 05 21 - Wires and Cables (0-1000 V).
- .6 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

- .1 Underwriters Laboratories' of Canada (ULC)
 - .1 CAN/ULC-S524:2019, Standard for the Installation of Fire Alarm Systems.
 - .2 CAN/ULC-S525:2016, Audible Signal Appliances for Fire Alarm Systems including accessories.
 - .3 CAN/ULC-S526:2016-REV1, Visible Signal Devices for Fire Alarm Systems.
 - .4 CAN/ULC-S527:2019, Standard for the Control Units for Fire Alarm Systems
 - .5 CAN/ULC-S528:2014, Manual Pull Stations for Fire Alarm Systems.
 - .6 CAN/ULC-S529:2016, Smoke Detectors for Fire Alarm Systems.
 - .7 CAN/ULC-S530:91(R2018), Heat Actuated Fire Detectors for Fire Alarm Systems.
 - .8 CAN/ULC-S536:2019, Inspection and Testing of Fire Alarm Systems.
 - .9 CAN/ULC-S537:2019, Verification of Fire Alarm Systems.
- .2 NBC 2015, National Building Code.
- .3 The 2015 National Fire Code (O.Reg. 213/07) is enforced by the municipal fire department.
- .4 The installation shall be in accordance all applicable codes. If any requirements of these specifications are different, omitted, or contrary to the codes, then the code governs and overrides these specifications at no additional cost to this contract.

- .5 In no instance shall the standards established by the drawings and specifications be reduced by any of the codes referred to above.

1.3 SYSTEM DESCRIPTION

- .1 New system is to be a fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques with peer to peer network architecture for data control and digital, and multiplexing techniques with peer to peer network architecture for data transmission.
- .2 New system is to carry out fire alarm and protection functions; including receiving alarm signals; initiating single stage alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.
- .3 Zoned, non-coded, single stage.
- .4 Central control unit located at main entrance.
- .5 Main control, annunciator panels and system functions shall be located as indicated and include:
 - .1 Alarm device address and zone annunciation.
 - .2 Device address and zone trouble annunciation (system wiring and devices).
 - .3 Single stage signal operation.
 - .4 Provisions for direct automatic signalling to the local fire department
 - .5 Annunciation of all wiring, and components failures.
 - .6 Automatic deactivation of access control system door locks and release of door hold open devices.
 - .7 Provision to transmit signal to elevator controllers in machine rooms for automatic elevator cab homing to the main floor or alternate floor.
 - .8 Wall mounted active graphic annunciator panel.
 - .9 Wall mounted floor plans of typical levels.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- .1 System:
 - .1 Subject to Departmental Representative's inspection for final acceptance.
 - .2 Comply with all requirements of the Town of Cobourg Building Inspection and Town of Cobourg Fire Department Fire Prevention Branches.

- .2 System components: listed by ULC and comply with applicable provisions of National Building Code and meet requirements of local authority having jurisdiction.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings for new devices in accordance with Section 01 33 00.
- .2 Include:
 - .1 Details for devices.
 - .2 Pictorial drawings of devices indicating the location of the components and parts, and their respective catalogue number and electrical characteristics.
 - .3 Maintenance instructions and recommended spare parts list.

1.6 OPERATION AND MAINTENANCE DATA

- .1 Provide updated operation and maintenance data for fire alarm system for incorporation into manual specified in Section 01 78 00.
- .2 Include:
 - .1 Instructions for complete fire alarm system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.
 - .4 List of recommended spare parts for system.

1.7 MAINTENANCE

- .1 Coordinate system modifications with existing maintenance contract.

1.8 TRAINING

- .1 Provide additional requirements in accordance with Section 01 79 00.
- .2 Provide 24 hours of on-site training. Six (6) weeks prior to completion, submit two copies of training plan to the Departmental Representative for review. Include a listing of training topics and a proposed training schedule. Amend the plan as instructed by the Departmental Representative and resubmit for approval prior to training commencement.

- .3 Training shall include on-site lectures, seminars, equipment demonstration and hands-on staff training by qualified fire alarm system equipment representatives in use and maintenance of fire alarm system.
- .4 Training shall include all aspects of the fire alarm system operation under normal and alarm conditions and system test procedures. Provide at various stages of system completion, including:
 - .1 Substantial completion of the fire alarm system.
 - .2 Six months after final acceptance and commissioning of the entire fire alarm system, provide six (6) hours additional training.
- .5 All training sessions, demonstrations and seminars shall be scheduled during working weekdays between the hours 8:30am to 11:30am and 1:00pm to 4:00pm, or as directed by the Departmental Representative.

1.9 SYSTEM VERIFICATION AND TESTING

- .1 Provide complete verification, testing and certification for all new or modify work of the fire alarm system as outlined herein. Indicate all verification and testing activities and milestones in the project schedule. Provide in accordance with Section 26 05 00. This includes:
 - .1 At completion of new modified system installation to CAN/ULC-S537.
 - .2 Partial integrated systems testing and verification.
 - .3 Partial system acceptance testing with Authorities Having Jurisdiction for new and modified system.
- .2 Installation shall be in full compliance with the requirements of the Town of Cobourg Buildings Branch and the Cobourg Fire Department Fire Prevention Bureau.
- .3 Provide testing and verification services of the manufacturer technical support.
- .4 Schedule testing in the presence of the authority having jurisdiction.

The testing schedule, as approved by the Departmental Representative, shall occur weekday evenings going no later than 24:00 hours (midnight) daily. Approved testing on weekends shall be no longer than ten (10) hours per day. Commissioning activities shall not be scheduled on weekends.
- .5 The Contractor shall provide the necessary qualified personnel to assist with all testing and verification.

- .6 Provide manufacturer's qualified and licensed technician, sprinkler technician, elevator technician and electrician to be present for all acceptance testing and inspection by Authorities Having Jurisdiction.

1.10 QUALIFICATIONS

- .1 All contractors personnel performing testing and verification, and installing fire alarm system including equipment, devices, wire termination and other components, and performing testing and verification shall be certified in accordance with the National Fire Code.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Equipment and devices: ULC listed and labelled.
- .2 Manual pull stations: to CAN/ULC-S528.
- .3 Thermal detectors: to CAN/ULC-S530.
- .4 Smoke detectors: to CAN/ULC-S529.
- .5 Power supply: to CAN/ULC-S524.
- .6 Audible signal devices: to CAN/ULC-S524.
- .7 Visual signal devices: to CAN/ULC-S526.
- .8 Control unit: to CAN/ULC-S527.

2.2 CONTROL PANEL

- .1 Central Control Unit (CCU).
 - .1 Shall be newly provided Addressable Fire Alarm Panel

2.3 DATA COMMUNICATIONS LINKS

- .1 Provide data communications links for two-way data communication with addressable initiate devices, interface modules and control modules utilizing digital poll/response protocol communication format. Addressable cables shall be type: DCLA.
- .2 Provide line isolators for all addressable data communications link cables which pass through fire separations. Provide as required in compliance with requirements of CAN/ULC-S524

2.4 POWER SUPPLIES

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

2.5 INITIATING/INPUT CIRCUITS

- .1 Data communication link wiring for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors shall be wired in DCLA configuration.
- .2 Alarm receiving circuits (active and spare); compatible with smoke detectors and open contact devices.
- .3 Actuation of alarm initiating device: cause system to operate to suit sequences of operation.
- .4 Receiving circuits for supervisory, N/O devices shall be connected to addressable input modules.
- .5 Actuation of supervisory initiating device: cause system to operate to suit sequence of operation.

