

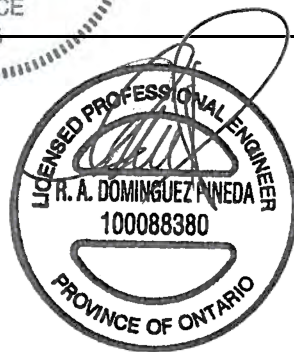
PROJECT TITLE BUILDING H: KITCHENS AND WASHROOMS
CORRECTIONAL SERVICE CANADA
BEAVER CREEK INSTITUTION - MEDIUM
2000 BEAVER CREEK DRIVE
GRAVENHURST, ON

PROJECT NUMBER R.073615.001

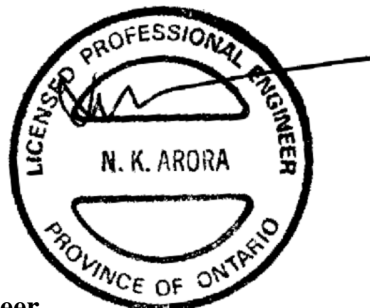
PROJECT DATE 2018-04-02



Architect



Mechanical Engineer



Electrical Engineer

END OF SECTION

Division 0 - Procurement and Contracting Requirements

Section 00 31 26 - EXISTING HAZARDOUS MATERIAL INFORMATION	2
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Division 1 - General Requirements

Section 01 11 00 - SUMMARY OF WORK	3
Section 01 14 00 - WORK RESTRICTIONS	2
Section 01 31 19 - PROJECT MEETINGS	2
Section 01 32 16 - CONSTRUCTION PROGRESS SCHEDULE BAR (GANTT) CHART	3
Section 01 33 00 - SUBMITTAL PROCEDURES	5
Section 01 35 13 - SPECIAL PROJECT PROCEDURES FOR CSC FACILITIES	7
Section 01 35 29 - HEALTH AND SAFETY REQUIREMENTS	5
Section 01 41 00 - REGULATORY REQUIREMENTS	2
Section 01 42 13 - ABBREVIATIONS AND ACRONYMS	12
Section 01 45 00 - QUALITY CONTROL	3
Section 01 51 00 - TEMPORARY UTILITIES	3
Section 01 52 00 - CONSTRUCTION FACILITIES	3
Section 01 56 00 - TEMPORARY BARRIERS AND ENCLOSURES	2
Section 01 61 00 - COMMON PRODUCT REQUIREMENTS	5
Section 01 73 00 - EXECUTION	2
Section 01 73 29 - CUTTING AND PATCHING	5
Section 01 74 11 - CLEANING	2
Section 01 74 20 - CONSTRUCTION DEMOLITION	2
Section 01 77 00 - CLOSEOUT PROCEDURES	2
Section 01 78 00 - CLOSEOUT SUBMITTALS	6
Section 01 79 00 - DEMONSTRATION AND TRAINING	2

Division 2 - Existing Conditions

Section 02 41 99 - DEMOLITION	3
Section 02 42 00 - REMOVAL AND SALVAGE OF CONSTRUCTION MATERIALS	1
Section 02 82 00.01 - MOULD REMEDIATION - MINIMUM PRECAUTIONS	6
Section 02 85 00.02 - MOULD REMEDIATION - MEDIUM PRECAUTIONS	8
Section 02 85 00.03 - MOULD REMEDIATION - MAXIMUM PRECAUTIONS	9

Division 5 - Metals

Section 05 50 01 - METAL FABRICATIONS	4
---	---

Division 6 - Wood, Plastics and Composites

Section 06 10 00 - ROUGH CARPENTRY	3
Section 06 20 00 - FINISH CARPENTRY	4
Section 06 40 00 - ARCHITECTURAL WOODWORK	8

Division 7 - Thermal and Moisture Protection

Section 07 92 00 - JOINT SEALANTS	5
---	---

Division 8 - Openings

Section 08 31 00 - ACCESS DOORS AND PANELS	4
--	---

Division 9 - Finishes

Section 09 21 16 - GYPSUM BOARD ASSEMBLIES	8
Section 09 30 13 - CERAMIC TILING	7
Section 09 65 16 - RESILIENT SHEET FLOORING	6
Section 09 91 23 - INTERIOR PAINTING	12

Division 10 - Specialties

Section 10 26 00.01 - WALL AND CORNER GUARDS	3
Section 10 28 10 - TOILET AND BATH ACCESSORIES	4

Division 11 - Equipment

Section 11 31 00 – RESIDENTIAL APPLIANCES	2
---	---

Division 21 - Fire Suppression

Section 21 05 01 - COMMON WORK RESULTS - MECHANICAL	13
Section 21 05 05 - COMMON WORK RESULTS FOR FIRE SUPPRESSION	4
Section 21 13 13 - WET PIPE SPRINKLER SYSTEMS	6

Division 22 - Plumbing

Section 22 05 00 - COMMON WORK RESULTS FOR PLUMBING	6
Section 22 11 16 - DOMESTIC WATER PIPING	5
Section 22 13 17 - DRAINAGE WASTE AND VENT PIPING - CAST IRON AND COPPER	3
Section 22 42 00 - COMMERCIAL PLUMBING FIXTURES	3
Section 22 42 01 - PLUMBING SPECIALTIES AND ACCESSORIES	4

Division 23 - Heating, Ventilating and Air Conditioning

Section 23 03 01 - USE OF MECHANICAL SYSTEMS DURING CONSTRUCTION	2
Section 23 05 05 - INSTALLATION OF PIPEWORK	5
Section 23 05 19.01 - THERMOMETERS AND PRESSURE GAUGES - PIPING SYSTEMS	4
Section 23 05 23.01 - VALVES - BRONZE	10
Section 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	7
Section 23 05 53.01 - MECHANICAL IDENTIFICATION	6
Section 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC	12
Section 23 07 13 - DUCT INSULATION	6
Section 23 07 15 - THERMAL INSULATION FOR PIPING	14
Section 23 31 13.01 - METAL DUCTS - LOW PRESSURE TO 500 PA	10
Section 23 31 13.02 - METAL DUCTS - HIGH PRESSURE TO 2500 PA	6
Section 23 33 14 - DAMPERS - BALANCING	3
Section 23 33 16 - DAMPERS - FIRE AND SMOKE	4
Section 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES	3

Division 26 - Electrical

Section 26 05 00 - COMMON WORK RESULTS - FOR ELECTRICAL	8
Section 26 05 05 - Selective Demolition for Electrical.....	4
Section 26 05 20 - WIRE AND BOX CONNECTORS (0-1000V).....	3
Section 26 05 21 - WIRES AND CABLES (0-1000V)	3
Section 26 05 28 - GROUNDING - SECONDARY	3
Section 26 05 31 - SPLITTERS, JUNCTION, PULL BOXES	2
Section 26 05 32 - OUTLET BOXES, CONDUIT BOXES.....	2
Section 26 05 34 - CONDUITS, FASTENINGS AND FITTINGS	4
Section 26 27 26 - WIRING DEVICES.....	4
Section 26 50 00 - LIGHTING	5

END OF TABLE OF CONTENTS

Part 1 General

1.1 DEFINITIONS

- .1 Hazardous Materials Information: Information prepared by a specialist consultant hired directly by the Departmental Representative, and is included as information documents related to Project and identified in the Appendices as such, and only as specifically referenced in the Appendices.
- .2 Contract Documents: All documents and information of any type and in any form, specifically prepared for use of Contract and as defined in Contractor's Agreement Form.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Status of Hazardous Materials Information: Hazardous Materials Information identified in the Appendices; or any part thereof, are not part of Contract Documents prepared by the Departmental Representative and are made available to Bidder for the purpose of providing Bidder with access to information available to Departmental Representative under the following conditions:
 - .1 Hazardous Materials Information shall not be considered a representation or warranty that information contained therein is accurate, complete, or appropriate.
 - .2 Bidder shall interpret and draw conclusions about Hazardous Materials Information and are encouraged to obtain specialist advice with regards to this information.
 - .3 Departmental Representative assumes no responsibility for such interpretations and conclusions.
 - .4 Information contained in Hazardous Materials Information may be time sensitive and dates shall be considered when interpreting Hazardous Materials Report.
 - .5 Bidder may rely upon data contained in Hazardous Materials Report; or parts thereof, which are specifically incorporated into Contract Documents by means of copying, transcribing or referencing, but shall draw their own conclusions from such data and shall not rely on opinions or interpretations contained therein.
- .2 Hazardous Building Materials Assessment: A Hazardous Building Materials Assessment was prepared for this project and is attached as an Appendix, but is not incorporated into the Contract Documents:
 - .1 Title: Limited Investigation of Mould Growth – Building FBH “Horizon”
Beaver Creek Institution, 2000 Beaver Creek Drive, Gravenhurst, Ontario
 - .2 Report File Number: 100550
 - .3 Preparation Date: March 3, 2015
 - .4 Prepared By: Pinchin Ltd.
 - .5 Number of Pages: 56
- .3 Direct inquiries during Bid period to person identified within the Contracting Authority to receive inquiries; the Departmental Representative will not accept direct enquiries with regards to hazardous materials removal.

Part 2 Products

2.1 USE OF HAZARDOUS MATERIALS INFORMATION

- .1 Information presented in the Hazardous Materials Information was commissioned by the Departmental Representative; recommendations contained in the Hazardous Materials Information were used by the Departmental Representative to assess relative risk of exposure to hazardous materials and the level of involvement of all parties contributing to the Contract Documents.
- .2 Information contained in the Hazardous Materials Information may be useful to the Contractor, and is made available for review with no implied or express warranty from the Departmental Representative as to the accuracy or completeness of this Document.

Part 3 Execution

3.1 HAZARDOUS MATERIALS INFORMATION

- .1 A copy of the Hazardous Materials Information documents is included in the Appendix.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Title and description of Work.
- .2 Contract Method.
- .3 Contractor use of premises.
- .4 Owner occupancy.

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 encompass kitchen and washroom upgrades, replacement of flooring in existing bedroom, corridors, vestibule and kitchen space, and ceiling refinishing in ranges A,B,C,D,E,F,G,H,J,K,L,M for both ground and second floor, in Building H at Beaver Creek Institution located at 2000 Beaver Creek Drive, Gravenhurst, Ontario, PIP 1Y2; and further identified as PWGSC Project Number R.073615.001.

1.4 CONTRACT METHOD

- .1 Construct Work under single, 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.
- .2 Within 48 hours of acceptance of bid submit a list of subcontractors.

1.6 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Departmental Representative's continued use of premises during construction.
- .2 Construct work according to schedule authorized by Departmental Representative.
- .3 Maintain fire access/control.
- .4 The Work shall be completed to minimize disruptions to occupied Units at Beaver Creek Institution. It is expected that the Work will be undertaken in accordance with the following sequence and as approved by the Departmental Representative:

- .1 Mobilization Phase, including submittals for all subsequent phases – 4 weeks
- .2 Phase 1: Range A & G – 9 weeks (including 1 week phase closeout)
- .3 Phase 2: Range B & H – 9 weeks (including 1 week phase closeout)
- .4 Phase 3: Range C & J – 9 weeks (including 1 week phase closeout)
- .5 Phase 4: Range D & K – 9 weeks (including 1 week phase closeout)
- .6 Phase 5: Range E & L – 9 weeks (including 1 week phase closeout)
- .7 Phase 6: Range F & M – 9 weeks (including 1 week phase closeout)
- .5 Demolition and construction Work including all finishing to be completed in each Phase prior to Phase closeout.
- .6 Schedule Phases sequentially, allowing time indicated for each Phase described in .4 above, including 1 week for Phase closeout procedures as indicated in Section 01 77 00.
- .7 Schedule two (2) idle weeks between each phase to allow for Departmental Representative's decanting operations and coordination. Construction Work including correction of deficiencies will not be permitted during this time.
- .8 Ranges will be emptied of staff and inmates during construction but in order to minimize disruption to CSC, the Contractor must have all materials to undertake the Work available at the Site in order to commence demolition and construction of the Work.
 - .1 The Contractor shall undertake this Work in accordance with the requirements of Section 01 35 13 Special Procedures for CSC Facilities on a twelve hour (12) per day schedule during a regular week. No work to be undertaken without Departmental Representative's approval of the Contractor's schedule.
- .9 Work to include: demolition of finishes, flooring, walls, and ceiling, new security plumbing fixtures and lighting, and mechanical ventilation.
- .10 Work involves mold remediation of existing finishes.

1.7 CONTRACTOR USE OF PREMISES

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

1.8 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
 - .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.
-

Part 2 PRODUCTS

2.1 NOT USED

.1 Not used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 7 days of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum.
- .3 Construct barriers in accordance with Section 01 56 00.

1.5 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 16.
 - .2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
 - .3 Keep within limits of work and avenues of ingress and egress.
 - .4 Ingress and egress of Contractor vehicles at site is limited to areas noted on Drawings.
 - .5 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate and exterior areas, determine location of reinforcing, service lines, pipes, conduits or other items by x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.
-

1.6 BUILDING SMOKING ENVIRONMENT

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

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 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 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.
 - .3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, site signage, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security in accordance with Sections 01 35 13 and 01 56 00.
 - .7 Health and safety in accordance with Section 01 35 29.
 - .8 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .9 Owner provided products.
 - .10 RFI Procedures.
 - .11 Record drawings and specifications in accordance with Section 01 33 00.
 - .12 Maintenance manuals in accordance with Section 01 78 00.
 - .13 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.
 - .14 Monthly progress claims, administrative procedures, photographs, hold backs.

- .15 Appointment of inspection and testing agencies or firms.
- .16 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 Schedule progress meeting bi-weekly.
- .2 Provide two week look ahead schedule at each progress meeting.
- .3 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.
- .4 Notify parties minimum 5 days prior to meetings.
- .5 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 2 days after meeting.
- .6 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 DEFINITIONS

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

1.2 REQUIREMENTS

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

1.3 SUBMITTALS

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

- .2 Submit to Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT) following Phases described in Section 01 11 00.
- .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.

1.5 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Interior Architecture (Walls, Floors and Ceiling).
 - .6 Lighting.
 - .7 Electrical.
 - .8 Heating, Ventilating, and Air Conditioning.
 - .9 Fire Systems.
 - .10 Testing and Commissioning.
 - .11 Supplied equipment long delivery items.
 - .12 Departmental Representative supplied equipment required dates.

1.6 PROJECT SCHEDULE REPORTING

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

1.7 PROJECT MEETINGS

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

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 ADMINISTRATIVE

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

- .4 Allow 5 working days for Departmental Representative's review of each submission.
 - .5 List priority of return for concurrent submittals.
 - .6 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.
 - .7 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.
 - .8 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.
 - .9 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.
 - .10 After Departmental Representative's review, distribute copies.
-

- .11 Submit one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request. Submit three hard copies and one electronic copy of all approved and final shop drawings with Operations and Maintenance Data binders.
 - .12 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.
 - .13 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.
 - .14 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.
 - .15 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.
 - .16 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.
 - .17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .18 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.
 - .19 Delete information not applicable to project.
 - .20 Supplement standard information to provide details applicable to project.
 - .21 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.
-

- .22 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 PHOTOGRAPHIC DOCUMENTATION

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

1.5 CERTIFICATES AND TRANSCRIPTS

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

1.6 FEES, PERMITS AND CERTIFICATES

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates and permits required.
- .3 Furnish certificates and permits.