2.6 ALARM OUTPUT CIRCUITS

- .1 Alarm output circuit: connected to horns and horn/strobes.
- .2 Horns on each floor or building area shall be wired to new fire alarm panel.

2.7 AUTOMATIC ALARM INITIATING DEVICE

.1 Manual Alarm Stations

- .1 Addressable manual pull station, pull lever, break glass rod, semi-flush wall mounted type, single action, electronics to communicate station's status to addressable module/transponder over two (2) wires and to supply power to station. Station address to be set on station in field.
- .2 Provide a locked set feature to permit the transmission of an alarm without breaking the glass for fire drills or tests.
- .3 Finish the station in red with white bilingual lettering instructions.
- .4 Manual stations flush mounted and equipped with a suitable terminal block and addressable electronics. Mount in two-gang outlet box, with suitable device skirt.

.2 Thermal Fire Detectors

- .1 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C, rate of rise 8.3°C per minute.
 - .1 Electronics to communicate detector's status to addressable module/transponder.
 - .2 Detector address to be set on detector base or head in field.
 - .3 EMI/RFI shielded electronics.
 - .4 Sealed against rear air flow entry.

.3 Smoke Detectors

- .1 Addressable variable-sensitivity smoke detectors.
 - .1 Twist lock plug-in type with fixed base.
 - .2 Wire-in base assembly with integral read alarm LED, and terminals for remote relay or alarm LED.
 - .3 Photo-electric type.
 - .4 Electronics to communicate detector's status to addressable module/transponder.
 - .5 Detector address to be set on detector base or head in field.
 - .6 Sealed against rear air flow entry. EMI/RFI shielded electronics. Device openings provide 360° smoke entry.
 - .7 System to indicate when devices require cleaning. Annunciate zone and individual address of device.

- .4 Remote Alarm Lamp
 - .1 LED type mounted on standard single gang switch box with brushed stainless steel faceplate, screw type terminals and wired to the detector for which it is to provide remote indication.

2.8 SIGNAL DEVICES

- .1 Combination horn/visual alarm device with horn features as described above as follows:
 - .1 Xenon flash tube.
 - .2 Flashing red.
 - .3 24 VDC operator.
 - .4 15 candela strobe or 30 candela strobe.
 - .5 Mounted on horn grille.
- .2 Mounted in metal boxes suitable for surface mounting or install recessed in suspended ceilings.
- .3 Supported on Tee-Bar ceilings with adjustable mounting brackets attached to horn box.

2.9 END-OF-LINE DEVICES

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

2.10 ANCILLARY DEVICES

- .1 Remote relay units to interface with fan motor control fan shutdown.
- .2 Operated by addressable control relay module.
- .3 Multiple pole, double voltage rated to suit application.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install systems in accordance with CAN/ULC-S524.
- .2 Install manual alarm stations and connect to alarm circuit wiring.

- .3 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.
- .4 Connect alarm circuits to main control panel.
- .5 Install horns and visual signal devices and connect to signalling circuits.
- .6 Connect signalling circuits to main control panel.
- .7 Install end-of-line devices at end of alarm and signalling circuits. Locations of end-of-line devices as directed by Departmental Representative.
- .8 Splices in wiring is not permitted.
- .9 Provide necessary raceway, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- .10 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .11 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.
- .12 Install horns and connect to horn circuits.
- .13 Provide all other fire alarm system wiring in accordance with requirements indicated in Section 26 05 21. Provide all wiring in new separate conduit systems for the following:
 - .1 Initiate circuits and auxiliary control.
 - .2 Signal/paging circuits.
- .14 Install and demonstrate capabilities of fault isolation modules needed to meet requirements of CAN/ULC-S524.

3.2 FIELD QUALITY CONTROL

- .1 Perform modified system verification in accordance with CAN/ULC-S537.
- .2 Contractor's personnel performing work on the fire alarm system shall be CFAA accredited and currently licensed.
- .3 Fire alarm system:
 - .1 Test such device and alarm circuit to ensure manual stations, thermal and smoke detectors, transmit alarm to control panel and actuate first stage alarm, general alarm and ancillary devices.

- .2 Check annunciator panels to ensure zones are shown correctly.
- .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.
- .4 Addressable data communication link (DCL) cabling:
 - .1 Test all DCLA, DCLB and DCLC data communication link wiring and demonstrate performance meets requirements outlined in CAN/ULC-S524 Table -1.
 - .2 Provide final system programming incorporating all program changes made during construction.

3.3 SCHEDULING AND PLANNING

- .1 Review strategy and planning carefully with the Departmental Representative. Provide a detailed construction schedule.
- .2 Contact the Town of Cobourg Building Inspection Office and the Cobourg Fire Department and review proposed implementation procedures and work schedule.
- .3 Stage the work to provide an organized systematic approach to the installation, verification and testing process.
- .4 The Contractor shall outline in the detail construction schedule all description of work, sequencing, hours of work, disruptions and schedule dates.

3.4 VERIFICATION FORMS AND CHECKLISTS

- .1 Provide all required tools, materials, labour to complete verification forms and checklists for each new fire alarm system component throughout the building.
- .2 Provide sample verification forms to be used. Make all modifications as directed by the Departmental Representative.
- .3 Zone identification and description, device address and description shall be submitted to the Departmental Representative for review and acceptance prior to commissioning of devices and system. Provide English and French text to be displayed or printed.
- .4 Complete all forms and submit to Departmental Representative for review prior to commissioning each portion of the new system.

3.5 TESTING AND VERIFICATION

- .1 Refer to 3.3 Implementation Sequence and Requirements.

- .2 At each stage of completion of the new system equipment and devices test and verify the system using the supervisory services of the manufacturer. Perform verification to CAN/ULC-S537.
- .3 After completion of system verification perform commissioning to CAN/ULC-S536.
- .4 Only after the testing verification and commissioning tasks are completed, and all deficiencies rectified, notify the Departmental Representative, the representatives of the Town of Cobourg Building Inspection and the Cobourg Fire Department and perform acceptance testing. This includes in their presence demonstrate the proper functioning of the entire system.
- .5 The purpose of a verification procedure for the system is to make certain that all equipment operates as intended. Upon completion of the verification procedures, an approved certificate of verification shall be provided to the Departmental Representative. One copy shall be displayed near the control panel, and a copy shall be kept with the system documentation. An equipment schedule listing each device and showing confirmation that was verified shall be provided.
- .6 The verification shall be performed by manufacturers' field technicians registered with the Canadian Fire Alarm Association (C.F.A.A.).
- .7 The system verification, and inspection and testing shall be conducted in accordance with the latest revisions of the CAN/ULC-S537, "Standard for Verification of Fire Alarm Systems" and CAN/ULC-S536 "Standard for the Inspection and testing of fire alarm systems" and as described herewith.
- .8 Simulate grounds and breakers on initiate and signal circuits to demonstrate and ensure proper operation of trouble signals. Simulate capability of subsequent alarm signals during each imposed open circuit and ground fault conditions. Trouble signals shall be verified to operate an open circuit, short circuit, ground fault or the removal of any plug-in component. Wiring shall be inspected to ensure that individual terminations have been provided for all conductors, and that where applicable correct polarities have been observed.
- .9 All equipment installed as part of the system shall be inspected for visible damage or tampering which might interfere with its intended operation.

- .10 Any device which is field adjustable shall be tested to ensure that its setting is acceptable under ambient conditions at the location of installation.
- .11 Each and every new manual initiating device shall be operated to verify their proper operation.
- .12 Each and every new heat detector, resettable or self-restoring: a heat source shall be used to test the device operation.
- .13 Each and every new heat detector, non-resettable: simulate the detectors operation by shorting terminals on the detector base.
- .14 Each and every new smoke detector, duct and area type: detector sensitivity shall be tested according to the manufacturer's recommendations. Detector operation shall be tested by introducing "smoke" into the detector.

Review location of smoke detector device with manufacturer prior to installation and adjust as required. Install sampling tubes and verify air flow through tubes and smoke detector housing. Relocate as necessary if insufficient air flow due to duct air turbulence or installation method.
- .15 All audible signal appliances shall be tested for acceptable operation. Tests shall be made to determine that the signal is audible throughout the building above normal ambient noise. Tests shall be made to verify that adequate power is available from both normal and standby sources under the maximum system load. Provide field measure sound pressure levels (dBA) for each room or area and record results on a floor plan which shall be submitted with the verification report.
- .16 Installation of additional signals or revisions to power sources shall be made to ensure audibility prior to completion of the inspection before a certificate of verification can be issued.
- .17 Annunciators shall be tested to ensure proper operation, correct voltage, correct zoning and visibility of all legends.
- .18 The system normal power supply shall be inspected to ensure that is properly fused, locked away from unauthorized interruption, adequate to meet system requirements and separated from auxiliary device power source such that a fault in such circuit cannot affect fire alarm system control unit power.

- .19 Battery units shall be inspected for protection from accidental damage and for adequate ventilation. Batteries shall be permanently connected to a properly fused charging circuit dedicated to the alarm system batteries.
- .1 The batteries shall have sufficient capacity to operate the fire alarm system for 24 hours with the charger input disconnected, followed by 120 minutes of full evacuation alarm operation.
- .20 All control equipment shall be tested for acceptable operation. An inspection and test shall be made of all cable terminals, plug connectors, plug-in circuits, lamp sockets and controls to confirm that their mechanical and electrical connections and mounting are acceptable, and where applicable, to confirm their electrical supervision.
- .21 All field wiring shall be verified to be terminated on a single conductor per terminal basis.
- .1 All lamps and indicators shall be tested for acceptable operation. All control functions shall be operated to verify correct response. Simulation of open circuits, short circuits and ground faults shall be performed on all relevant components to confirm proper trouble circuit response.
- .22 Ancillary equipment connections shall be tested for proper operation. Such equipment shall be inspected to ensure that faults in it will not interfere with alarm system operation.
- The remote central station connection shall be tested for acceptable operation.
- .23 On completion of all tests and verification provide the Departmental Representative's approval for approval a certificate of test and verification and proof of liability insurance for tests and verification.
- .24 Only when testing is completed in accordance with the ULC verification standards and as noted herewith, the ULC label shall be affixed to each control panel and the certificate of verification issued.
- .25 All costs involved in this inspection including security escort by Commissionaires, manufacturer's technician, the verification agent, and the electrical contractor's personnel shall be included with the electrical contractor's total tender price.

3.6

WARRANTY PERIOD

- .1 Refer to Section 26 05 00.
- .2 During the warranty period provide fire alarm system monthly inspection and testing in accordance with CAN/ULC-S536.
- .3 Prior to the end of the warranty period provide complete system inspection and testing performed in conformance with CAN/ULC-S536.
- .4 All work shall be performed by the Fire Alarm System Manufacturer accredited CFAA Technician.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 32 12 16 - Asphalt Paving.
- .3 Section 32 16 15 - Concrete Walks and Curbs.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-17, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136/C135M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-18, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .4 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 1010 - November 2013, Material Specifications for Aggregates - Base, Subbase, Select Subgrade and Backfill.
 - .2 OPSS 310 - November 2017, Construction Specifications for Hot Mix Asphalt.
 - .3 OPSS 805 - November 2018, Construction Specifications for Temporary Erosion and Sediment Control Measures.

1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

- .3 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.1 and CAN/CGSB-8.2.
 - .2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Quality Control:
 - .1 Submit condition survey of existing conditions.
 - .2 Submit written notice at least 7 days prior to excavation work.
 - .4 Submit written notice when bottom of excavation is reached.
 - .5 Submit testing inspection results and report.
- .2 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field, clearance record from utility authority and location plan of relocated and abandoned services, as required.

1.5 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify and establish location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as

indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, establish location and state of use of buried utilities and structures.

.6 Confirm locations of buried utilities that be affected by Work by careful test excavations or soil hydrovac methods.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.8 Where utility lines or structures exist in area of excavation, obtain direction before removing or re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Conduct condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Owner

.3 Where required for excavation, cut roots or branches.

Part 2 Products

2.1 MATERIALS

.1 Granular 'A' and 'B' Type 3 as per OPSS 1010.

.2 Type 3 fill: selected material from excavation or other sources, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum cement content of 25 kg/m³ with 40% by volume fly ash replacement: to CSA-A3001, Type GU.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CSA-A23.1/A23.2.

.5 Cement: Type GU.

.6 Slump: 160 to 200 mm.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

3.2 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION / PROTECTION

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses, and removed from site.
- .2 Strip topsoil to depths as indicated.
 - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as indicated.
 - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil offsite.

3.5 STOCKPILING

- .1 Stockpile fill materials in areas designated.
 - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Protect open excavations against flooding and damage due to surface run-off.
- .3 Dispose of water in to approved collection or runoff areas, and in manner not detrimental to public and private property, or portion of Work completed or under construction.

3.7 EXCAVATION

- .1 Advise at least 7 days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Remove concrete, masonry, paving, walks, demolished foundations and rubble, and other obstructions encountered during excavation.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 Dispose of surplus and unsuitable excavated material off site.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

3.8 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D 698 and ASTM D 1557.
 - .1 Under concrete slabs: provide 200 mm compacted thickness base course of Granular 'A' fill. Compact base course to 100%.
 - .2 Under asphalt: 100%.

3.9 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Department Representative has inspected installations.
 - .2 Department Representative has inspected construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to

equalize loading. Difference not to exceed 0.3 m.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure.