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 PURPOSE

- .1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

1.2 DEFINITIONS

- .1 "Contraband" means:
 - .1 An intoxicant, including alcoholic beverages, drugs and narcotics.
 - .2 Tobacco or associated tobacco products.
 - .3 An igniting device, lighter or matches.
 - .4 A weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization.
 - .5 An explosive or a bomb or a component thereof.
 - .6 Currency over any applicable prescribed limit, \$25.00 when possessed by an inmate without prior authorization.
 - .7 Any item not described in paragraphs 1.2.1.1 to 1.2.1.6 that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
 - .2 "Unauthorized Smoking and related Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.
 - .2 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
 - .3 "CSC" means Correctional Service Canada.
 - .4 "Director" means Director, Warden or Superintendent of the Institution as applicable.
 - .5 "Construction Employees" means persons working for the General Contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
 - .6 "Departmental Representative" means the project manager from Public Works and Government Services Canada.
 - .7 "Perimeter" means the fenced or walled area of the Institution that restrains the movement of the inmates.
 - .8 "Construction Limits" means the area as shown on the contract drawings that the Contractor will be allowed to work". This area may or may not be isolated from the security area of the Institution.
-

1.3 PRELIMINARY PROCEEDINGS

- .1 Prior to the commencement of work, the Contractor shall meet with the Director or his representative to:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.
- .2 Contractor shall:
 - .1 Ensure that all Construction Employees are aware of the security requirements.
 - .2 Ensure that a copy of the security requirements is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all Construction Employees.
- .3 All work shall be completed without delay and a schedule of operation shall be provided to the Project Authority 48 hours (minimum) prior to commencing work. The schedule shall include the following; start date, hours of work, names of those who require entry, milestone dates and completion date.

1.4 CONSTRUCTION EMPLOYEES

- .1 Submit to the Director a list of the names with date of birth of all Construction Employees on the construction site and a security clearance form for each employee.
- .2 Allow two (2) weeks for processing of security clearances. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC Institutions are not valid at this Institution.
- .3 The Director may require that facial photographs may be taken of Construction Employees and these photographs may be displayed at appropriate locations in the Institution or in an electronic database for identification purposes. The Director may require that these photographs be displayed prominently on the Construction Employees clothing while employees are in the Institution.
- .4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
- .5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
 - .1 Appear to be under the influence of alcohol, drugs or narcotics.
 - .2 Behave in an unusual or disorderly manner.
 - .3 Are in possession of contraband.
- .6 Smoking is prohibited anywhere on CSC property.

1.5 VEHICLES

- .1 All unattended vehicles on CSC property shall have windows closed; doors and trunks shall be locked and keys removed. The keys shall be securely in the possession of the owner or an employee of the company that owns the vehicle.

- .2 The Director may limit at any time the number and type of vehicles allowed within the Institution.
- .3 Drivers of delivery vehicles for material required by the project will not require security clearances but must remain with their vehicle the entire time that the vehicle is in the Institution. The Director may require that these vehicles be escorted by Institutional Staff or Commissionaires while in the Institution.
- .4 If the Director permits trailers to be left inside the secure perimeter of the Institution, these trailer doors will be locked at all times. All windows will be securely locked when left unoccupied. All trailer windows shall be covered with expanded metal mesh. All storage trailers inside and outside the perimeter shall be locked when not in use.

1.6 PARKING

- .1 Parking area(s) to be used by Construction Employees will be designated by the Director. Parking in other locations will be prohibited and vehicles may be subject to removal.

1.7 SHIPMENTS

- .1 All shipments of project material, equipment and tools shall be addressed in the Contractor's name to avoid confusion with the Institution's own shipments. The Contractor must have his/her own employees on site to receive any deliveries or shipments. CSC staff will NOT accept receipt of deliveries or shipments of any material equipment or tools.

1.8 TELEPHONES

- .1 The installation of telephones, facsimile machines and computers with Internet connections requires the prior approval of the Director.
- .2 The Director will ensure that approved telephones, facsimile machine and computers with internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an internet connection to unauthorized personnel.
- .3 Wireless cellular and digital telephones are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.
- .4 The Director may approve but limit the use of two way radios.

1.9 WORK HOURS

- .1 Work hours within the Institution are: Monday to Friday 08:00 hrs. to 15:45 hrs.
 - .2 Work will not be permitted during weekends and statutory holidays without the permission of the Director. A minimum of seven days advance notice will be required to obtain the required permission.
-

1.10 OVERTIME WORK

- .1 No overtime work will be allowed without permission of the Director. Give a minimum forty-eight (48) hours advance notice when overtime work on the construction project is necessary and approved, and seven (7) days notice is required for work during weekends and statutory holidays. If overtime work is required because of an emergency such the completion of a concrete pour or work to make the construction safe and secure, the Contractor shall advise the Director as soon as this condition is known and follow the directions given by the Director. Costs to the Crown for such events may be attributed to the Contractor.
- .2 When overtime work, weekend statutory holiday work is required and approved by the Director, extra staff members may be posted by the Director or his designate, to maintain the security surveillance. The Departmental Representative may post extra staff for inspection of construction activities. The actual cost of this extra staff may be subject to reclamation by the Crown.

1.11 TOOLS AND EQUIPMENT

- .1 Maintain a complete list of all tools and equipment to be used during the construction project. Make this inventory available for inspection when required.
- .2 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.
- .3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .4 Store all tools and equipment in approved secure locations.
- .5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor.
- .6 All missing or lost tools or equipment shall be reported immediately to the Director.
- .7 The Director will ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
 - .1 At the beginning and conclusion of every construction project.
 - .2 Weekly, when the construction project extends longer than a one week period.
- .8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The Contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day.
- .9 If propane or natural gas is used for heating the construction, the Institution may require that an employee supervise the construction site during non-working hours.

1.12 PRESCRIPTION DRUGS

- .1 Employees of the Contractor who are required to take prescription drugs during the workday shall obtain approval of the Director to bring a one day supply only into the Institution.

1.13 CONTRABAND

- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on Institutional Property.
- .2 Discovery of Contraband on the construction site and the identification of the person(s) responsible for the Contraband shall be reported immediately to the Director.
- .3 Contractors shall be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of Contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.
- .4 Presence of arms and ammunition in vehicles of Contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

1.14 SEARCHES

- .1 All vehicles and persons entering Institutional property may be subject to search.
- .2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of Contraband, he may order that person to be searched.
- .3 All employees entering the Institution may be subject to screening of personal effects for traces of Contraband drug residue.

1.15 ACCESS TO AND REMOVAL FROM INSTITUTION PROPERTY

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

1.16 MOVEMENT OF VEHICLES

- .1 Escorted commercial vehicles will be allowed to enter or leave the Institution through the vehicle access gate during the following hours:
 - .1 08:00 hrs. to 11:30 hrs. and 13:00 to 15:45 hrs.
- .2 Construction vehicles shall not leave the Institution until an inmate count is completed.
- .3 The Contractor shall advise the Director twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .4 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC Staff or Commissionaires working under the authority of the Director.
- .5 Commercial Vehicles will only be allowed access to Institutional Property when their contents are certified by the Contractor or his/her representative as being strictly necessary to the execution of the construction project.
- .6 Vehicles shall be refused access to Institutional Property if, in the opinion of the Director, they contain any article which may jeopardize the security of the Institution.
- .7 Private vehicles of Construction Employees will not be allowed within the security wall or fence of medium or maximum security Institutions without the permission of the Director.

- .8 With prior approval of the Director, a vehicle may be used in the morning and evening to transport a group of employees to the work site. This vehicle will not remain within the Institution the remainder of the day.
- .9 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another solid object.
- .10 Construction vehicles should expect searches and delays prior to entry and exit of access gate.

1.17 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

- .1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.
- .2 However, notwithstanding paragraph above, the Director may:
 - .1 Prohibit or restrict access to any part of the Institution.
 - .2 Require that in certain areas of the Institution, either during the entire construction project or at certain intervals, Construction Employees only be allowed access when accompanied by a member of the CSC security staff.
- .3 During the lunch and coffee breaks, all employees will remain within the construction site. Employees are not permitted to eat in the officer's lounge and dining room.
- .4 Contractor movement outside of the work area will be restricted during inmate movement times. CSC will advise of dates and times prior to inmate movement.
- .5 All pedestrian traffic must enter and exit the site through the front entrance; no pedestrian movement is permitted through the sally port.

1.18 SURVEILLANCE AND INSPECTION

- .1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.
- .2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among Construction Employees and maintained throughout the construction project.

1.19 STOPPAGE OF WORK

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

1.20 CONTACT WITH INMATES

- .1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his/her security clearance revoked.
- .2 It is forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this Contract.

1.21 COMPLETION OF CONSTRUCTION PROJECT

- .1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 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 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Facility Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide Facility Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.

- .4 Contractor's and Sub-contractors' Safety Communication Plan.
- .5 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Facility Emergency Response requirements and procedures provided by Departmental Representative.
- .6 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 3 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 days after receipt of comments from Departmental Representative.
- .7 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.
- .8 Submit names of personnel and alternates responsible for site safety and health.
- .9 Submit records of Contractor's Health and Safety meetings when requested.
- .10 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.
- .11 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.
- .12 Submit copies of incident and accident reports.
- .13 Submit Material Safety Data Sheets (MSDS).
- .14 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.
- .15 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel, in accordance with O. Reg. 490, prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

1.3 FILING OF NOTICE

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

1.4 WORK PERMIT

- .1 Obtain building permits related to project prior to commencement of Work.
- .2 Obtain Hot Work Permit from CSC Plant Manager.

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, concrete block, concrete brick, ceramic tile.
 - .2 Mercury in switches, fluorescent light tubes, thermostats and pressure-sensing devices.
 - .3 Asbestos in window caulking and ceiling tile mastic.
 - .4 Lead in paint, solder in electronic equipment, solder caulking in ball fittings of cast iron pipes, and solder used on domestic water lines.
 - .5 PCBs in ballasts.
 - .6 Mould on gypsum board and tile ceiling.
 - .7 HCFC-22 and CFC-based Ozone Depleting Substances in air conditioning units.

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 HEALTH AND SAFETY CO-ORDINATOR

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

1.14 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.
 - .1 Contractor's Safety Policy.
 - .2 Constructor's Name.
 - .3 Notice of Project.
 - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
 - .5 Ministry of Labour Orders and reports.
 - .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
 - .7 Address and phone number of nearest Ministry of Labour office.
 - .8 Material Safety Data Sheets.
 - .9 Written Emergency Response Plan.
 - .10 Site Specific Safety Plan.
 - .11 Valid certificate of first aider on duty.
 - .12 WSIB "In Case of Injury At Work" poster.
 - .13 Location of toilet and cleanup facilities.

1.15 CORRECTION OF NON-COMPLIANCE

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

1.16 BLASTING

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

1.17 POWDER ACTUATED DEVICES

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

1.18 WORK STOPPAGE

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

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 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 RELICS AND ANTIQUITIES

- .1 Relics and antiquities, and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tables, and similar objects found on site shall remain the property of Parks Canada. Protect such articles and request directives from Departmental Representative.

1.5 IAQ - INDOOR AIR QUALITY

- .1 Comply with CSA-Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651-12(R2017) including Annex A.

1.6 ACCESSIBLE DESIGN

- .1 Comply with CSA B651-12(R2017), Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

1.7 STATISTICAL INFORMATION

- .1 Provide statistical information to Departmental Representative:
 - .1 Within ten working days after March 31 and September 30 occurring between commencement of work and final completion
 - .2 Within ten working days after final completion.
- .2 Include in statistical information:
 - .1 Statement of total person days of labour used on site in performance of contract, including labour provided under sub-contracts.

- .2 Estimate of total value in dollars of material delivered to site and installed, including material provided and installed under sub-contracts.
- .3 This information is required by Government of Canada solely to provide statistics that will aid in assessing socio-economic benefits of this project.

1.8 TAXES

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

1.9 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 GF: ground floor.
 - .5 GFCI: ground fault circuit interrupter.
 - .6 GL: glass or glazing.
 - .7 GL BLK: glass block.
 - .8 GPC: gypsum plaster ceiling.
 - .9 GPW: gypsum plaster wall.
 - .10 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.
 - .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 MECH: mechanical.
 - .7 MET: metal.
 - .8 MET DK: metal deck.
 - .9 MET FL: metal flashing.
 - .10 MET GRID CLG: metal grid ceiling.
 - .11 MET GRTG: metal grating.
 - .12 MET LIN CLG: metal linear ceiling.
 - .13 MET T PTN: metal toilet partition.
 - .14 MH: maintenance hole.
-

- .15 MIN: minimum.
 - .16 MLP: metal lath and plaster.
 - .17 MO: masonry opening.
 - .18 MR: marble.
 - .19 MT: metal threshold.
 - .20 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 OVHD: overhead.
 - .8 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 chloride.
 - .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 AWI/AWMAC - Architectural Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada.
 - .7 AWWPA - American Wood Preservers' Association.
 - .8 AWWA - American Water Works Association.
 - .9 BHMA - Builders Hardware Manufacturers Association.
 - .10 CCMPA - Canadian Concrete Masonry Producers Association.
 - .11 CGSB - Canadian General Standards Board.
 - .12 CNTA - Canadian Nursery Trades Association.
 - .13 CPCA - Canadian Painting Contractors Association.
 - .14 CRCA - Canadian Roofing Contractors Association.
 - .15 CSA - Canadian Standards Association.
 - .16 CSC - Construction Specifications Canada.
 - .17 CSDMA - Canadian Steel Door Manufacturers Association.
 - .18 CSI - Construction Specifications Institute.
 - .19 CSSBI - Canadian Sheet Steel Building Institute.
 - .20 CRCA - Canadian Roofing Contractors Association.
 - .21 DHI - Door and Hardware Institute.
 - .22 EEMAC - Electrical and Electronic Manufacturer's Association of Canada.
 - .23 ESA - Electrical Safety Authority.
 - .24 FCC - Fire Commissioner of Canada.
 - .25 FSC - Forest Stewardship Council.
 - .26 GANA - Glass Association of North America.
 - .27 HMMA - Hollow Metal Manufacturers Association.
 - .28 IEEE - Institute of Electrical and Electronics Engineers Inc.
 - .29 ISO - International Organization for Standardization.
 - .30 IWFA - International Window Film Association.
 - .31 LEED - LEED Canada, Leadership in Energy and Environmental Design.
 - .32 MPI - Master Painters Institute.
 - .33 NAAMM - National Association of Architectural Metal Manufacturers.
 - .34 NCPI - National Clay Pipe Institute.
 - .35 NEMA - National Electrical Manufacturers Association.
 - .36 NFPA - National Fire Protection Association.
 - .37 OPSD - Ontario Provincial Standard Drawings.
 - .38 OPSS - Ontario Provincial Standard Specifications.
 - .39 PPI - Plastics Pipe Institute.
 - .40 SDI - Steel Door Institute.
 - .41 SCAQMD - South Coast Air Quality Management District.
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- .42 TIA - Telecommunications Industry Association.
- .43 TIAC - Thermal Insulation Association of Canada.
- .44 TTMAC - Terrazzo Tile and Marble Association of Canada.
- .45 UL - Underwriters Laboratories.
- .46 ULC - Underwriters Laboratories of Canada.
- .47 US EPA - United States Environmental Protection Agency.
- .48 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 EC - Environment 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 RCMP - Royal Canadian Mounted Police.
 - .13 TBS - Treasury Board Secretariat.
 - .14 TC - Transport Canada.