3.10 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects.
- .2 Replace topsoil as indicated.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Ontario Provincial Standard Specification
 - .1 OPSS 1010 April 2013, Aggregates - Base, Sub-base, Select Sub-grade and Backfill Material.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

Part 2 Products

2.1 MATERIALS

- .1 Granular 'A' fill: properties to meet the requirements of Ontario Provincial Standard Material Specification OPSS 1010.
 - .1 Crushed material consisting of pit run or screened stone, gravel, sand.
- .2 Granular 'B' Type II fill: properties to meet the requirements of Ontario Provincial Standard Material Specification OPSS 1010.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular base after subgrade surface is inspected and approved by Departmental Representative.
- .2 Placing:
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.

- .4 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .7 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
- .1 Ensure compaction equipment is capable of obtaining required material densities.
- .4 Compacting:
- .1 Compact to density not less than maximum dry density specified in individual specification sections.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.4 CLEANING

- .1 Progress Cleaning: 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

1.1 RELATED REQUIREMENTS

- .1 Section 31 11 23 - Aggregate Base Courses.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-10(2015), Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29-15, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245-15, Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-2015 (Seventh Edition), Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 ASTM International
 - .1 ASTM C 88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C 117-17, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 123-14, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C 127-15, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C 128-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C 131-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C 136-14, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C 207-2011, Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM D 995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D 2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .11 ASTM D 3203-17, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .12 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
- .5 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 1010 - November 2013, Material Specifications for Aggregates - Base, Subbase, Select Subgrade and Backfill Material.
 - .2 OPSS 310 - November 2017, Construction Specifications for Hot Mix

Asphalt.

.3 OPSS 1150 - November 2018, Material Specification for Hot Mix Asphalt.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials and erosion and sedimentation control plan. Stockpile minimum 50% of total amount of aggregate required before beginning asphalt mixing operation.

.3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.

.4 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.

Part 2 Products

2.1 MATERIALS

.1 Performance graded asphalt cement: PG 58-34.

.2 Asphalt Course:

.1 Base Course: HL8 or SP19 mm as per OPSS 1150.

.2 Surface Course: HL3 or SP12.5 mm as per OPSS1150.

.3 Aggregates: in accordance with Section 31 05 16 - Aggregate Materials, and requirements as follows:

.1 Base: Granular 'A' as per OPSS 1010.

.2 Subbase: Granular 'B' Type 2 as per OPSS 1010.

2.2 EQUIPMENT

.1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Drum diameter: 1200 mm minimum.

.2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 50 mm thick.

- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
- .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller.
 - .3 Straight edges, 4.5 m in length, to test finished surface.

2.3 MIX DESIGN

- .1 Mix design to be developed by testing laboratory and reviewed by Department Representative.

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 asphalt paving in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .2 When paving over existing asphalt surface, clean pavement surface.
 - .1 When levelling course is not required, patch and correct depressions and other irregularities before beginning paving operations.
- .3 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.

- .2 Schedule delivery of material for placing in daylight.
- .3 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .4 Deliver loads continuously in covered vehicles and immediately spread and compact.
 - .1 Deliver and place mixes at temperature within range, but not less than 135°C.

3.4 MILLING (GRINDING) OF ASPHALT

- .1 Mill (grind) existing bituminous pavement as indicated to accommodate new pavement installation.

3.6 PROOF ROLLING

- .1 Proof roll using suitable heavy machinery with pneumatic tires. Non-standard proof rolling equipment will not be accepted.
- .2 Make sufficient passes with proof vehicle to subject every point on surface to two separate passes of loaded tire.
- .3 Where proof rolling reveals areas of defective subbase, remove defective (soft) subgrade materials to depth and extent as directed by Engineer and replace with new dry materials as approved by the Engineer.
- .4 Replace subbase material and compact in accordance with this section.
- .5 Prior to base asphalt being laid, the Contractor is to coordinate a Proof Roll inspection of the road base material with Departmental Representative. Contractor to ensure the road base materials have been previously tested and have met material quality and compaction requirements.

3.7 PLACING OF ASPHALT

- .1 Clean surface prior to placing asphalt.
- .2 Install tack coat prior to placing asphalt.
- .3 Place asphalt concrete to thicknesses, grades and lines as indicated.
- .4 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is 5°C minimum.
 - .2 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .5 Place asphalt concrete in compacted lifts of thickness as indicated.
- .6 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .7 Place individual strips no longer than 200 m.

- .8 Install neat saw cut at limits of work.

3.8 COMPACTING

- .1 Do not change rolling pattern unless mix changes or lift thickness changes.

- .2 Roll asphalt continuously to density not less than 96% of Marshall density.

.3 General:

.1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.

.2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.

.4 Use static compaction for levelling coarse less than 25 mm thick.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.

.6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.

.11 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.12 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

.13 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.4 Intermediate rolling:

.1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.

.2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

.5 Finish rolling:

.1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.

.1 If necessary to obtain desired surface finish, use pneumatic-tired rollers.

.2 Conduct rolling operations in close sequence.

3.9 COMPACTION REQUIREMENTS

- .1 Granular Base: 98-100% SPMDD (Standard Proctor Maximum Dry Density, ASTM, D-698).
- .2 Asphaltic Concrete: 92-97% MRD (Maximum Relative Dry Density, ASTM D2041).

3.10 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.
 - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
 - .3 Paint contact surfaces of existing structures such as manholes and curbs with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

3.11 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.
- .3 Finished asphalt surface to have positive drainage towards existing catchbasin outlets.

3.12 FIELD TESTING

- .1 Coordination and payment for granular and asphalt field testing by Contractor:
 - .1 Carry out three (3) granular compaction tests evenly across the

site. Submit field and laboratory results.

.2 Carry out two (2) asphaltic concrete sampling and compaction tests evenly across the site after placement of asphalt paving. Submit field and laboratory results.

3.13 DEFECTIVE WORK

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.

.1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.14 CLEANING

.1 Progress Cleaning: 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

1.1 SECTION INCLUDES

- .1 Materials and installation for sand-set unit paving without mortared joints for pedestrian or light vehicular traffic.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C117-17, Standard Test Method for Material Finer than 75 µm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136/C136M-19, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International).
 - .1 CSA A23.1-M90/A23.2-M90, Concrete materials and Methods of Concrete Construction.
 - .2 CSA-A179-04 (2014), Mortar and Grout for Unit Masonry.
 - .3 CSA A231.1:19/A231.2:19, Precast Concrete Paving Slabs/Precast Concrete Pavers.

1.3 SUBMITTALS

- .1 Submit following product test data:
 - .1 Sieve analysis for gradation of bedding and joint material.
 - .2 Unit paver test data.
- .2 Submit shop drawings in accordance with Section 01 33 00.
- .3 Submit samples in accordance with Section 01 33 00.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 0.
- .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 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.