1.5 PROVINCIAL GOVERNMENT DEPARTMENTS AND AGENCIES

- .1 MOEE - Ontario Ministry of Environment and Energy.
- .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/m^3 : kilogram per cubic metre.
- .5 kN: kilonewton.
- .6 kPa: kilopascals.
- .7 kw: kilowatts.
- .8 l/s: litre per second.
- .9 m: metre.
- .10 m^3 : 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/m^3 : micrograms per cubic metre.

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 INSPECTION

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

1.3 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work, above and beyond those required of the Contractor.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.4 ACCESS TO WORK

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

1.5 PROCEDURES

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

1.6 REJECTED WORK

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

1.7 REPORTS

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

1.8 TESTS AND MIX DESIGNS

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

1.9 MILL TESTS

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

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.

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 REFERENCES

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

1.3 SUBMITTALS

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

1.4 INSTALLATION AND REMOVAL

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

1.5 DEWATERING

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

1.6 WATER SUPPLY

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

1.7 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 and to CSA B651, Annex A.
 - .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 Pay costs for maintaining temporary heat, when using permanent heating system.
- .7 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.
- .8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.8 TEMPORARY POWER AND LIGHT

- .1 Use electric power from Departmental Representative's existing system without metering and without payment of use charges to levels available.
- .2 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.9 TEMPORARY COMMUNICATION FACILITIES

- .1 Refer to Section 01 35 13.

1.10 FIRE PROTECTION

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

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

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

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 A23.1-14/A23.2-14, 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 HOISTING

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

1.6 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.

1.7 CONSTRUCTION PARKING

- .1 Parking will not be permitted on site.
- .2 Provide and maintain adequate access to project site.
- .3 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.

1.8 OFFICES

- .1 Provide office heated to 22°C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.10 SANITARY FACILITIES

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

1.11 CONSTRUCTION SIGNAGE

- .1 No signs or advertisements, other than warning signs, are permitted on site.
- .2 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

1.12 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

- .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 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.

1.6 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.

1.7 ACCESS TO SITE

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

1.8 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.

1.9 FIRE ROUTES

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

1.10 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.

1.11 PROTECTION OF BUILDING FINISHES

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

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 REFERENCES

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

1.3 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
 - .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
 - .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
 - .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
 - .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.
-

1.4 AVAILABILITY

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

1.5 METRIC SIZED MATERIALS

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

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
 - .3 Store products subject to damage from weather in weatherproof enclosures.
 - .4 Store cementitious products clear of earth or concrete floors, and away from walls.
 - .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
 - .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
 - .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
-

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

1.7 TRANSPORTATION

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

1.8 MANUFACTURER'S INSTRUCTIONS

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

1.9 QUALITY OF WORK

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

1.10 CO-ORDINATION

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

1.11 CONCEALMENT

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

1.12 REMEDIAL WORK

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

1.13 LOCATION OF FIXTURES

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

1.14 FASTENINGS

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

1.15 FASTENINGS - EQUIPMENT

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

1.16 PROTECTION OF WORK IN PROGRESS

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

1.17 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants 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

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

- .1 This Section includes procedural requirements for cutting and patching required for installation of subsequent work, adjustment to installed work and repairs arising from testing and inspection.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 99 – Demolition: Demolition of selected portions of the building for alterations.
- .2 Section 07 84 00 – Firestopping and Smoke seals: Through penetration firestop systems for patching fire rated construction.
- .3 Requirements in this Section apply to mechanical and electrical installations; refer to Mechanical and Electrical Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work., and for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS

- .1 Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- .2 Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00.
- .2 Informational Submittals: Provide the following submittals during the course of the work:
 - .1 Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - .1 Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - .2 Changes to Existing Construction:
 - .1 Describe anticipated results
 - .2 Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements
 - .3 Products: List products to be used and firms or entities that will perform the Work.
 - .4 Dates: Indicate when cutting and patching will be performed.
 - .5 Utilities:
 - .1 List utilities that cutting and patching procedures will disturb or affect
 - .2 List utilities that will be relocated and those that will be temporarily out of service

- .3 Indicate how long service will be disrupted
- .6 Structural Elements: Submit details and engineering calculations showing integration of reinforcement with original structure to the Departmental Representative prior to making cuts or modifications where cutting and patching involve adding reinforcement to structural elements.
- .7 Departmental Representative's Acceptance:
 - .1 Obtain acceptance of cutting and patching proposal before cutting and patching
 - .2 Review and acceptance of cutting and patching proposal does not waive right to later require removal and replacement of unsatisfactory work

1.5 QUALITY ASSURANCE

- .1 Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load deflection ratio.
- .2 Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety, including but not limited to the following:
 - .1 Primary operational systems and equipment.
 - .2 Air or smoke barriers.
 - .3 Fire protection systems.
 - .4 Control systems.
 - .5 Communication systems.
 - .6 Conveying systems.
 - .7 Electrical wiring systems.
- .3 Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety, including but not limited to the following:
 - .1 Water, moisture, or vapour barriers.
 - .2 Membranes and flashings.
 - .3 Exterior curtain wall construction.
 - .4 Equipment supports.
 - .5 Piping, ductwork, vessels, and equipment.
 - .6 Noise and vibration control elements and systems.

- .4 Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Departmental Representative's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm, including but not limited to the following:
- .1 Processed concrete finishes.
 - .2 Masonry.
 - .3 Ornamental metal.
 - .4 Matched veneer woodwork.
 - .5 Preformed metal panels.
 - .6 Roofing.
 - .7 Firestopping and smoke seals.
 - .8 Window wall system.
 - .9 Stucco.
 - .10 Finished flooring.
 - .11 Finished coatings.
 - .12 Wall coverings.
 - .13 HVAC enclosures, cabinets, or covers.
- .5 Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

- .1 Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

Part 2 Products

2.1 MATERIALS

- .1 Comply with requirements specified in other Sections of the Project Manual.
- .2 Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible:
- .1 If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed:
 - .1 Provide investigative methods that use non-ionizing radiation or other approved method to determine locations of existing services and reinforcing in existing concrete slabs and block walls before cutting and renovations.
 - .2 Advise Departmental Representative of findings before proceeding with the Work and revise penetration locations as required and directed by Departmental Representative.
 - .3 Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers before patching.
 - .4 Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Provide temporary support of Work to be cut in accordance with Section 01 52 00.
- .2 Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- .3 Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- .4 Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 PERFORMANCE

- .1 Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay:
 - .1 Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- .2 Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations:
 - .1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - .2 Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - .3 Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond core drill.

- .4 Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
- .5 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- .6 Proceed with patching after construction operations requiring cutting are complete.
- .3 Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications:
 - .1 Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - .2 Exposed Finishes: Restore exposed finishes and extend on to adjoining construction using techniques that completely hide patching and refinishing work.
 - .3 Floors and Walls:
 - .1 Patch and repair floor and wall surfaces in the new space where walls or partitions that are removed extend from one finished area into another.
 - .2 Provide an even surface of uniform finish, colour, texture, and appearance.
 - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .4 Apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing the patch where patching occurs in a painted surface; provide additional coats until patch blends with adjacent surfaces.
 - .4 Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance.
 - .5 Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

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

1.3 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 Departmental Representative 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.
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- .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 Sweep and wash clean paved areas.
- .16 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .17 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Target for this project is 50% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Brick and portland cement concrete.
 - .2 Corrugated cardboard.
 - .3 Wood, not including painted or treated wood or laminated wood.
 - .4 Gypsum board, unpainted.
 - .5 Steel.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
 - .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested using Deconstruction and Waste Reduction Workplan.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

1.2 WASTE PROCESSING SITES

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

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

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

END OF SECTION

Part 1 GENERAL

1.1 INSPECTION AND DECLARATION

- .1 Provide the following at the end of each Phase:
 - .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.
- .2 Provide the following prior to application for Substantial Performance of the Work:
 - .1 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 Boiler Inspection Branch, PWGSC Fire Protection Engineer and Utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to Departmental Representative's personnel.
 - .6 Work is complete and ready for final inspection.
 - .3 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

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

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.
-

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

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

1.2 SUBMISSION

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

1.3 FORMAT

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

- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format. Forward pdf, MS Word, MS Excel, and Autocad dwg files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

1.4 CONTENTS - EACH VOLUME

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

1.5 AS-BUILTS AND SAMPLES

- .1 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".

1.6 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Amendments and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

1.7 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.
- .15 Additional requirements: As specified in individual specification sections.

1.8 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.

1.9 SPARE PARTS

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

1.10 MAINTENANCE MATERIALS

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

1.11 SPECIAL TOOLS

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

1.12 STORAGE, HANDLING AND PROTECTION

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

1.13 WARRANTIES AND BONDS

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

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of equipment and systems to Departmental Representative'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 DESCRIPTION

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

1.3 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct 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.

1.4 CONDITIONS FOR DEMONSTRATIONS

- .1 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

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

1.6 DEMONSTRATION AND INSTRUCTIONS

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

Part 2 PRODUCTS

2.1 NOT USED

.1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 CSA International
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Submit demolition drawings:
 - .1 Submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario Canada, showing proposed method.
- .3 If material resembling spray or trowel-applied asbestos or other designated substance listed be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
 - .1 Proceed only after receipt of written instructions have been received from Departmental Representative.
- .4 Notify Departmental Representative before disrupting building access or services.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not used.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
 - .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
 - .3 Notify and obtain approval of utility companies before starting demolition.
-

- .4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.
 - .1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.
 - .2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PROTECTION

- .1 Prevent movement, settlement, or damage to adjacent parts of building to remain in place. Provide bracing and shoring required.
- .2 Keep noise, dust, and inconvenience to occupants to minimum.
- .3 Protect building systems, services and equipment.
- .4 Provide temporary dust screens, covers, railings, supports and other protection as required.

3.3 PREPARATION

- .1 Protection of In-Place Conditions:
 - .1 Prevent movement, settlement, or damage to adjacent parts of building to remain in place. Provide bracing and shoring required.
 - .2 Keep noise, dust, and inconvenience to occupants to minimum.
 - .3 Protect building systems, services and equipment.
 - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
 - .5 Do Work in accordance with Section 01 35 29.
- .2 Demolition/Removal:
 - .1 Remove items as indicated.
 - .2 Remove parts of existing building to permit new construction.
 - .3 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

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 Refer to demolition drawings and specifications for items to be salvaged for reuse.
-

- .4 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 02 41 99 – Demolition
- .2 Section 10 28 10 - Toilet and Bath Accessories
- .3 Division 26 50 00 - Lighting

1.2 EXISTING WORK BEING SALVAGED

- .1 The following listed materials, components and items of equipment shall be carefully removed from their present existing locations, stored safely on site, and reinstalled at the locations noted for each item.
- .2 Clean all items of construction or building debris, or materials that are not a part of the salvaged work before storing.

Part 2 Products

2.1 SALVAGED ITEMS

- .1 Items salvaged by Contractor for reinstallation include the following:
 - .1 Surface Mounted LED light fixtures and lamps, quantities as shown on Drawings.
 - .2 Soap dispensers, quantities as shown on Drawings.
 - .3 Paper Towel Dispensers, quantities as shown on Drawings.
 - .4 Toilet Paper Dispensers, quantities as shown on Drawings.
 - .5 Steel doors and frames as indicated on Drawings.
- .2 Confirm with Departmental Representative any additional items that appear to be salvageable prior to disposal.

Part 3 Execution

3.1 SALVAGE

- .1 Remove and handle salvageable items on site to minimize damage and to ensure that usability is maintained.
- .2 Clean all salvaged items thoroughly prior to reinstallation.
- .3 Place materials on pallets or wrap in protective film to ensure that loose pieces and projections do not cause injury to personnel, and that salvaged items remain as complete units.
- .4 Reinstall light fixtures in new ceiling grid in accordance with Section 26 50 00.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section has been designed to provide general practices and procedures for:
 - .1 Removing and disposing of less than one square metre of mould contaminated materials, including settled dust, that may be uncovered during the course of the kitchens and washrooms renovation project.
 - .2 Preventing cross-contamination between contaminated areas and adjacent or nearby uncontaminated areas.
 - .3 Protecting personnel during remediation.

1.2 REFERENCES

- .1 CCA 82-2004, Canadian Construction Association, Mould Guidelines for the Canadian Construction Industry, 2004.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

- .1 Cleaning solution: detergent solution.
- .2 Competent person: individuals acceptable to Departmental Representative who can demonstrate that mould remediation training has been obtained, is capable of identifying existing microbial hazards in workplace and selecting appropriate control strategy for microbial exposure.
- .3 Contractor: remediation contractor providing demolition and removal services as defined in specification.
- .4 Fibre reinforced polyethylene sheet (FRPS): rip-proof fibre reinforced polyethylene sheet sheeting with added fibre reinforced adhesive tape along edges.
- .5 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining particles greater than 0.3 microns in any direction at 99.97% efficiency.
- .6 HVAC: heating ventilating and air-conditioning systems which serve occupied areas. Includes but is not limited to air handling units, duct work, terminal boxes and vents.
- .7 Mould Contaminated Work Area (MCWA): specific area or location where actual work is being performed or such other areas of a facility where it has been determined that it may be hazardous to public health as result of mould remediation.
- .8 Occupied Area: areas of building or work site that is outside of Mould Contaminated Work Area.
- .9 PPE: Personnel Protection Equipment.

- .10 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have a minimum of two litres capacity for work.

1.4 REGULATORY REQUIREMENTS

- .1 Comply with regulations in effect at time work is performed. In case of conflict among these requirements or with these specifications the more stringent requirement applies. If no regulations exist, follow guidelines most widely accepted by recognized professional organizations such as occupational hygienists, health professionals or environmental engineers, and Departmental Representative, or follow guidelines as listed in paragraph 1.2 References.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Maintain general log to provide permanent record of project. Maintain logs and other required documentation as part of permanent project file.

1.6 INSTRUCTION AND TRAINING

- .1 Before commencing work, provide to Departmental Representative satisfactory proof that every worker has had instruction and training in potential health hazards of mould exposure, handling of hazardous materials, and in use of disposable respirators and protective clothing.
- .2 Instruction and training must be provided by designated construction safety advisor.