- .5 Divert unused aggregate materials from landfill to facility for reuse as approved by Departmental Representative.
- .6 Divert unused geotextiles from landfill to plastic recycling facility approved by Departmental Representative.
- .7 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Unit pavers: uniform in material, colour, size and from one manufacturer.
- .2 Precast concrete paving slabs: to CSA A231.1/A231.2, Texture HD² smooth, 811 mm x 404 mm paver size, 90 mm thick. Running bond pattern. Colour as selected from standard range.
- .3 Crushed stone or gravel base: consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .1 Gradations: within limits specified when tested to ASTM C136/C136M and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	% Passing
19 mm	100
12.5 mm	70-100
4.75 mm	40- 70
2.00 mm	23- 50
0.425 mm	7- 25
0.075 mm	3- 8

- .4 Joint sand: to CAN/CSA-A179, hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .5 Edging: high density polyethylene unless otherwise noted on drawings.
- .6 Geotextile filter: non-woven synthetic fibre fabric, supplied in rolls.
 - .1 Width: 0.915 m minimum.
 - .2 Length: 15 m minimum.
 - .3 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.

PART 3 - EXECUTION

3.1 PROTECTION

- .1 Prevent damage to buildings, landscaping, curbs, sidewalks, trees, fences,

roads and adjacent property. Make good any damage.

3.2 SUBGRADE

- .1 Ensure that subgrade preparation conforms to levels and compaction required to allow for installation of granular base.

3.3 GEOTEXTILE

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with pins.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Pin successive strips of geotextile with securing pins as per manufacturer's written instructions.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 After installation, cover with overlying layer within 4 hours of placement.
- .8 Replace damaged or deteriorated geotextile to approval of Departmental Representative.

3.4 GRANULAR BASE

- .1 Base minimum thickness: 100 mm.
- .2 Spread and compact crushed stone or gravel base in uniform layers not exceeding 100 mm compacted thickness.
- .3 Compact base to a density of not less than 95% Standard Density in accordance with ASTM D698.
- .4 Shape and roll alternately to obtain smooth, even and uniformly compacted granular base and ensure conformity of grades with finish surface.
- .5 Apply water as necessary during compaction to obtain specified density. If granular base is excessively moist, remove it and install more granular material to rid it of sponginess.
- .6 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.
- .7 Ensure top of granular base does not exceed plus or minus 10 mm over 3 m

straightedge.

3.5 EDGING

- .1 Install edging true to grade at all dissimilar, adjacent landscaping.

3.6 BEDDING SAND

- .1 Place and spread bedding sand to 25 mm compacted thickness.
- .2 Maximum thickness after compaction: 25 mm.
- .3 Use material other than bedding sand to compensate for depressions that exceed specified tolerances in surface of base.
- .4 Do not use joint sand for bedding sand.

3.7 SURFACE COURSE

- .1 Ensure bedding sand and granular base are not saturated prior to placement of unit pavers.
- .2 Install unit paving true to grade on the bedding sand, in location, layout and running pattern.
- .3 Where required, cut units accurately without damaging edges.
- .4 Precast concrete paving slabs:
 - .1 Install paving slabs with 10 mm wide joints.
 - .2 For vehicular areas, use cut pieces no smaller than one-third of a whole paver.
 - .3 Compact and level slabs with min. 22 kN force mechanical plate vibrator use minimum 19 mm thick plywood or neoprene pad under plate compactor and over slabs until units are true to grade and free of movement.
 - .4 Do not compact unit paving within 1 m of unrestrained edges.
 - .5 Fill spaces between pavers by sweeping in sand.
 - .6 Pass mechanical plate vibrator over unit paving to achieve compaction of sand in joints. Ensure joints are full at completion of compaction.
 - .7 At completion of each work day, ensure work within 1 m of laying face is left fully compacted with sand filled joints.
 - .8 Surface of finished pavement: free from depressions exceeding 3 mm as measured with 3 m straight edge.
 - .9 Sweep surface clean and check final elevations for conformance to drawings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Section 32 11 23 - Aggregate Base Courses.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.1-19, Concrete materials and methods of concrete construction, latest edition
 - .2 CSA A23.2-19, Test methods and standard practices for concrete, latest edition

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance CSA A23.1.
- .2 Reinforcing steel: in accordance with CSA A23.1.
- .3 Joint filler: in accordance with CSA A23.1.
- .4 Granular base: material to Section 32 11 23 - Aggregate Base Courses:
 - .1 Granular 'A'
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .6 Concrete sealer and joint sealant in accordance with CSA A23.1.

Part 3 Execution

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials. Dispose of surplus and unsuitable excavated material off site.

3.2 GRANULAR BASE

- .1 Obtain Departmental Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to at least 100% of maximum density to ASTM D698.

3.3 CONCRETE

- .1 Obtain Departmental Representative approval of granular base and reinforcing steel prior to placing concrete.
- .2 Install formwork in accordance with CSA A23.1
 - .1 Forms to be secured to resist pressure of wet concrete, impact and vibration of construction equipment without springing or movement.
 - .2 Tolerance: 6 mm in 3 m horizontal, 3 mm in 3 m vertical.
- .3 Do concrete work in accordance with CSA A23.1.
- .4 Concrete pavement, sidewalks and curbs to be in accordance with the locations shown on plan.
- .5 Immediately after floating, where indicated give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
- .6 Provide edging as indicated.

3.4 TOLERANCES

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5 STRAIGHT EDGING

- .1 Following strike off and consolidation, concrete to be scraped with an aluminum or magnesium straight edge. Straightedge to be 3 m long and equipped with a handle to permit use from side of concrete. Prior to scraping concrete, any excess water or laitance to be removed from surface of concrete. Straightedge to be drawn perpendicular to the centerline of pavement, forward in the direction of the paving, one half its length after each pass. Correct irregularities in surface with addition or removal of concrete and resurface with straightedge.

3.6 CONTRACTION JOINTS

- .1 Sawcut contraction joints at maximum 6m intervals.

3.7 EXPANSION / ISOLATION JOINTS

- .1 Expansion / isolation joints shall be constructed where new concrete abuts rigid objects, stairs, walls, curbs, buildings, or changes in direction and as shown on plans.
- .2 Expansion joints shall be constructed to the full depth of slab and continuous from edge to edge. Finished joint should not deviate in

horizontal alignment more than 6mm from a straight line. Edge and texture joint to match adjacent surface.

- .3 Install joint filler in expansion and isolation joints in accordance with CSA A23.1.
- .4 Provide full depth joint at end of day's construction or when concrete placement is interrupted for more than 30 minutes.
- .5 Seal isolation joints with sealant in accordance with CSA A23.1.

3.8 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative. Compact and shape to required contours as indicated.

3.9 CLEANING

- .1 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 RELATED REQUIREMENTS

- .1 Section 32 12 16 - Asphalt Paving.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.5-99, Low Flash Petroleum Spirits Thinner.
 - .2 CAN/CGSB-1.74-01, Alkyd Traffic Paint.
- .2 Green Seal (GS)
 - .1 GS-11-2013, Standard for Paints and Coatings.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #32 Traffic Markings Paint, Alkyd.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 MATERIALS

- .1 Paint and Markings:
 - .1 To MPI #32, Alkyd zone/traffic marking.
 - .2 Traffic Marking Coatings: maximum VOC limit 450 g/L to SOR/2009-264 Schedule 1 and to GS-11 Standard.
 - .3 Paints: in accordance with MPI recommendation for surface conditions.
 - .4 Colour: yellow and white, to match existing conditions.
- .2 Thinner: to MPI listed manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

- .1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.
- .2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.