1.7 WORKER PROTECTION

- .1 Respirators suitable for protection against mould and acceptable to Provincial Authority having jurisdiction. Non-powered half-face respirator, as a minimum, equipped with replaceable HEPA filter cartridges, personally issued to workers and marked as to efficiency and purpose.
 - .2 Gloves and eye protection.
 - .3 Disposable full-body dust-impervious coveralls including head covering.
 - .4 No person required to enter Mould Contaminated Work Area to have facial hair that affects seal between respirator and face.
 - .5 Eating, drinking and chewing are not permitted in Mould Contaminated Work Area.
 - .6 Before leaving Mould Contaminated Work Area, dispose of protective clothing as waste as specified.
 - .7 Ensure workers wash hands and face after leaving Mould Contaminated Work Area.
 - .8 Provide facilities for washing located at the work area.
-

1.8 VISITOR PROTECTION

- .1 Protective clothing and approved ½ face mask respirators to be worn by Authorized Visitors to Mould Contaminated Work Area.
- .2 Instruct Authorized Visitors in proper use of protective clothing, respirators, and procedures.
- .3 Instruct Authorized Visitors proper procedures to be followed in entering into and exiting from Mould Contaminated Work Area.
- .4 Provide and Facilitate access to Departmental Representative at all times during construction progress, at no additional cost to contract.

1.9 SITE CONDITIONS

- .1 Inform sub-trades of presence of mould-contaminated materials and potential health hazards of mould exposure.
- .2 Submit to Departmental Representative copy of notifications prior to start of work.

1.10 HOURS OF WORK

- .1 Typical work schedule - Perform work during hours specified by the Departmental Representative. Include in Contract additional costs due to this requirement. Be available to work continuously from beginning to end of project.

1.11 EXISTING CONDITIONS

- .1 Varying quantities of mould-impacted materials have been previously identified in the kitchen, washrooms, and adjoining corridors/spaces of the Ranges included in this renovation project. These areas will undergo mould remediation using Maximum Mould Remediation Precautions. During the course of the project, it is possible that minor quantities of additional mould-impacted material are uncovered in adjacent areas or areas outside those being remediated, that are affected by the project. The requirements within this Specification shall be adhered to where less than 1 square metre of mould impacted material is identified.
- .1 Mould-impacted materials that have been previously identified and are to be handled, removed, or otherwise disturbed and disposed of during this project are identified within the document listed below. The referenced report contains background information; investigation methodology; findings; conclusions and recommendations; and includes appended drawings of the work areas. This specification shall be read and interpreted in association with the referenced technical report.
 - .1 Limited Investigation of Mould Growth – Building FBH “Horizon”. Beaver Creek Institution, 2000 Beaver Creek Drive, Gravenhurst, Ontario. Prepared by Pinchin Ltd (File No. 100550). Dated March 3, 2015.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Drop Sheets: 0.15 mm thick woven fibre reinforced fabric bonded both sides with fibre reinforced polyethylene sheet.

- .2 Disposal bags: dust-tight 0.15 mm clear polyethylene waste bags.
- .3 Wetting Agent: water to mist mould-containing material.
- .4 Cleaning solution: detergent solution for damp wipe and/or mop.
- .5 Fibre reinforced adhesive tape: used in sealing joints of fibre reinforced polyethylene sheets and for attachment of fibre reinforced polyethylene sheet to finished and unfinished surfaces. Fibre reinforced adhesive tape must be capable of adhering under both dry and wet conditions.
- .6 Materials: provide materials such as fibre reinforced polyethylene sheeting, lumber, nails, and hardware necessary to construct and dismantle barriers that isolate Mould Contaminated Work Area.

2.2 TOOLS AND EQUIPMENT

- .1 Tools and equipment: suitable for use with microbial contamination and must be able to withstand de-contamination.
- .2 Personnel protective equipment (protective clothing, disposable respirators): provided in sufficient quantities for duration of project.
- .3 Vacuum cleaners: equipped with HEPA filters.
- .4 Ladders and/or scaffolds: adequate length, strength and sufficient quantity to support work schedule.

Part 3 EXECUTION

3.1 PREPARATION OF MOULD WORK AREA (<1 SQUARE METRES IN OCCUPIED SPACE)

- .1 Mould Contaminated Work Area and areas adjacent and around area: to be unoccupied. Vacating people from spaces adjacent to Mould Work Area is not necessary but is recommended in case of infants (less than 12 months old), elderly people, persons having undergone recent surgery, immune suppressed people or people with chronic inflammatory lung diseases.
- .2 Clean movable objects within proposed Mould Contaminated Work Area using HEPA filtered vacuum equipment, damp wipe surfaces and remove such objects from Mould Contaminated Work Area to secure and clean area.
- .3 Remove visible dust from surfaces in Mould Contaminated Work Area where dust is likely to be disturbed during course of work. Use HEPA vacuum and damp wipe area.
- .4 Do not use compressed air to clean up or remove dust from surfaces.
- .5 Seal off return air grills in Mould Contaminated Work Area with fibre reinforced polyethylene sheeting and fibre reinforced adhesive tape to minimize migration of contaminants to other parts of building.

- .6 Use 0.15 mm fibre reinforced polyethylene drop sheets tightly sealed with fibre reinforced adhesive tape over flooring in Mould Contaminated Work Areas.

3.2 MICROBIAL REMEDIATION

- .1 Use sprayer (low-velocity, fine-mist) to mist (not wet) materials containing mould to be cut or scraped. Perform work to reduce dust creation to lowest levels practicable.
- .2 Non-porous and semi-porous materials can be cleaned using the cleaning solution and reused depending on depth to which microbial growth has penetrated substrate. Wood to be discarded if fungal growth has affected its soundness. Authorization for only cleaning is subject to written approval by Departmental Representative.
- .3 Porous materials with more than one square metre of mould contamination and/or dampness to be removed, discarded and replaced.
- .4 Dispose of contaminated building materials as specified.
- .5 During remediation, should Departmental Representative suspect contamination of areas outside Mould Contaminated Work Area, contractor to stop remediation work and immediately decontaminate these affected areas. Eliminate causes of such contamination. Unprotected individuals are prohibited from entering contaminated areas until a visual inspection determines areas are free from contamination.
- .6 Notify Departmental Representative of mould contaminated material discovered during work and not apparent from drawings, specifications or report pertaining to work. Do not disturb such material pending instructions from Departmental Representative.

3.3 REPAIR AND CLEAN-UP

- .1 Clean, frequently during work and immediately after completion of work, Mould Contaminated Work Area using a HEPA vacuum and/or by damp mopping with cleaning solution.
- .2 Perform restoration of designated Mould Contaminated Work Area as specified.
- .3 Leave areas dry and visibly free from contamination, debris and dust.
- .4 Perform final thorough clean-up of work areas and adjacent areas affected by work using HEPA vacuum and/or damp mopping with detergent solution.

3.4 FINAL CLEARANCE

- .1 Departmental Representative to conduct thorough visual inspection to detect visible accumulations of dust or bulk materials remaining in work area. Should dust, debris, microbial contamination, or residue be detected repeat cleaning until area meets approval.

3.5 WASTE DISPOSAL

- .1 Place dust and mould-containing waste in doubled-bagged dust-tight 0.15 mm clear polyethylene waste bags. Treat drop sheets and disposable protective clothing as waste; fold these items to contain dust, and place in plastic bags. Securely seal bags.

- .2 Clean exterior of each waste-filled bag using damp cloths and cleaning solution or HEPA vacuum prior to removal from Mould Contaminated Work Area.
- .3 Remove waste bags from site and dispose. There is no special requirements for disposal of mouldy materials, as such they can be disposed of in landfill.

3.6 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

- .1 Relocate objects moved to temporary locations to their proper positions. Ensure objects are cleaned before been moved into cleaned areas.
- .2 Remount objects removed to former positions.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section has been designed to provide general practices and procedures for:
 - .1 Removing and disposing of 1 square metre to 10 square metres of mould contaminated materials, including settled dust, that may be uncovered during the course of the kitchens and washrooms renovation project.
 - .2 Preventing cross-contamination between contaminated areas and adjacent or nearby uncontaminated areas.
 - .3 Protecting personnel during remediation.

1.2 REFERENCES

- .1 CCA 82-2004, Canadian Construction Association, Mould Guidelines for the Canadian Construction Industry, 2004.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

- .1 Authorized Visitors: Departmental Representatives or designated representatives, and representatives of regulatory agencies.
- .2 Cleaning solution: detergent solution
- .3 Competent person: individuals acceptable to Departmental Representative who can demonstrate that mould remediation training has been obtained, is capable of identifying existing microbial hazards in workplace and selecting appropriate control strategy for microbial exposure.
- .4 Contractor: remediation contractor providing demolition and removal services as defined in specifications.
- .5 Critical barrier or enclosure: minimum of two separate layers of 0.15 mm fibre reinforced polyethylene sheeting (FRPS) tarp taped securely and separately over windows, doorways, diffusers, grilles and any other openings between work area and uncontaminated areas outside of work area including outside of building.
- .6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows: Place two overlapping sheets (minimum overlap of 1 metre or width of doorway) of FRPS tarp over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway and securing vertical edge of other sheet along opposite vertical side of doorway. Reinforce free edges of FRPS, tarp with fibre reinforced adhesive tape and weight bottom edge to ensure proper closing. Space curtained doorways minimum of 2 metres apart.
- .7 Decontamination Room: enclosure located between Mould Contaminated Work Area and uncontaminated area for decontamination of equipment and workers, typically consisting of two curtained doorways at least 2 metres apart.

- .8 Fibre Reinforced Polyethylene Sheet (FRPS): rip-proof polyethylene sheeting with fibre reinforced adhesive tape added along edges.
- .9 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining particles greater than 0.3 microns at 99.97% efficiency.
- .10 HVAC: heating ventilating and air-conditioning systems which serve occupied areas. Includes but is not limited to air handling units, duct work, terminal boxes and grills.
- .11 Mould Contaminated Work Area (MCWA): specific area or location where actual work is being performed or such other area of facility which it has been determined may be hazardous to public health as result of mould remediation.
- .12 Negative pressure: maintain Mould Contaminated Work Area at negative pressure relative to surrounding space to prevent contaminants from leaving contaminated area. Use exhaust fan with HEPA filter to maintain Mould Contaminated Work Area at lower pressure than surrounding areas. Maintain pressure differential of 5 to 7 Pa. Air flow movement can be verified with smoke pencil.
- .13 Occupied Area: areas of building or work site that are outside Mould Contaminated Work Area.
- .14 PPE: Personnel Protective Equipment.
- .15 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray; with minimum of six litres capacity for work.

1.4 REGULATORY REQUIREMENTS

- .1 Comply with regulations in effect at time work is performed. In case of conflict among these requirements or with these specifications more stringent requirement applies. If no regulations exist, follow guidelines as listed in paragraph 1.2 References.
- .2 Comply with Ontario Regulation O.Reg. 347/90, General – Waste Management, as amended.

1.5 ACTION AND INFORMATION SUBMITTALS

- .1 Submit proof satisfactory to Departmental Representative that employees have had instruction on potential hazards of mould exposure, use of personal respirator and protective clothing, entry and exit from work areas and aspects of work procedures and protective measures.
 - .2 Submit proof of attendance in form of certificate that supervisory personnel have been trained in mould remediation course, approved by Departmental Representative. Minimum of one supervisor for every ten trained workers.
 - .3 Submit Provincial and/or local requirements for Notice of Project form.
 - .4 Submit proof of Contractors Liability Insurance for dealing with hazardous materials.
 - .5 Submit Workplace Safety and Insurance Board (WSIB) status and transcription of insurance.
-

1.6 INSTRUCTION AND TRAINING

- .1 Before commencing work, provide Departmental Representative proof that workers have had instruction and training in potential health hazards of mould exposure, handling of hazardous materials, in personal hygiene including protective clothing, entry and exit from Mould Contaminated Work Area, use of disposal procedures including building materials, respirators and protective clothing.
- .2 Instruction and training related to use of personal respirators:
 - .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 designated construction safety advisor.
- .4 Supervisory personnel to complete required training in mould remediation.

1.7 WORKER PROTECTION

- .1 Respirators suitable for protection against mould and acceptable to Provincial Authority having jurisdiction. Non-powered half-face respirator, as a minimum, equipped with replaceable HEPA filter cartridges, personally issued to workers and marked as to efficiency and purpose.
- .2 Gloves and eye protection.
- .3 Disposable full-body dust-impervious coveralls including head covering.
- .4 Ensure that no person required to enter Mould Contaminated Work Area has facial hair that affects seal between respirator and face.
- .5 Eating, drinking and chewing are not permitted in Mould Contaminated Work Area.
- .6 Before leaving Mould Contaminated Work Area, dispose of protective clothing as waste as specified.
- .7 Ensure workers wash hands and face after leaving Mould Contaminated Work Area.
- .8 Provide facilities for washing located at work area.

1.8 VISITOR PROTECTION

- .1 Protective clothing and approved ½ face mask respirators to be worn by Authorized Visitors to Mould Contaminated Work Area.
 - .2 Instruct Authorized Visitors in proper use of protective clothing, respirators, and procedures.
 - .3 Instruct Authorized Visitors proper procedures to be followed in entering into and exiting from Mould Contaminated Work Area.
 - .4 Facilitate Departmental Representative access at all times during construction progress at no additional cost to contract.
-

1.9 SITE CONDITIONS

- .1 Inform sub-trades of presence of mould-contaminated materials and potential health hazards of mould exposure.
- .2 Submit to Departmental Representative copy of notifications prior to start of work.

1.10 HOURS OF WORK

- .1 Typical work schedule - Perform work during hours specified by the Departmental Representative. Include in Contract additional costs due to this requirement. Be available to work continuously from beginning to end of project.

1.11 EXISTING CONDITIONS

- .1 Varying quantities of mould-impacted materials have been previously identified in the kitchens, washrooms, and adjoining corridors/spaces of the Ranges included in this renovation project. These areas will undergo mould remediation using Maximum Mould Remediation Precautions. During the course of the project, it is possible that minor quantities of additional mould-impacted materials are uncovered in adjacent areas or areas outside those being remediated. The requirements within this Specification shall be adhered to where 1 to 10 square metres of mould impacted material is identified.
- .2 Mould-impacted materials that have been previously identified and are to be handled, removed, or otherwise disturbed and disposed of during this project are identified within the document listed below. The referenced report contains background information; investigation methodology; findings; conclusions and recommendations; and includes appended drawings of the work areas. This specification shall be read and interpreted in association with the referenced technical report.
 - .1 Limited Investigation of Mould Growth – Building FBH “Horizon”. Beaver Creek Institution, 2000 Beaver Creek Drive, Gravenhurst, Ontario. Prepared by Pinchin Ltd (File No. 100550). Dated March 3, 2015.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Drop Sheets: fibre reinforced polyethylene 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Disposal bags: dust-tight 0.15 mm clear polyethylene waste bags.
- .3 Wetting Agent: water to mist mould-containing material.
- .4 Cleaning solution: detergent solution for damp wipe and/or mop.
- .5 Fibre reinforced adhesive tape: used in sealing joints of fibre reinforced polyethylene sheets and for attachment of fibre reinforced polyethylene sheet to finished and unfinished surfaces. Fibre reinforced adhesive tape must be capable of adhering under both dry and wet conditions.
- .6 Materials: provide materials such as fibre reinforced polyethylene sheeting, lumber, nails and hardware necessary to construct and dismantle barriers that isolate Mould Contaminated Work Area.

2.2 TOOLS AND EQUIPMENT

- .1 Tools and equipment: suitable for use with microbial contamination and must be able to withstand de-contamination.
- .2 Personnel protective equipment (protective clothing, personal respiratory filter cartridges, HEPA air filters, etc.): to be provided in sufficient quantities for duration of project.
- .3 Vacuum cleaners: equipped with HEPA filters.
- .4 Ladders and/or scaffolds: adequate length, strength and sufficient quantity to support work schedule.
- .5 Exhaust air fan systems: equipped with HEPA filters and be capable of providing sufficient exhaust air to create a minimum pressure differential of 5 to 7 Pa and to allow sufficient flow of air through area.

Part 3 EXECUTION

3.1 PREPARATION OF MOULD CONTAMINATED WORK AREA (1 to <10 SQUARE METRES CONTAMINATED IN AREA)

- .1 Mould Contaminated Work Area and areas adjacent and around area to be unoccupied. Vacating is recommended in case of infants (less than 12 months old), elderly people, persons having undergone recent surgery, immune suppressed people or people with chronic inflammatory lung diseases.
- .2 One supervisor for every ten trained workers is required.
- .3 Approved supervisor must remain within Mould Contaminated Work Area at all times during disturbance, removal or other handling of mould-contaminated materials.
- .4 Turn off HVAC systems prior to starting remediation work to prevent contamination and dust dispersal to other areas of building.
- .5 Avoid the spread of dust and debris from the work site to non-contaminated adjacent areas. Isolate the zone, cover clean components, and protect motors, bearings, sensors, electrical components, etc.
- .6 Clean filters inside the air-handling unit can be removed or protected before remediation. Contaminated porous materials must be discarded; and sealed in plastic bags or a suitable sealed container.
- .7 Remove visible dust from surfaces in Mould Contaminated Work Area where dust is likely to be disturbed during course of mould remediation work. Use HEPA vacuum and damp wipe the area.
- .8 When removing insulation, clean the underlying metal surface of debris and dust prior to installing new insulation.
- .9 Do not use compressed air to clean up or remove dust from any surface.
- .10 Erect critical barriers around perimeter of Mould Contaminated Work Area before remediation using single layer of 0.15 mm fibre reinforced polyethylene sheeting extending from floor slab to as close as possible to underside of above floor slab. Seal gaps due to ductwork, piping conduits with layer of 0.15 mm fibre reinforced polyethylene sheeting. For larger areas, a steel or wooden stud frame can be erected and fibre reinforced polyethylene sheeting attached to it.

- .11 Seal off windows, doorways, skylights, ducts, grilles, diffusers, ceiling plenums, electrical outlets and openings between work area and uncontaminated areas to prevent spread of dirt and spores with 2 separate layers of 0.15 mm (fibre reinforced polyethylene sheeting securely held in place by fibre reinforced adhesive tape. Doorways and corridors that will not be used for passage during work must be sealed with fixed critical barriers.
- .12 Use 0.15 mm fibre reinforced drop sheets tightly sealed with fibre reinforced adhesive tape over flooring in work areas.
- .13 Ensure that containment area is under negative pressure. Use HEPA filtered fan exhausted outside of Mould Contaminated Work Area to create negative pressure. Negative air units exhausting indoors will require on-site DOP testing certification.
- .14 In smaller easily contained areas, use HEPA vacuum cleaner nozzle within enclosure. Locate vacuum canister outside enclosure.
- .15 Before beginning work, at each access to contaminated 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 MOULD HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING MOULD DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.
- .16 Do not begin remediation work until barriers are inspected and authorization is given by the Departmental Representative.

3.2 MICROBIAL REMEDIATION

- .1 If remediation procedures are expected to generate dust or visible concentration of fungi is heavy (blanket as opposed to patchy coverage), then it is recommended that Maximum Precautions Section 02 85 00.03 for Mould Remediation be followed.
- .2 Use sprayer (low-velocity, fine-mist) to mist (not wet) materials containing mould to be cut or scraped. Perform work to reduce dust creation to lowest levels practicable.
- .3 Non-porous and semi-porous materials can be cleaned using the cleaning solution and reused depending on depth to which microbial growth has penetrated substrate. Wood to be discarded if fungal growth has affected its soundness. Authorization for only cleaning is subject to written approval by Departmental Representative.
- .4 Porous materials with more than 1 square metre of mould contamination and/or dampness to be removed, discarded and replaced.
- .5 Dispose of contaminated building materials as specified.
- .6 During mould remediation, should Departmental Representative suspect contamination of areas outside enclosed Mould Contaminated Work Area, contractor to stop remediation work and immediately decontaminate affected area(s). Eliminate causes of such contamination. Prohibit unprotected individuals from entering this contaminated area(s) until air and swab sampling and a visual inspection determines area(s) are free from contamination.
- .7 Notify the Departmental Representative of mould contaminated material discovered during work and not apparent from drawings, specifications or report pertaining to work. Do not disturb such material pending instructions from Departmental Representative.

3.3 REPAIR AND CLEAN-UP

- .1 During mould remediation and immediately after completion of mould remediation, clean enclosure starting within top of enclosure and working down to floors. Clean both enclosed area and Decontamination Room using HEPA vacuum and/or by damp wiping with cleaning solution.
- .2 HEPA vacuum inside layer of polyethylene sheeting within work area and damp wipe prior to removal. Removal of this layer to occur after removal and decontamination activities are completed and work area inspected by Departmental Representative.
- .3 All tools and equipment used during decontamination must be cleaned prior to removal from the work site.
- .4 Remove inside layer of fibre reinforced polyethylene sheeting by rolling it away from walls to centre of work area. Vacuum visible debris during cleanup, immediately, using HEPA vacuum.
- .5 Dispose of used fibre reinforced polyethylene sheets; used fibre reinforced adhesive tape, cleaning material, clothing, and contaminated waste.

3.4 INSPECTION AND AIR SAMPLING

- .1 Carry out final visual inspection check to ensure that no dust or debris remains on surfaces as result of dismantling operations. All work is subject to final inspection and written approval by Departmental Representative. No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .2 The Departmental Representative may perform final clearance air, swab, and/or tape lift sampling prior to re-occupancy. Sample results will be compared to an outdoor reference sample or samples collected from an area known to not be impacted by mould for comparative purposes. Repeat cleaning using HEPA vacuum equipment, or damp cleaning methods, in conjunction with sampling until levels comparative to the reference samples, at the sole discretion and decision of the Departmental Representative. No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 Upon notification that final tests are acceptable remove remaining critical barriers. HEPA vacuum surfaces behind containment barriers, including walls, floors, ceiling tiles, windows, doors and other surfaces, as applicable. HEPA vacuum adjacent interior spaces within 3 metres of former location of containment barriers.

3.5 WASTE DISPOSAL

- .1 Place debris and mould-containing waste in doubled-bagged dust-tight 0.15 mm fibre reinforced clear polyethylene waste bags. Treat drop sheets and disposable protective clothing as waste; fold these items to contain dust, and place in plastic bags. Securely seal bags.
 - .2 Cover large items that have heavy mould growth with fibre reinforced polyethylene sheeting and sealed with fibre reinforced adhesive tape before they are removed from enclosure.
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- .3 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum prior to removal from Mould Contaminated Work Area.
- .4 Remove waste bags from site and dispose. There are no special requirements for disposal of mouldy materials, as such they can be disposed of in landfill.
- .5 All waste routes, waste disposal schedule, and waste storage are subject to written approval by Departmental Representative.

3.6 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

- .1 Return objects moved to temporary locations to their location. Ensure objects are cleaned before been moved into cleaned areas.
- .2 Remount objects removed to former positions.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section has been designed to provide general practices and procedures for:
 - .1 Removing and disposing of more than ten square metres of mould contaminated materials, including settled dust.
 - .2 Removal where mould is presumed present, but the quantity of mould cannot be determined due to concealed conditions.
 - .3 Preventing cross-contamination between contaminated areas and adjacent or nearby uncontaminated areas.
 - .4 Protecting personnel during remediation.

1.2 REFERENCES

- .1 CCA 82-2004, Canadian Construction Association, Mould Guidelines for the Canadian Construction Industry, 2004.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

- .1 Authorized Visitors: Departmental Representatives or designated representatives, and representatives of regulatory agencies.
 - .2 Cleaning solution: detergent solution
 - .3 Competent person: individuals acceptable to Departmental Representative who can demonstrate that mould remediation training has been obtained, is capable of identifying existing microbial hazards in workplace and selecting appropriate control strategy for microbial exposure.
 - .4 Contractor: remediation contractor providing demolition and removal services as defined in specifications.
 - .5 Critical barrier or enclosure: minimum of two separate layers of 0.15 mm fibre reinforced polyethylene sheeting (FRPS) tarp taped securely and separately over windows, doorways, diffusers, grilles and any other openings between work area and uncontaminated areas outside of work area including outside of building.
 - .6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows: Place two overlapping sheets (minimum overlap of 1 metre or width of doorway) of FRPS tarp over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway and securing vertical edge of other sheet along opposite vertical side of doorway. Reinforce free edges of FRPS, tarp with fibre reinforced adhesive tape and weight bottom edge to ensure proper closing. Space curtained doorways a minimum of two (2) metres apart.
 - .7 Decontamination Room: enclosure located between Mould Contaminated Work Area and uncontaminated area for decontamination of equipment and workers, typically consisting of two curtained doorways at least 2 metres apart.
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- .8 Fibre Reinforced Polyethylene Sheet (FRPS): rip-proof polyethylene sheeting with fibre reinforced adhesive tape added along edges.
- .9 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining particles greater than 0.3 microns at 99.97% efficiency.
- .10 HVAC: heating ventilating and air-conditioning systems which serve occupied areas. Includes but is not limited to air handling units, duct work, terminal boxes and grills.
- .11 Mould Contaminated Work Area (MCWA): specific area or location where actual work is being performed or such other area of facility which it has been determined may be hazardous to public health as result of mould remediation.
- .12 Negative pressure: maintain Mould Contaminated Work Area at negative pressure relative to surrounding space to prevent contaminants from leaving contaminated area. Use exhaust fan with HEPA filter to maintain Mould Contaminated Work Area at lower pressure than surrounding areas. Maintain pressure differential of 5 to 7 Pa. Air flow movement can be verified with smoke pencil.
- .13 Occupied Area: areas of building or work site that are outside Mould Contaminated Work Area.
- .14 PPE: Personnel Protective Equipment.
- .15 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray; with minimum of six litres capacity for work.

1.4 REGULATORY REQUIREMENTS

- .1 Comply with regulations in effect at time work is performed. In case of conflict among these requirements or with these specifications more stringent requirement applies. If no regulations exist, follow guidelines as listed in paragraph 1.2 References.
- .2 Comply with Ontario Regulation O.Reg. 347/90, General – Waste Management, as amended.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit proof satisfactory to Departmental Representative that employees have had instruction on potential hazards of mould exposure, use of personal respirator and protective clothing, entry and exit from work areas and aspects of work procedures and protective measures.
 - .2 Submit proof of attendance in form of certificate that supervisory personnel have been trained in mould remediation course, approved by Departmental Representative. Minimum of one supervisor for every ten trained workers.
 - .3 Submit Provincial and/or local requirements for Notice of Project form.
 - .4 Submit proof of Contractors Liability Insurance for dealing with hazardous materials.
 - .5 Submit Workplace Safety and Insurance Board (WSIB) status and transcription of insurance.
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1.6 INSTRUCTION AND TRAINING

- .1 Before commencing work, provide Departmental Representative proof that workers have had instruction and training in potential health hazards of mould exposure, handling of hazardous materials, in personal hygiene including protective clothing, entry and exit from Mould Contaminated Work Area, use of disposal procedures including building materials, respirators and protective clothing.
- .2 Instruction and training related to use of personal respirators:
 - .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 designated construction safety advisor.
- .4 Supervisory personnel to complete required training in mould remediation.

1.7 WORKER PROTECTION

- .1 Provide tight-fitting full-face dual cartridge air purifying respirator equipped with HEPA filter cartridges, as a minimum to be worn. Disposable respirators not allowed.
- .2 Gloves that extend to middle of forearm.
- .3 Use mould/dust-impervious polyethylene coated disposable head and foot coverings, and full body suit. Seal gaps, such as those around ankles and wrists, with fibre reinforced adhesive tape.
- .4 Procedures for entering Mould Contaminated Work Area. Each worker to:
 - .1 Remove street clothes in Decontamination Room and put on respirator with new filters or reusable filters, clean disposable protective clothing and head covers before entering Mould Contaminated Work Area. Store street clothes, uncontaminated footwear and towels in Decontamination Room.
 - .2 Ensure that no person required to enter Mould Contaminated Work Area has facial hair that affects seal between respirator and face.
 - .3 Eating, drinking and chewing are not permitted in Mould Contaminated Work Area. Drinking is permitted in Decontamination Area.
- .5 Procedures for exiting Mould Contaminated Work Area. Workers to:
 - .1 Remove gross contamination from clothing before leaving work area then proceed to Decontamination Room and remove disposable protective clothing except respirators. Place contaminated worksuits in closed containers for disposal with mould contaminated materials.
 - .2 Clean outside of respirator with cleaning solution. Remove respirator, remove and dispose of filters in container provided for purpose. Wash and rinse inside of respirator.
 - .3 When not in use in work area, store reusable work footwear in Decontamination Room. Upon completion of mould remediation, clean footwear thoroughly inside

and out using cleaning solution before removing from Mould Contaminated Work Area or from Decontamination Room.

- .4 Proceed to decontamination room and change into street clothes at end of each day's work.
- .5 If re-entering work area, follow entering and exiting procedures.
- .6 Workers: to be fully protected with respirators and protective equipment clothing during preparation of erecting enclosure prior to commencing actual mould remediation.
- .7 Post in Decontamination room procedures specified, in both official languages.

1.8 VISITOR PROTECTION

- .1 Protective clothing and approved full face respirators to be worn by Authorized Visitors to Mould Contaminated Work Area.
- .2 Instruct Authorized Visitors in proper use of protective clothing, respirators, and procedures.
- .3 Instruct Authorized Visitors proper procedures to be followed in entering into and exiting from Mould Contaminated Work Area.
- .4 Provide and facilitate access to Departmental Representative at all times during construction progress at no additional cost to contract.

1.9 SITE CONDITIONS

- .1 Inform sub-trades of presence of mould-contaminated materials and potential health hazards of mould exposure.
- .2 Submit to Departmental Representative copy of notifications prior to start of work.