3.3 APPLICATION

- .1 Pavement markings: lay out pavement markings.
- .2 Apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.
- .3 Apply traffic paint evenly at rate of 3 m² /L.
- .4 Do not thin paint.
- .5 Paint lines of uniform colour and density with sharp edges.

3.4 TOLERANCE

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.

- .2 Remove incorrect markings.

3.5 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

3.6 PROTECTION

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.

1.2 DEFINITIONS

- .1 Compost:
 - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
 - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
 - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants.
 - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category A.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Quality control submittals:
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

Part 2 Products

2.1 TOPSOIL, PM-01

- .1 Topsoil for planting beds and sodded areas:
 - .1 Mixture of particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .2 Topsoil shall meet the following physical and chemical properties:
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, and 7 to 15% clay.
 - .2 Total organic matter, 10 to 18% by weight.
 - .3 pH: 6.5 to 8.0
 - .4 Electrical Conductivity: less than 2.5 milliSiemens/cm

- .5 Fertility: major soil nutrients present in following amounts:
 - .1 Phosphorus (P): 10 to 60 ppm
 - .2 Potassium (K): 80 to 250 ppm
 - .3 Calcium, magnesium, sulphur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
- .3 Contain no toxic elements or growth inhibiting materials.
- .4 Contains no weed seeds in quantities that cause noticeable weed infestations in the final planting bed.
- .5 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .6 Consistence: friable when moist.

2.2 SOURCE QUALITY CONTROL

- .1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct.
 - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than 50 mm above surface.
 - .3 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
 - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.2 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.

- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil as indicated and to following minimum depths after settlement:
 - .1 150 mm for sodded areas.
 - .2 450 mm for planting beds.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.3 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Leave surfaces smooth, uniform and firm against deep footprinting.

3.4 ACCEPTANCE

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.5 SURPLUS MATERIAL

- .1 Dispose of materials except topsoil not required off site.

3.6 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 91 19.13 - Topsoil Placement and Grading.

1.2 REFERENCES

- .1 Canada "Fertilizers Regulations" (C.R.C., c. 666), enabled under the Canada Statute "Fertilizers Act", R.S., 2015, c. F-10.
- .2 Canada "Seeds Regulations" (C.R.C., c. 1400), enabled under the Canada Statute "Seeds Act", R.S.C., 2020, c. S-8.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Schedule sod laying to coincide with preparation of soil surface.
 - .2 Schedule sod installation when frost is not present in ground.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sod and fertilizer and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Schedule deliveries in order to keep storage at the job site to a minimum without causing delays.
- .2 Deliver, unload and store rolled sod on pallets only.
- .3 Do not deliver small, irregular or broken pieces of sod. Departmental Representative will reject these.
- .4 During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.
- .5 During dry weather, protect sod from drying. Water sod as necessary to ensure its vitality and prevent dropping soil in handling. The Departmental Representative will reject dried-out sod.

Part 2 Products

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Supply sod in standard-sized units and of a uniform thickness, rolled for easy handling.
 - .2 Turf Grass Nursery Sod types:
 - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.
 - .2 Number One Named Cultivars: Nursery Sod grown from certified seed.

- .3 Turf Grass Nursery Sod quality:
 - .1 Not more than 1 broadleaf weed and up to 1% native grasses per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 60 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.

- .2 Water:
 - .1 Free of impurities that would inhibit growth.

- .3 Fertilizer:
 - .1 To Canada "Fertilizers Act" and Fertilizers Regulations.
 - .2 Complete, commercial fertilizer, slow release containing maximum 35 % soluble nitrogen. Ratio to be 2:1:1.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain written approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative and commence work when instructed by Departmental Representative.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 FERTILIZING PROGRAM

- .1 Apply fertilizer in accordance with manufacturer's instructions.

3.4 CLEANING

- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .1 Clean and reinstate areas affected by Work.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
 - .1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
 - .2 Cut grass to 60 mm when or prior to it reaching height of 80 mm.
 - .3 Maintain sodded areas weed free 95%.
 - .4 Fertilization program:
 - .1 One month following sodding, apply fertilizer at 1 kg N / 100 m², follow with thorough watering. Application must be done before June 15 or after August 15.

3.6 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 60 mm.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
 - .5 Fertilizing in accordance with fertilizer program has been carried out at least once.

Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 Definitions:
 - .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.
- .2 Reference Standards:
 - .1 Canadian Standards Association (CSA) CSA B651-2018, Accessible Design for the Built Environment.
 - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling: obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.
- .2 Schedule to include:
 - .1 Quantity and type of plant material.
 - .2 Shipping dates.
 - .3 Arrival dates on site.
 - .4 Planting Dates.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for trees, shrubs, ground cover, fertilizer, anchoring equipment, and mulch and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS SDS.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Ontario Association.
 - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
 - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Ornamental Maintenance designation.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Protect plant material from frost, excessive heat, wind and sun during delivery.
 - .2 Protect plant material from damage during transportation:
 - .1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
 - .2 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
 - .3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
- .3 Storage and Handling Requirements:
 - .1 Immediately store and protect plant material which will not be installed within 1 hour in accordance with supplier's written recommendations and after arrival at site in storage location approved by Departmental Representative.
 - .2 Protect stored plant material from frost, wind and sun and as follows:
 - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.
 - .2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots.
 - .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.
 - .3 Store and manage hazardous materials in accordance with manufacturer's written instructions.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 20.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 20.

1.6 WARRANTY

- .1 For plant material over 75 mm caliper the 12 months warranty period is extended to 24 months.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.
- .3 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- .1 Type of root preparation, sizing, grading and quality: comply with Canadian Standards for Nursery Stock.
 - .1 Source of plant material: grown in Zone 6a in accordance with Plant Hardiness Zones in Canada.
 - .2 Plant material must be planted in zone specified as appropriate for its species.
 - .3 Plant material in location appropriate for its species.
- .2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system. Non poisonous thornless to CSA B651.
- .3 Trees: with straight trunks, well and characteristically branched for species.
- .4 Trees larger than 200 mm in caliper: half root pruned during each of two successive growing seasons, the latter at least one growing season before arrival on site.
- .5 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 STAKES

- .1 T-bar, steel, 40 x 40 x 5 x 2440 mm. Colour contrasted to CSA B651.

2.4 WIRE TIGHTENER

- .1 Type 1: galvanized steel, stamped plate type, rod, triangular shape.
- .2 Type 2: turnbuckle, galvanized steel, 9.5 mm diameter with 270 mm open length.

2.5 GUYING WIRE

- .1 Type 1: steel, 3 mm wire.
- .2 Type 2: 1.5 mm diameter multi-wire steel cable.
- .3 Type 3: 3 mm diameter multi-wire steel cable.
- .4 Colour contrasted to CSA B651.

2.6 CLAMPS

- .1 U-bolt: galvanized, 13 mm diameter, c/w curved retaining bar and hex nuts.