1.10 EXISTING CONDITIONS

- .1 Varying quantities of both accessible and concealed mould-impacted material have been previously identified in the kitchens, washrooms, or adjacent corridors/spaces of the Ranges included in this renovation project. These areas will undergo mould remediation using Maximum Mould Remediation Precautions, to be completed before renovations can proceed. Mould-impacted materials include, but are not limited to, drywall, batt insulation, millwork, and fibreboard. Room contents, including furniture and other porous or semi-porous items, are also subject to the requirements of this specification.
- .2 Mould-impacted materials that have been previously identified and are to be handled, removed, or otherwise disturbed and disposed of during this project are identified within the document listed below. The referenced report contains background information; investigation methodology; findings; conclusions and recommendations; and includes appended drawings of the work areas. This specification shall be read and interpreted in association with the referenced technical report.
 - .1 Limited Investigation of Mould Growth – Building FBH “Horizon”. Beaver Creek Institution, 2000 Beaver Creek Drive, Gravenhurst, Ontario. Prepared by Pinchin Ltd (File No. 100550). Dated March 3, 2015.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Drop Sheets: fibre reinforced polyethylene 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Disposal bags: dust-tight 0.15 mm clear polyethylene waste bags.
- .3 Wetting Agent: water to mist mould-containing material.
- .4 Cleaning solution: detergent solution for damp wipe and/or mop.
- .5 Fibre reinforced adhesive tape: used in sealing joints of fibre reinforced polyethylene sheets and for attachment of fibre reinforced polyethylene sheet to finished and unfinished surfaces. Fibre reinforced adhesive tape must be capable of adhering under both dry and wet conditions.
- .6 Provide materials such as fibre reinforced polyethylene sheeting, lumber, nails and hardware necessary to construct and dismantle barriers that isolate Mould Contaminated Work Area.

2.2 TOOLS AND EQUIPMENT

- .1 Tools and equipment: suitable for use with microbial contamination and must be able to withstand de-contamination.
- .2 Personnel protective equipment (protective clothing, personal respiratory filter cartridges, HEPA air filters, etc.) provide in sufficient quantities for duration of project.
- .3 Exhaust air fan systems: equipped with HEPA filters and be capable of providing sufficient exhaust air to create a minimum pressure differential of 5 Pa to 7 Pa and to allow sufficient flow of air through area (minimum of 4 air exchanges per hour). Negative air units exhausting indoors will require on-site DOP testing certification.
- .4 Pressure differential measurement instrument: provide to ensure exhaust air devices provide minimum pressure differential required between Mould Contaminated Work Area and uncontaminated areas. Install equipment in critical barrier between Mould Contaminated Work Area and uncontaminated areas and gap seal with fibre reinforced adhesive tape.
- .5 Vacuum cleaners: HEPA filters.
- .6 Ladders and/or scaffolds: adequate length, strength and sufficient quantity to support work schedule.

Part 3 EXECUTION

3.1 PREPARATION OF MOULD CONTAMINATED WORK AREAS

- .1 Mould Contaminated Work Area and areas adjacent and around area to be unoccupied: Vacating is required for infants (less than 12 months old), elderly people, persons having undergone recent surgery, immune suppressed people or people with chronic inflammatory lung diseases.
 - .2 One supervisor for every ten trained mould remediation workers is required.
 - .3 Approved supervisor must remain within Mould Contaminated Work Area during disturbance, removal, or other handling of mould-contaminated materials.
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- .4 Turn off HVAC systems serving Mould Contaminated Work Areas prior to starting remediation work to prevent contamination and dust dispersal to other areas of building.
- .5 Clean movable objects within proposed Mould Contaminated Work Area using HEPA filtered vacuum, damp wipe surfaces and remove such objects from Mould Contaminated Work Area to a secure and clean area.
- .6 Clean fixed objects within proposed work area using HEPA filtered vacuum, damp wipe surfaces and enclose with 2 separate layers of 0.15 mm fibre reinforced polyethylene sheeting securely sealed with fibre reinforced adhesive tape.
- .7 Remove visible dust from surfaces in work area where dust is likely to be disturbed during course of mould remediation work. Use HEPA vacuum and damp wipe area.
- .8 Do not use compressed air to clean up or remove dust from surfaces.
- .9 Seal off windows, doorways, skylights, ducts, grilles, diffusers, ceiling plenums, electrical outlets and openings between work area and uncontaminated areas to prevent spread of dirt and spores with 2 separate layers of 0.15 mm (fibre reinforced polyethylene sheeting securely held in place by fibre reinforced adhesive tape. Doorways and corridors that will not be used for passage during work must be sealed with fixed critical barriers.
- .10 Erect critical barriers around perimeter of Mould Contaminated Work Area before remediation using two separate layers of 0.15 mm fibre reinforced polyethylene sheeting extending from floor slab to as close as possible to underside of above floor slab. Seal gaps due to ductwork, piping conduits with 2 separate layers of 0.15 mm fibre reinforced polyethylene sheeting. For larger areas, erect steel or wooden stud frame and fibre reinforced polyethylene sheeting attached to it. Frame openings greater than 3 square metres with 38 x 89 mm studs spaced 400 mm on center. Barriers must be constructed without disturbing contaminated materials.
- .11 Seal floor and wall surfaces within enclosure which are not to be removed as microbial waste with minimum of 2 separate layers of 0.15 mm polyethylene sheeting. Cover floors first so that fibre reinforced polyethylene extends at least 300 mm and fold up against enclosure wall, overlap vertical fibre reinforced polyethylene sheet with floor fold up.
- .12 Build worker Decontamination Room at exits from work areas.
- .13 Put negative pressure system in operation and operate continuously from time first fibre reinforced polyethylene is installed to seal openings until final completion of work including final clean-up. Negative air units exhausting indoors will require on-site DOP testing certification.
- .14 After Mould Contaminated Work Area enclosure is completed, remove HVAC filters, pack in sealed plastic bags 0.15 mm minimum thickness and treat as contaminated waste. Remove objects that might interfere with mould removal, as directed by Departmental Representative. Use HEPA vacuum during removal to reduce dust dispersal.
- .15 Before beginning mould remediation work, at each access to Mould Contaminated 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 MOULD HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING MOULD DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

- .16 Do not begin remediation work until barriers are inspected and authorization is given by the Departmental Representative.

3.2 PREPARATION OF WORKER DECONTAMINATION ENCLOSURE SYSTEM

- .1 Establish worker decontamination enclosure system between Mould Contaminated Work Area and uncontaminated area. Access to Mould Contaminated work area through this enclosure.
- .2 Access to Decontamination Room through double flap curtained openings.
- .3 Decontamination Room: build Decontamination Room between Mould Contaminated Work Areas, with two curtained doorways, one to Mould Contaminated Work Area and one to uncontaminated areas. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in Decontamination Room. Decontamination Room: large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change clothes comfortably. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly. Ensure wash facilities, including warm water and soap, to allow for worker denomination and cleaning.
- .4 No personnel permitted to leave Decontamination Room unless first decontaminated by changing, wet cleaning or HEPA vacuuming to remove dust and mould spores. No contaminated materials or persons to enter uncontaminated area.

3.3 MAINTENANCE OF ENCLOSURES

- .1 Maintain enclosures in tidy condition.
- .2 Ensure that barriers and fibre reinforced polyethylene linings are effectively sealed with duct tape at beginning of each working period. Repair damaged barriers and remedy defects immediately upon discovery.
- .3 Use smoke methods to test effectiveness of barriers when directed by Departmental Representative.

3.4 MICROBIAL REMEDIATION WORK AREAS

- .1 Commence mould remediation work when:
 - .1 Mould Contaminated Work Areas and decontamination enclosures are effectively segregated from parts of building required to remain in use. Enclosures are to be inspected and approved by Departmental Representative.
 - .2 Tools, equipment and materials waste containers are on site.
 - .3 Building security has been set up.
 - .4 Warning signs as specified are displayed where access to contaminated areas is possible.
 - .5 Notifications have been completed and preparatory steps have been taken.
- .2 Authorized supervisor employed by contractor and qualified in microbial contamination remediation to be on job site to ensure establishment and maintenance of negative pressure enclosure and proper work practices throughout project.
- .3 Do not begin remediation work until authorized by Departmental Representative.

- .4 Use sprayer low-velocity, fine mist to mist where materials containing mould are to be cut scraped. Perform work to reduce dust creation to lowest levels practicable.
- .5 Remove microbially contaminated materials, gypsum drywall walls, insulation from framing, and flooring finishes in designated locations as outlined in specification. Removal to include visibly contaminated material as determined by Departmental Representative.
- .6 Remove contaminated material in small sections within enclosure. Pack material in sealable plastic bags 0.15 mm minimum thickness and place in containers for disposal.
- .7 Non-porous (e.g. metals, glass and plastics) and semi-porous (e.g. wood studs, furniture) materials that are identified as contaminated can be cleaned using HEPA-filtered vacuuming and damp wiping with detergent solution and reused depending on depth to which microbial growth has penetrated substrate. Wood is to be discarded if fungal growth has affected its soundness. Authorization for only cleaning is subject to written approval by Departmental Representative.
- .8 Where designed waste container is not used, remove sealed containers containing mould waste and dispose following specified procedures in Section 3.7 Waste Disposal.
- .9 During mould remediation, should the Departmental Representative suspect contamination of areas outside enclosed Mould Contaminated Work Area, contractor to stop remediation work and immediately decontaminate these affected areas. Eliminate causes of such contamination. Unprotected individuals prohibited from entering these contaminated areas until air and swab sampling and visual inspections determine areas are free of contamination.

3.5 REPAIR AND CLEAN-UP

- .1 During mould remediation and immediately after completion of mould remediation, clean enclosure starting within top of enclosure and working down to floors. Clean both enclosed area and Decontamination Room using HEPA vacuum and/or by damp mopping with cleaning solution.
 - .2 HEPA vacuum inside layer of polyethylene sheeting within work area and damp wiped prior to removal. Removal of this layer to occur after removal and decontamination activities are completed and work area inspected by Departmental Representative.
 - .3 Remove inside layer of fibre reinforced polyethylene sheeting by rolling it away from walls to centre of work area. Vacuum visible debris during cleanup, immediately, using HEPA vacuum.
 - .4 HEPA vacuum, minimum of twelve hours after inside layer of fibre reinforced polyethylene sheeting has been removed, second layer of polyethylene sheeting and damp wipe.
 - .5 Include Decontamination Room in similar clean-up.
 - .6 Remove non-essential fibre reinforced polyethylene sheetings and visible accumulations of material and debris.
 - .7 Dispose of used fibre reinforced polyethylene sheets; used fibre reinforced adhesive tape, cleaning material, clothing, and contaminated waste.
 - .8 Include sealed waste containers and equipment used in Mould Contaminated Work Areas in cleanup and removed from work areas, via Decontamination Room.
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3.6 INSPECTION AND AIR SAMPLING

- .1 Carry out final visual inspection check to ensure that no dust or debris remains on surfaces as result of dismantling operations. All work is subject to final inspection and written approval by Departmental Representative. No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .2 The Departmental Representative may perform final clearance air, swab, and/or tape lift sampling prior to re-occupancy. Sample results will be compared to an outdoor reference sample or samples collected from an area known to not be impacted by mould for comparative purposes. Repeat cleaning using HEPA vacuum equipment, or damp cleaning methods, in conjunction with sampling until levels comparative to the reference samples, at the sole discretion and decision of the Departmental Representative. No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 Upon notification that final tests are acceptable remove remaining critical barriers. HEPA vacuum surfaces behind containment barriers, including walls, floors, ceiling tiles, windows, doors and other surfaces, as applicable. HEPA vacuum adjacent interior spaces within 3 metres of former location of containment barriers.

3.7 WASTE DISPOSAL

- .1 Place debris and microbial waste in doubled-bagged dust-tight 0.15 mm clear polyethylene waste bags. Treat drop sheets and disposable protective clothing as waste; fold these items to contain dust, and place in plastic bags. Securely seal bags and place in waste containers for transport.
- .2 Cover large items that have heavy mould growth with two layers of polyethylene sheeting and sealed with fibre reinforced adhesive tape before they are removed from cleaned work area.
- .3 Clean outside of bags and/or waste containers with damp cloth and cleaning solution or HEPA vacuumed prior to their transport to uncontaminated areas of building.
- .4 Remove waste bags and/or containers from site and dispose. There is no special requirement for disposal of mouldy materials; as such they can be disposed of in landfill.
- .5 All waste routes, waste disposal schedule, and waste storage are subject to written approval by Departmental Representative.

3.8 RE-ESTABLISHMENT OF MOVABLE OBJECTS AND SYSTEMS

- .1 Return objects moved to temporary locations to their original location. Ensure objects are cleaned before been moved into cleaned area.
- .2 Remount objects to former positions.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 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 A1011/A1011M-17, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- .2 Canadian Standards Association (CSA):
 - .1 CSA B651-12(R2017), Accessible Design for the Built Environment.
 - .2 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.2 DESIGN REQUIREMENTS

- .1 Design metal fabrications in accordance with CSA B651.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data of each item specified in accordance with Sections 01 33 00 and 01 78 00.
 - .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.
 - .2 Indicate each item's conformance with CSA B651.
 - .3 Each shop drawing submission shall bear signature and stamp of qualified professional engineer registered or licensed in province of Ontario.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/ G40.21, Grade 350W and 300W respectively, minimum 30% recycled content.
 - .2 Steel pipe: to ASTM A53/A53M double extra strong, black finish, 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.
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- .7 Steel gratings welded: bearing bars, cross bars, bent connecting bars and anchors, welding quality, mild carbon steel to ASTM A1011/A1011M.

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 round 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: in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a.
- .3 Zinc primer: zinc rich, ready mix in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a.

2.4 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.

2.5 ANGLE LINTELS

- .1 Steel angles: galvanized or prime painted, sizes indicated for openings. Provide 200 mm minimum bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Finish: shop painted.
 - .1 Primer: VOC limit 250 g/L maximum to GS-11 when applied onsite.

2.6 FABRICATION

- .1 Fit joints in true planes and securely fasten.
 - .2 Weld to CSA W59. File or grind welds smooth and flush with adjoining surface.
 - .3 Fabricate gratings within limits given in Metal Bar Grating Manual, Revised 1979.
 - .4 Shop assemble work.
-

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Supply other sections with templates, instructions and built-in items.
- .2 Install work straight, plumb and level to a tolerance of 1:600.
- .3 Provide required reinforcing and anchorage.
- .4 Touch-up burnt, scratched or chipped primer.

3.2 LOOSE ANGLE LINTELS

- .1 Supply masonry section with steel loose angle lintels of sizes required to suit masonry openings.
- .2 Apply alkyd primer to interior lintels. Galvanize exterior lintels.
- .3 Provide 150 mm bearing at ends.
- .4 Weld or bolt together back-to-back angles.

3.3 COUNTER BRACKETS

- .1 Supply and install steel brackets, supports and angles for support of counters.
- .2 Drill for countersunk screws and anchor bolts.
- .3 Apply alkyd primer.