- .2 Crimp type.

2.7 ANCHORS

- .1 Wood:
 - .1 Type 1: 38 x 38 x 460 mm.
 - .2 Type 2: 38 x 67 x 600 mm.
- .2 Drive-in type.
 - .1 Type 1: 13 mm diameter x 75 mm long, aluminum.
 - .2 Type 2: 18 mm diameter x 120 mm long, aluminum.
- .3 Screw-in type:
 - .1 Type 1: 100 mm diameter steel disc.

2.8 GUYING COLLAR

- .1 Tube: plastic, 13 mm diameter, nylon reinforced.

2.9 TRUNK PROTECTION

- .1 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 x 25 mm mesh and fastener.
- .2 Plastic: perforated spiralled strip.
- .3 Burlap: clean 2.5 kg/m² minimum mass and 150 mm minimum wide, and twine fastener.
- .4 Tar impregnated crepe paper and twine fastener.

2.10 MULCH

- .1 Shredded wood: varying in size from 25 to 125 mm in length, from coniferous trees.

2.11 FERTILIZER

- .1 Synthetic commercial type as recommended by manufacturer.

2.12 ANTI-DESICCANT

- .1 Wax-like emulsion.

2.13 FLAGGING TAPE

- .1 Fluorescent, colour to CSA B651.

2.14 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of plant material prior to planting.

- .2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for planting 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 PRE-PLANTING PREPARATION

- .1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.
- .2 Remove damaged roots and branches from plant material.
- .3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.
- .4 Locate and protect utility lines.
- .5 Notify and acquire written acknowledgment from utility authorities before beginning excavation of planting pits for trees and shrubs.

3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS

- .1 Establishment of sub-grade for planting beds in accordance with Section 31 22 13.
- .2 Preparation of planting beds in accordance with Section 32 91 19.13.
- .3 For individual planting holes:
 - .1 Stake out location and obtain approval from Departmental Representative prior to excavating.

3.4 PLANTING

- .1 For bare root stock, place 50 mm backfill soil in bottom of hole.
 - .1 Plant trees and shrubs with roots placed straight out in hole.
- .2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.
 - .1 Do not pull burlap or rope from under root ball.

- .3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
- .4 Plant vertically in locations as indicated.
 - .1 Orient plant material to give best appearance in relation to structure, roads and walks.
- .5 For trees and shrubs:
 - .1 Backfill soil in 150 mm lifts.
 - .1 Tamp each lift to eliminate air pockets.
 - .2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.
 - .3 After water has penetrated into soil, backfill to finish grade.
 - .2 Form watering saucer as indicated.
- .6 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .7 Water plant material thoroughly.
- .8 After soil settlement has occurred, fill with soil to finish grade.

3.5 TRUNK PROTECTION

- .1 Install trunk protection on deciduous trees as indicated and in accordance with CSA B651-12(R2017).
- .2 Install trunk protection before installation of tree supports.

3.6 MULCHING

- .1 Ensure soil settlement has been corrected prior to mulching.
- .2 Spread mulch at new planter beds.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.
 - .1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
 - .1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
 - .2 Remove weeds monthly.
 - .3 Replace or respread damaged, missing or disturbed mulch.
 - .4 For non-mulched areas, cultivate as required to keep top layer of soil friable.
 - .5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .6 Remove dead or broken branches from plant material.
 - .7 Keep trunk protection and guy wires in proper repair and

adjustment.

.8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.8 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .2 Reform damaged watering saucers.
 - .3 Remove weeds monthly.
 - .4 Replace or respread damaged, missing or disturbed mulch.
 - .5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.
 - .6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .7 Apply fertilizer in early spring as indicated by soil test.
 - .8 Remove dead, broken or hazardous branches from plant material.
 - .9 Keep trunk protection and tree supports in proper repair and adjustment.
 - .10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.
 - .11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
 - .12 Submit monthly written reports to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for composting, 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.
 - .2 Divert discarded burlap, wire and plastic plant containers materials from landfill to plastic recycling facility approved by Departmental Representative.
 - .3 Dispose of unused fertilizer at official hazardous material collection site approved by Departmental Representative.

.4 Dispose of unused anti-desiccant at official hazardous material collections site approved by Departmental Representative.

.5 Divert unused wood and mulch materials from landfill to recycling or composting facility approved by Departmental Representative.

3.12 CLOSEOUT ACTIVITIES

.1 Submit maintenance reports for trees, shrubs, and other plantings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 11 23 - Aggregate Base Courses
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-18, Standard for Hypochlorites.
 - .2 ANSI/AWWA B301-18, Standard for Liquid Chlorine.
 - .3 ANSI/AWWA B303-18, Standard for Sodium Chlorite.
 - .4 ANSI/AWWA C500-19, Standard for Metal-Seated Gate Valves for Water Supply Service.
 - .5 ANSI/AWWA C504-15, Standard for Rubber-Seated Butterfly Valves.
 - .6 ANSI/AWWA C651-14, Standard for Disinfecting Water Mains.
 - .7 ANSI/AWWA C800-14, Standard for Underground Service Line Valves and Fittings.
 - .8 ANSI/AWWA C900-16, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2 ASTM International
 - .1 ASTM B 88M-2020, Standard Specification for Seamless Copper Water Tube Metric.
 - .2 ASTM C 117-17, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 136-19, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C 478M-19, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .5 ASTM D 698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .6 ASTM F 714-19, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .4 CSA International
 - .1 CAN/CSA-B137-Series 2013, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CAN/CSA-B137.1-13, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CAN/CSA-B137.3-13, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .5 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual.

- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S520-16, Standard for Fire Hydrants.
 - .2 CAN/ULC-S543-09(R2016), Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.
- .7 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.PROV 1010-November 2013, Material Specifications for Aggregates-Base, Subbase, Select Subgrade and Backfill Material.
 - .2 OPSD 1105.010-Nov 2013, Hydrant Installation
- .8 LAKEFRONT UTILITY SERVICES INC (LUSI)
 - .1 Watermain and Appurtenance Policy 2019.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Pipe certification to be on pipe.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.
- .2 Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, valve boxes, valve chambers and hydrants for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

1.6 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to

interruption schedule.

- .3 Notify Owner, building occupants and superintendent minimum of 72 hours in advance of interruption in service.
- .4 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .5 Provide and post "Out of Service" sign on hydrant not in use.
- .6 Advise local police department of anticipated interference with movement of traffic.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end.
 - .1 CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket coupling.
 - .2 Cast iron fittings: to ANSI/AWWA C110/A21.10, and for pipe diameters larger than NPS 4 cement mortar lined to ANSI/AWWA C104/A21.4.
- .2 In accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

2.2 VALVES AND VALVE BOXES

- .1 Valves to open clockwise.
- .2 Gate valves, butterfly valves and cast iron valve boxes to LUSI Material Standards.
- .3 In accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

2.3 SERVICE CONNECTIONS

- .1 Polyvinyl chloride pressure pipe: to CAN/CSA-B137.3, type 1120 series 160, 1.1 MPa.
- .2 PVC joints: solvent welded in accordance with manufacturer's specifications.
- .3 Brass corporation stops: red brass to ASTM B62, compression type having threads to ANSI/AWWA C800.
- .4 Brass inverted key-type curb stops: red brass to ASTM B 62, compression type without drains.
 - .1 Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury.
 - .2 Top of cast iron box marked "WATER"/"EAU".