3.4 SUMP PIT COVER AND FRAME

- .1 Sump Pit Cover and Frame: Fabricate frames from steel angles; 35 mm x 35 mm x 6 mm, weld angles together to form continuous frame for sump pit cover and as follows:
 - .1 Provide hygienic EPDM seals continuous around perimeter of sanitary sump pit as indicated.
 - .2 Weld stud anchors to angle frame at 610 mm O/C.
 - .3 Form 8 mm thick checker plate cover, reinforced with 35 mm x 35 mm x 6 mm angle stiffeners spaced at 610 mm o/c, welded to checker plate cover, and made flush to adjacent concrete surfaces
 - .4 Provide two (2) recessed pull rings on opposite sides of cover
 - .5 Provide four (4) standoff legs to underside of cover to provide a minimum of 75 mm clear space when cover sits on floor.
 - .6 Secure checker plate cover to sump pit frame with ¼ turn quick connectors to ensure a tight fit between frame and cover.
 - .7 Hot dipped galvanized 300 g/m² minimum
 - .2 Provide four (4) standoff legs to underside of cover to provide a minimum of 75 mm clear space when cover sits on concrete floor slab
 - .3 Secure grating cover to sump pit frame with ¼ turn quick connectors to ensure a tight fit between frame and cover.
 - .4 Hot dipped galvanized 300 g/m² minimum
-

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Wood Protection Association (AWPA):
 - .1 AWPA P5-15, Standard for Waterborne Preservatives.
- .2 CSA International
 - .1 CAN/CSA-O80 Series-15, Wood Preservation, Includes Update No. 1 (2008).
 - .2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .3 CSA O112-M Series 1977(R2006), Standards for Wood Adhesives.
 - .4 CSA O121-17, Douglas Fir Plywood.
 - .5 CSA O141-05 (R2014), Softwood Lumber.
 - .6 CAN/CSA-Z809-16, Sustainable Forest Management.
- .3 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2017.

1.2 QUALITY ASSURANCE

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

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 wood products and accessories 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 off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Lumber: softwood, S4S, moisture content S-DRY graded and stamped in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.
- .2 Furring, blocking, nailing strips, strapping, grounds, rough bucks, bracing, bridging: NLGA spruce, pine or fir (SPF), 121c. and pine, 113d.

2.2 ACCESSORIES

- .1 Sealants: in accordance with Section 07 92 00.
- .2 General purpose adhesive: to CSA O112 Series.
- .3 Nails, spikes and staples: to CSA B111.
- .4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections 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 Install members true to line, levels and elevations, square and plumb to a tolerance of 1:600 and rigidly secure in place.
- .2 Install furring and blocking as required to space-out and other work as required.
- .3 Countersink bolts where necessary to provide clearance for other work.

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 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute (AWMAC/WI)
 - .1 AWMAC/WI North American Architectural Woodwork Standards (NANAWWS), 2017.
- .2 CSA International
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
- .3 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber GR 2017.
- .4 ASTM International:
 - .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 wood products 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.
 - .3 Submit duplicate 300 mm samples of wood base for opaque finish.
- .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 Architectural Woodwork Standards 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 Architectural Woodwork Standards, 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 Test and Evaluation Reports: submit certified test reports for wood products from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

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 indoors 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.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Wood Mouldings: Provide interior millwork in accordance with NAWWS Section 06 for profiles and configurations required for the project and as follows:
 - .1 Hardwood Trim: Selected to meet NAWWS Custom Grade, kiln dried; species white maple finished lumber (S4S), edge grain (vertical), suitable for opaque finish in profiles indicated on Drawings for the following:
 - .1 Wall Base
 - .2 CAN/CSA-Z809, SFI or Forestry Stewardship Council (FSC) certified.

2.2 ACCESSORIES

- .1 Anchors: Select material, type, size, and finish required for each substrate for secure anchorage:
 - .1 Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
 - .2 Provide toothed steel or lead expansion sleeves for drilled-in-place anchors.
- .2 Nails and staples: to CSA B111; galvanized to ASTM A123/A123M for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .3 Wood screws: plain, type and size to suit application.
- .4 Splines: wood.
- .5 Adhesive and Sealants: in accordance with Section 07 92 00.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Do finish carpentry to AWMAC/WI NAAWS.
 - .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 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.
 - .4 Install door and window trim in single lengths without splicing.

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 finish carpentry installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI).
 - .1 AWMAC/WI North American Architectural Woodwork Standards, NAAWS – Edition 3.1 - 2017.
- .2 ASTM International:
 - .1 ASTM D790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - .2 ASTM D2583-13a, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
 - .3 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .4 CSA International
 - .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O121-17, Douglas Fir Plywood.
 - .3 CAN/CSA-Z809-16, Sustainable Forest Management.
- .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA LD-3-2005, High-Pressure Decorative Laminates (HPDL).
- .7 National Hardwood Lumber Association (NHLA)
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.
- .8 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2014.
- .9 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-A2005, Adhesives and Sealants Applications.
- .10 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 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.
 - .1 Scales: profiles full size, details half full size.
 - .3 Indicate materials, thicknesses, finishes and hardware.
 - .4 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 300 x 300 mm.
 - .4 Submit duplicate samples of laminated plastic for colour selection.
 - .5 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.
 - .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 Architectural Woodwork Standards, 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.
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- .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.

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.
- .3 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.
 - .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 indoors 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.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Softwood Plywood: Douglas fir plywood (DFP) to CSA O121, standard construction, sanded GS2, square edge, FSC certified.
 - .1 Plywood resin to contain no added urea-formaldehyde.
- .2 Laminated plastic for flatwork (PL-1): to NEMA LD3, Grade VGL, Type HD, pattern, colour, finish as selected by Departmental Representative.
- .3 Nails and staples: to CSA B111.
- .4 Wood screws: type and size to suit application.
- .5 Splines: metal.
- .6 Sealant: in accordance with Section 07 92 00.
 - .1 Sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .7 Laminated plastic adhesive:

- .1 Adhesive: contact adhesive to CAN/CGSB-71.20.
- .2 Adhesives: VOC limit 120 g/L maximum to SCAQMD Rule 1168 and GS-36.
- .3 Clear Wood Finishes: VOC limit 550 g/L maximum to SCAQMD Rule 1113

2.2 MANUFACTURED UNITS

- .1 Casework:
 - .1 Fabricate caseworks to AWMAC/WI NAAWS custom quality grade.
 - .2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
 - .1 Board sizes: "standard" or better grade.
 - .2 Dimension sizes: "standard" light framing or better grade.
 - .3 Urea-formaldehyde free.
 - .3 Framing NLGA Grade No.1.
 - .4 Countertops:
 - .1 Softwood plywood, thickness as shown on Drawings, except that countertops and backsplashes at sinks and wet areas have water resistant plywood cores; no exceptions.
 - .2 Backsplash Edge Style: Square
 - .3 Backsplash to Countertop Transition: As shown on Drawings.
 - .4 Countertop Edge Style: As shown on Drawings.
 - .5 Case bodies (ends, divisions and bottoms).
 - .1 Softwood plywood, thickness as shown on Drawings, except that case bodies at wet areas have water resistant plywood cores; no exceptions.
 - .6 Backs:
 - .1 Softwood plywood, thickness as shown on Drawings, except that backs at wet areas have water resistant plywood cores; no exceptions.
 - .7 Interiors:
 - .1 Softwood plywood, thickness as shown on Drawings, except that interiors at wet areas have water resistant plywood cores; no exceptions.
 - .8 Shelving:
 - .1 Softwood plywood, thickness as shown on Drawings.
 - .2 Edge banding: High Pressure Decorative Laminate for HPDL Finished Surfaces; colour to match with surface finish
 - .9 Drawers:
 - .1 Fabricate drawers to AWMAC/WI NAAWS premium grade supplemented as follows:
 - .2 Sides and Backs.
 - .1 Softwood plywood, thickness as shown on Drawings.
 - .3 Bottoms:
 - .1 Softwood plywood, thickness as shown on Drawings.
 - .4 Fronts:
 - .1 Softwood plywood, thickness as shown on Drawings.

.10 Doors:

.1 Softwood plywood, thickness as shown on Drawings.Casework Doors:

2.3 HARDWARE

- .1 Cabinet hinge: to ANSI/BHMA-A156.9-2015, type B81602 or type B81612.
- .2 Piano hinge: to ANSI/BHMA-A156.9-2015, type B81491, reversible.
- .3 Magnetic catch: to ANSI/BHMA-A156.9-2015, type B13171, heavy duty.
- .4 Gate latch: hidden type, single acting, bolt activated by pressing button concealed on bottom of latch case, brushed nickel finish.
- .5 Cabinet pull: to ANSI/BHMA-A156.9-2015, type B32011, and CSA B651-12, finish 628, satin aluminum, 76.2 mm centres, back mounted.
- .6 Adjustable shelf standard: to ANSI/BHMA- A156.9-2015, type B84061, surface application, open shelf rest type B84091.
- .7 Drawer slide set: heavy duty to ANSI/BHMA- A156.9-2015, type B05051, with zinc plate finish.
 - .1 Progressive full extension: 'Model 8500' manufactured by knape and Vogt.
- .8 Cam locks: to ANSI/BHMA-A156.11-2014, key removable in locked and unlocked position, cam attached with screw or nut, type E07261, Grade 1. Keyed alike.
- .9 Closet bar: to ANSI/BHMA-A156.16-2013, attached by surface screws, round type L03131.
- .10 Draw bolts: type recommended by laminated plastic manufacturer.

2.4 FABRICATION

- .1 Set nails and countersink screws apply stained 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.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400 mm. Keep joints 600 mm from sink cutouts.
- .9 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.

- .10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .11 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .12 Apply laminated plastic liner sheet where indicated.
- .14 Fabricate standing and running trim rigid, plumb and square, as detailed, with tight, bevelled, hairline joints; sand work smooth; set nails and screws, and fill with matching patching compounds and as follows:
 - .1 Butt and dowel joints for wall base.
 - .2 Build-in millwork as required to receive reinforcing, bracing, anchors
 - .3 Countersink bolts and washers; fill holes with matching wood plugs
 - .4 Fabricate straight run millwork accurately; provide over length to allow for site trimming to proper fit
 - .5 Plane sides and back, sand exposed faces, surfaces; hollow out backs 3 mm round-off edges
 - .6 Finish: Factory finished to match existing in accordance with requirements of Section 05 of NAAWS.

2.5 FINISHING

- .1 Finish in accordance with Section 09 91 23.

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 Install solid surfacing materials in accordance with manufacturer's written instructions.
- .7 At junction of counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00.
- .8 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.
- .9 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .10 Site apply laminated plastic to units as indicated.
 - .1 Adhere laminated plastic over entire surface.
 - .2 Make corners with hairline joints.
 - .3 Use full sized laminate sheets.
 - .4 Make joints only where approved by Departmental Representative.
 - .5 Slightly bevel arises.
- .11 For site application, offset joints in plastic laminate facing from joints in core.
- .12 Install wall base to walls, anchoring securely with proper hardware:
 - .1 Fasten pieces together in runs to provide a rigid rail construction, true, level and properly aligned.
 - .2 Apply 13 mm wide x 3 mm thick medium density adhesive backed tape gasket continuous along top and bottom edge where mounted snug to wall or cabinet work to close variation gaps.

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 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.
- .4 Sand smooth, fill and retouch nicks, chips and scratches; replace damaged items that cannot be repaired.

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 SECTION INCLUDES

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

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
 - .2 ASTM C920-14a, 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 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing 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 Material Safety Data Sheets (MSDS).
- .5 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
 - .2 Manufacturer's product data: Submit manufacturer's printed product data to describe:
 - .1 Sealant compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .3 Samples: Submit duplicate samples of each type of material and colour.
 - .1 Submit cured samples of exposed sealants for each color where required to match adjacent material.
 - .4 Manufacturer's Installation Instructions: Instructions to include installation instructions for each product used.
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1.4 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.

1.5 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.
- .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.

1.6 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.

1.7 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 Material Safety Data Sheets (MSDS) 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.
- .3 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

Part 2 PRODUCTS

2.1 SEALANT MATERIALS

- .1 Do not use sealant that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
 - .1 When low toxicity sealants 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.
 - .2 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Polyurethane:
 - .1 Type S-1: One component, non-sag, for general construction, Shore A Hardness 15+, conforming to CAN/CGSB-19.13, Type 2, MCG-2-25-A-N and ASTM C920, Type S, Grade NS, Class 25, Use NT, M, and A, colour to be selected by Departmental Representative from manufacturer's standard range.
- .2 Silicone:
 - .1 Type S-2: 100% silicone, mould and mildew resistant, Shore A Hardness 15-25, one component conforming to CAN/CGSB-19.13 and ASTM C920, primerless, Type S, Grade NS, Class 25, use NT, G, and A, SWRI validated.
 - .2 Type S-3: Exterior Weatherproofing Sealant: 100% silicone, single component, low modulus, neutral cure, Shore A Hardness 15-25, conforming to [CAN/CGSB 19.13-M](#), Classification C-1-40-B-N and C-1-25-B-N, and [ASTM C 920](#), Type S, Grade NS, Class 25, use NT, M, G, A and O, colour as selected by Departmental Representative from Standard Range.
- .3 Acoustical Sealant:
 - .1 Type S-5: Non-skinning, non-hardening, single component synthetic rubber sealant, conforming to ASTM C919, primerless, Type S, Grade NS, Class 25, SWRI validated.
- .4 Multi-Component:
 - .1 Type S-6: Saw cut sealant, multi-component, self levelling, conforming to ASTM D2240.
- .5 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 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
- .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
- .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

- .1 Where no specified type of sealant is shown or specified choose one of the sealants specified in this Section applicable to that intended application, and consistent with manufacturer's recommendations.
- .2 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: S-3.
- .3 Interior, fully concealed locations where no constant or consistent air pressure difference will exist across the joint: Type S-5.
- .4 Interior control and expansion joints in floor surfaces: Sealant Type S-6.
- .5 Perimeters of interior frames, as detailed and itemized: Sealant Type S-3.
- .6 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant Type S-2.
- .7 Exposed interior control joints in drywall: Sealant Type S-1.

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.
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- .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 BACKUP MATERIAL

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

3.5 MIXING

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

3.6 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists 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 SUMMARY

- .1 This Section includes requirements for supply and installation of the following:
 - .1 Non-rated wall access doors and frames
 - .2 Non-rated Ceiling access doors and frames

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 – Gypsum Board Assemblies: Rated and non-rated access panels in walls and ceilings.
- .2 Division 22 – Plumbing: Shut-off and control valves for heating and plumbing systems; clean-outs for drainage systems.
- .3 Division 23 – Heating, Ventilating and Air Conditioning: Duct accessories for heating and air-conditioning duct access doors.
- .4 Division 26 – Electrical: Transformers and access doors for points and other electrical accessories.

1.3 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A780-09(2015), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - .2 ASTM B221-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - .3 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board
- .2 National Fire Protection Agency (NFPA):
 - .1 NFPA 80-2016, Standard for Fire Doors and Fire Windows
- .3 The Society for Protective Coatings (SSPC):
 - .1 SSPC-Paint 20: Zinc-Rich Coating (Type I – Inorganic, and Type II, Organic)
- .4 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S104-15, Standard Method for Fire Tests of Door Assemblies
- .5 Underwriters' Laboratories (UL), Standards for Safety acceptable to the Standards Council of Canada (SCC)

1.4 ADMINISTRATION REQUIREMENTS

- .1 Coordination: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified below, and as follows:
 - .1 Coordinate locations of all access panels in gypsum board ceilings with Departmental Representative for size and location prior to installation, making every effort to locate outside of gypsum board ceilings.

- .2 Coordinate acceptable locations and sizes with Architectural Reflected Ceiling Plans; no access panels are allowed in public corridors or feature ceilings.
- .3 Coordinate closely with mechanical and electrical sections for size and locations of access panels in walls and ceilings; provide access doors and panels required for project.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Product Data: Provide product data for each type of door and frame indicated, including construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
 - .2 Shop Drawings: Provide coordination drawings and reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:
 - .1 Method of attaching door frames to surrounding construction.
 - .2 Ceiling mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim.
 - .3 Samples: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Provide fire rated access doors and frames in accordance with NFPA 80 or CAN/ULC-S104, and labelled and listed by UL, ULC or ITS/Warnock Hersey, or another testing and inspecting agency acceptable to Authority Having Jurisdiction and Section 07 05 53.

Part 2 Products

2.1 NON-RATED ARCHITECTURAL ACCESS PANELS

- .1 Flush doors and trimless frames, fabricated as follows:
 - .1 Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
 - .2 Door: Extruded aluminum frame with gypsum board inlay and structural nylon corner elements:
 - .1 Gypsum Board: to ASTM C1396/C1396M, 13 mm and 16 mm thickness to match adjacent construction.
 - .2 Size: Square sized to suit access requirements if not indicated on Drawings.
 - .3 Latch: Tamper-resistant torx drive
 - .4 Hinge: Concealed, two point pin hinge, non-corroding, allowing door to open 120° and allowing door to be removed.

- .5 Edge Bead: Recessed extruded aluminum frame edge bead providing surface that can be finished to adjacent gypsum board.
- .6 Accessories: Fibreglass reinforced nylon, zinc plated screws, stainless steel springs and retaining wire to manufacturer's standard.
- .7 Finish: Aluminum frames, gypsum board, nylon and aluminum cam latch to receive the same finish and paint as the surrounding surface.

2.2 FABRICATION

- .1 Provide access door assemblies manufactured as integral units ready for installation.
- .2 Provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness for metal surfaces exposed to view in the completed Work.
- .3 Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- .4 Latching Mechanisms: Supply number required to hold doors in flush, smooth plane when closed based on size of door or panel opening.
- .5 Apply manufacturer's standard protective coating on aluminum that will come in contact with concrete after fabrication.

2.3 FINISHES

- .1 Comply with NAAMM AMP-500 for recommendations for applying and designating finishes.
- .2 Finish metal fabrications after assembly.
- .3 Aluminum Finishes:
 - .1 Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - .2 As-Fabricated Finish: AA-M10 Mechanical Finish: as fabricated, unspecified (mill finish).
- .4 Steel Finishes:
 - .1 Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For zinc coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A780.
 - .2 Factory Priming for Site Painted Finish: Apply shop primer immediately after cleaning and pre-treating, as follows:
 - .1 Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems and capability to provide a sound foundation for site-applied topcoats despite prolonged exposure.

- .2 Shop Primer for Zinc Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.
- .3 Galvanizing Repair Paint: High zinc dust content paint for reglvanizing welds in steel, complying with SSPC-Paint 20.

Part 3 Execution

3.1 PREPARATION

- .1 Advise installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.2 INSTALLATION

- .1 Installation shall be completed by Section 09 21 16.
- .2 Comply with manufacturer's written instructions for installing access doors and frames.
- .3 Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- .4 Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.
- .5 Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

3.3 ADJUSTING

- .1 Adjust doors and hardware after installation for proper operation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 07 92 00 - Joint Sealants
- .2 Section 08 11 00 - Metal Doors and Frames
- .3 Section 09 91 23 - Interior Painting

1.2 REFERENCES

- .1 American National Standards Institute (ANSI):
 - .1 ANSI A118.9-1992, Test Methods and Specification for Cementitious Backer Units
- .2 ASTM International
 - .1 ASTM C423-17, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - .2 ASTM C473-16, Standard Test Methods for Physical Testing of Gypsum Panel Products
 - .3 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .4 ASTM C645-14e1, Standard Specification for Nonstructural Steel Framing Members
 - .5 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .6 ASTM C754-17, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .7 ASTM C840-17a, Standard Specification for Application and Finishing of Gypsum Board.
 - .8 ASTM C1002-16, 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.
 - .9 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .10 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
 - .11 ASTM D3273-16, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - .12 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - .13 ASTM E413-16, Classification for Rating Sound Insulation
 - .14 ASTM E2638-10 Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.

- .3 Association of the Wall and Ceilings Industries International (AWCI)
 - .1 AWCI Levels of Gypsum Board Finish 101a-97.
- .4 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies
 - .2 CAN/ULC-S114-05, Test for Determination of Non-Combustibility in Building Materials
 - .3 CAN/ULC-S702-14, Mineral Fibre Thermal Building Insulation for Buildings

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 gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DESIGN REQUIREMENTS

- .1 Partition assembly to be fire resistance rated.
- .2 Minimum sound transmission rating of installed panel partition to be STC 30, tested to ASTM E90.
- .3 Minimum speech privacy category SPC Standard Speech Privacy 60-65, tested to ASTM E2638.

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 gypsum board assemblies materials level off ground, indoors, 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 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
 - .6 Replace defective or damaged materials with new.

1.6 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 Paper Faced Moisture and Mould Resistant Gypsum Board: Paper faced, microbial treated, water resistant gypsum board meeting requirements of ASTM C1396/C1396M; having water resistance 5% or less after a 2 hour immersion in accordance with ASTM C473 and mould resistant facers meeting a rating of 10 (zero mould growth) in accordance with ASTM D3273.
- .2 Cementitious Backer Board: Reinforced portland cement board, reinforcing mesh embedded near both faces in accordance with ANSI A118.9.
- .3 Non-load bearing channel stud framing: to ASTM C645, stud size as indicated on Drawings, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres. Steel: minimum 25% recycled content.
 - .1 Use 0.91 mm thickness stud framing to support fire rated door frames.
- .4 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height. Steel: minimum 25% recycled content.
- .5 Slotted Deflection Track: Premanufactured slotted top runner with 63 mm down standing legs and having 6 mm wide x 38 mm high slots spaced at 25 mm on centre along length of runner; tested and certified for use in fire rated wall construction and have a ULC or cUL_{US} labelled assembly for fire rated assemblies.
- .6 Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated; 1.2 mm nominal base metal thickness x 400 mm wide
- .7 Metal channel stiffener: 19 x 38 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating, minimum 25% recycled content.
- .8 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C645.

- .9 Carrying Channels: Cold rolled, commercial steel sheet with a core metal thickness of 1.2 mm x 13 mm minimum wide flange, with ASTM A653/A653M, Z120, hot dip galvanized zinc coating; 38 mm minimum depth.
- .10 Furring Channels: Commercial steel sheet with ASTM A653/A653M, Z120, hot dip galvanized zinc coating, as follows:
 - .1 Hat Shaped, Rigid Furring Channels: ASTM C645, 0.80 mm nominal core metal thickness x 22 mm deep.
 - .2 Resilient Furring Channels: 0.45 mm nominal thickness x 13 mm deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web).
- .11 Steel drill screws: to ASTM C1002.
- .12 Laminating compound: as recommended by manufacturer, asbestos-free.
- .13 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, aluminum coated, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .14 Sealants: in accordance with Section 07 92 00.
 - .1 Acoustic sealant: in accordance with Section 07 92 00.
- .15 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .16 Joint compound: to ASTM C475/C475M, asbestos-free.
- .17 Joint Tape: To ASTM C475/C475M, Type as recommended by gypsum board manufacturer for type of installation; use only mould resistant tape for mould and moisture resistant materials.
- .18 Acoustic Sound Batts for Non-Rated Assemblies: Meeting the requirements of ASTM C423, ASTM E90 and ASTM E413, and ULC-S702 mineral fibre acoustic sound batts, Type 1 for all properties other than thermal, width to friction fit steel studs; un-faced, thickness to fill a minimum of 90% of the cavity thickness, nominal density 12.2 kg/m³ minimum; STC ratings as indicated on drawings.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies 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 STEEL STUD FRAMING INSTALLATION

- .1 Install steel framing members to receive screw-attached gypsum board in accordance with ASTM C754 except where specified otherwise.
- .2 Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction in accordance with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with GA, Specification Standards Manual.
- .3 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .4 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .5 Place studs vertically at centres indicated on Drawings and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .6 Erect metal studding to tolerance of 1:1000.
- .7 Attach studs to bottom and ceiling track using screws.
- .8 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .9 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .10 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .11 Erect track at head of door openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above openings in same manner and spacing as wall studs.
- .12 Frame openings and around built-in equipment, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .14 Extend partitions to ceiling height except where noted otherwise on drawings.
- .15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use Slotted Deflection Track.
- .16 Install continuous insulating strips to isolate studs from uninsulated surfaces.

3.3 FURRING INSTALLATION

- .1 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.
 - .2 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
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- .3 Install work level to tolerance of 1:1200.
- .4 Frame perimeter of openings for access panels, light fixtures, diffusers and grilles.
- .5 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .6 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.
- .7 Furr beams, columns, pipes and exposed services where indicated.

3.4 ACCESSORIES 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 around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .6 Provide continuous polyethylene dust barrier behind and across control joints.
- .7 Locate control joints where indicated and at changes in substrate construction.
- .8 Install control joints straight and true.
- .9 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.
- .10 Install expansion joint straight and true.
- .11 Splice corners and intersections together and secure to each member with 3 screws.
- .12 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.

3.5 GYPSUM BOARD INSTALLATION AND FINISHING

- .1 Do installation and finishing of gypsum board to ASTM C840 except where specified otherwise.
- .2 Apply gypsum board after bucks, anchors, blocking, electrical and mechanical work have been reviewed.
- .3 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, screw fasteners for second layer. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C840.

- .2 Apply gypsum board vertically unless indicated otherwise. If horizontal is required, provide sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
 - .4 Tile Backing Panels:
 - .1 Install standard gypsum board panels in areas not subject to wetting to produce a flat surface.
 - .2 Install water resistant mould resistant gypsum board in all washrooms and housekeeping rooms.
 - .3 Construct shower surround partitions of cementitious backer board only, in strict accordance with manufacturer's current recommended installation procedures.
 - .4 Shim surfaces to produce a uniform plane across panel surfaces where tile backing panels abut other types of panels in the same plane.
 - .5 Water Resistant Mould Resistant Gypsum Board: Do not tape or fill joints in water resistant mould resistant gypsum board used as a substrate for ceramic tile.
 - .5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
 - .6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
 - .7 Install gypsum board with face side out.
 - .8 Do not install damaged or damp boards.
 - .9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.
 - .10 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener
 - .11 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.
 - .12 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.
-

- .13 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.
- .14 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .15 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .16 Mix joint compound slightly thinner than for joint taping.
- .17 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .18 Allow skim coat to dry completely.
- .19 Remove ridges by light sanding or wiping with damp cloth.

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.
- .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.

3.7 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
 - .1 ANSI A108/A118/A136.1:2017, Specifications for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.17, A118.1-.17, ANSI A136.1).
 - .2 CTI A118.3-2017, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
 - .3 CTI A118.4-2017, Specification for Latex Cement Mortar (included in ANSI A108.1).
 - .4 CTI A118.5-2017, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1).
 - .5 CTI A118.6-2017, Specification for Ceramic Tile Grouts (included in ANSI A108.1).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C627-10e1 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
 - .2 ASTM C979/C979M-16, Standard Specification for Pigments for Integrally Coloured Concrete.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-75.1-M88, Tile, Ceramic.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA A123.3-05(R2015), Asphalt Saturated Organic Roofing Felt.
 - .2 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .5 Terrazzo, Tile and Marble Association of Canada (TTMAC):
 - .1 Tile Specification Guide 09 30 00 2016/2017, Tile Installation Manual.
 - .2 Tile Maintenance Guide 2000.

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).
 - .3 Divider strip.
 - .4 Elastomeric membrane and bond coat.

- .5 Reinforcing tape.
 - .6 Levelling compound.
- .3 Provide samples in accordance with Section 01 33 00.
 - .1 Base tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
 - .2 Floor tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
 - .3 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.
 - .4 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

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 maintenance materials in accordance with Section 01 78 00.
 - .2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
 - .3 Maintenance material same production run as installed material.
-

Part 2 PRODUCTS

2.1 FLOOR TILE

- .1 Porcelain tile (FF-1): to CAN/CGSB-75.1, Type 4, Class MR 2, CR 1, 10 x 100 x 100 mm size, cushion edges, porcelain with abrasive admixture and slip resistant surface, matte glazed surface, colour to match existing.

2.2 WALL TILE

- .1 Ceramic tile (T-1): to CAN/CGSB-75.1, Type 5 Class MR 2, CR 1, 8 x 300 x 300 mm size, cushion edges, bright glazed surface, colour to match existing. Matching bullnose edge trim to suit application.
- .2 Ceramic tile (T-2): to CAN/CGSB-75.1, Type 5 Class MR 2, CR 1, 8 x 300 x 300 mm size, cushion edges, bright glazed surface, colour to be selected by Departmental Representative. Matching bullnose edge trim to suit application.

2.3 BASE TILE

- .1 Base (B-3, B-4): coved; type, size, colour and texture and properties to match adjacent flooring material.

2.4 TRIM SHAPES

- .1 Conform to applicable requirements of adjoining floor and wall tile.
- .2 Use slip resistant trim shapes for horizontal surfaces.
- .3 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.
- .4 Internal and External Corners: provide trim shapes as follows where indicated.
 - .1 Bullnose shapes for external corners including edges.
 - .2 Coved shapes for internal corners.
 - .3 Special shapes for:
 - .1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
 - .2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.

2.5 MORTAR MATERIALS

- .1 Primer: Low VOC, low viscosity primer as recommended by manufacturer to suit substrate and site conditions; provide proof of bonding ability of setting system where manufacturer recommends that a primer is not necessary to installation.
 - .2 Rapid Setting Mortar: Dry set mortar meeting or exceeding the requirements of ASTM C627 for Extra Heavy installation using rapid curing, latex modified, portland cement mortar meeting requirements of ANSI A108/A118/A136.1.
 - .3 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.
-

2.6 BOND COAT

- .1 Epoxy bond coat: non-toxic, non-flammable, non-hazardous during storage, mixing, application, and when cured. To produce shock and chemical resistant mortars having the following physical characteristics:
 - .1 Compressive Strength: 246 kg/cm².
 - .2 Bond Strength: 53 kg/cm².
 - .3 Water Absorption: 4.0% Max.
 - .4 Ozone Resistance, 200 hours @ 200 ppm: no loss of strength.
 - .5 Smoke Contribution Factor: 0.
 - .6 Flame Contribution Factor: 0.
 - .7 Finished mortar and grout to be resistant to urine, dilute acid, dilute alkali, sugar, brine and food waste products, petroleum distillates, oil and aromatic solvents.
 - .8 Bond Coat: maximum VOC limit 65 g/L.
- .2 Chemical-Resistant Bond Coat:
 - .1 Epoxy Resin Type: CTI A118.3.
 - .2 Furan Resin Type: CTI A118.5.
 - .3 Bond Coat: maximum VOC limit 65 g/L

2.7 GROUT

- .1 Colouring Pigments:
 - .1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979/C979M.
 - .2 Colouring pigments to be added to grout by manufacturer.
 - .3 Job coloured grout are not acceptable.