- .5 Service connections for PVC pipe:
 - .1 Service connections less than 100 mm: corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
 - .2 Service connections 100 mm and over: use tee fitting or tapping valve and sleeve.
- .6 Bronze type service clamps: for PVC pipe service connections.
 - .1 Service clamps to be of strap-type, with confined "O" ring seal cemented in place.
 - .2 Clamps to be tapped with threads to ANSI/AWWA C800.
- .7 Tee connections: for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.
- .8 50 mm diameter stainless steel liners for plastic pipe where pipe is used with compression fitting.
- .9 In accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

2.4 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Granular 'A' as per OPSS.PROV 1010.
 - .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to CSA-A23.1.

2.5 BACKFILL MATERIAL

- .1 Granular 'A' as per OPSS.PROV 1010, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.6 PIPE DISINFECTION

- .1 Sodium hypochlorite, Calcium hypochlorite, Liquid chlorine or Sodium chlorite to ANSI/AWWA B300, ANSI/AWWA B301, and ANSI/AWWA B303 to disinfect water mains.
- .2 Disinfect water mains in accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

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 distribution piping installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon

discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects.

.2 Remove defective materials from site.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Ensure trench depth allows coverage over pipe from finished grade in accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

3.4 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to 95% minimum of corrected maximum dry density.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling with compacted bedding material.

3.5 PIPE INSTALLATION

.1 Lay pipes to manufacturer's standard instructions and specifications.
.1 Do not use blocks except as specified.

.2 Join pipes in accordance with manufacturer's recommendations.

.3 Bevel or taper ends of PVC pipe to match fittings.

.4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 Lay pipes on prepared bed, true to line and grade.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.2 Take up and replace defective pipe.

.3 Correct pipe which is not in true alignment or grade or pipe

- which shows differential settlement after installation greater than 10 mm in 3 m.
- .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
 - .7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .9 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .10 Align pipes before jointing.
 - .11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .12 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
 - .13 Complete each joint before laying next length of pipe.
 - .14 Minimize deflection after joint has been made.
 - .15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
 - .16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes.
 - .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
 - .18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
 - .19 Do not lay pipe on frozen bedding.
 - .20 Do hydrostatic and leakage test and have results approved by LUSI representative before surrounding and covering joints and fittings with granular material.
 - .21 Backfill remainder of trench.

3.6 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as

indicated.

- .2 Support valves located in valve boxes or valve chambers by means of concrete located between valve and solid ground. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.
- .3 Install underground post-type indicator valves as indicated.
- .2 Install valves in accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

3.7 HYDRANT INSTALLATION

- .1 Install hydrant to manufacturer's recommendations at locations as indicated.
- .2 Install hydrant in accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

3.8 SERVICE CONNECTIONS

- .1 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
- .2 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300 mm inside right-of-way.
- .4 Tappings on PVC pipe to be PVC valve tees.
- .5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
- .6 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.
- .7 Leave corporation stop valves fully open.
- .9 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
- .10 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
- .11 Install curb stop with corporation box on services NPS 2 or less in diameter.
 - .1 Equip larger services with gate valve and cast iron box.
 - .2 Set box plumb over stop and adjust top flush with final grade elevation.
 - .3 Leave curb stop valves fully closed.
- .12 Place temporary location marker at ends of plugged or capped unconnected water lines.
 - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
 - .2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.9 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 For thrust blocks: do concrete Work in accordance with CSA A23.1.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints acceptable to LUSI Watermain and Appurtenance Policy 2019 requirements.

3.10 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify LUSI representative at least 48 hours in advance of proposed tests.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
- .5 Upon completion of pipe laying, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
- .7 Leave hydrants, valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply hydrostatic test pressure of 1034 kPa minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 2 hours.
- .14 Examine exposed pipe, joints, fittings and appurtenances while system

is under pressure.

- .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .16 Repeat hydrostatic test until defects have been corrected.
- .17 Apply leakage test pressure of 690 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .18 Define leakage as amount of water supplied from water metre in order to maintain test pressure for 2 hours.
- .19 Do not exceed allowable leakage of 2.22 L/mm of pipe, including lateral connections.
- .20 Locate and repair defects if leakage is greater than amount specified.
- .21 Repeat test until leakage is within specified allowance for full length of water main.

3.11 PIPE SURROUND

- .1 Upon completion of pipe laying, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 1 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90% of corrected maximum dry density.

3.12 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density.
 - .1 In other areas, compact to at least 90% corrected maximum dry density.

3.13 PAINTING OF HYDRANTS

- .1 After installation, paint hydrants in accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.

- .2 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

3.14 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: in accordance with LUSI Watermain and Appurtenance Policy 2019 requirements.
- .2 Provide connections and pumps for flushing as required.
- .3 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .4 When flushing has been completed to LUSI approval, introduce strong solution of chlorine into water main and ensure that it is distributed throughout entire system.
- .5 Chlorine application to be close to point of filling water main and to occur at same time.
- .6 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .7 Flush line to remove chlorine solution after 24 hours.
- .8 Measure chlorine residuals at extreme end of pipe-line being tested.
- .9 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .10 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.15 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as indicated.

3.16 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D 3034-16, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .2 CSA International
 - .1 CAN/CSA-B1800-18, Thermoplastic Non-pressure Pipe Compendium - B1800 Series.

1.3 SCHEDULING

- .1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit sewer pipe shop drawings for review.
- .4 Certification to be marked on pipe.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PLASTIC PIPE

- .1 Type PSM Poly Vinyl Chloride (PVC): to ASTM D 3034 and CAN/CSA-B1800.
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Locked-in gasket and integral bell system.
 - .3 Nominal lengths: 6 m.

2.2 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.3 BACKFILL MATERIAL

- .1 In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site.

3.2 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Protect trench from contents of sewer.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .1 Do not use blocks when bedding pipes.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% corrected maximum dry density.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material.

3.4 INSTALLATION

- .1 Lay and join pipe in accordance with manufacturer's recommendations.

- .2 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .3 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .4 Joint deflection permitted within limits recommended by pipe manufacturer.
- .5 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .6 Install plastic pipe and fittings in accordance with CAN/CSA-B1800.
- .7 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .8 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.
 - .1 Joint to be structurally sound and watertight.
- .9 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.
- .5 Compact each layer from mid height of pipe to underside of backfill to at least 95% corrected maximum dry density.

3.6 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density. In other areas, compact backfill to at least 90% corrected maximum dry density.

3.7 FIELD TESTS AND INSPECTIONS

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 Remove foreign material from sewers and related appurtenances by

flushing with water.

- .3 Television and photographic inspections:
 - .1 Carry out and pay for inspection of installed sewers by television camera, photographic camera or by other related means.
 - .2 Submit CCTV Report to Departmental Representative.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION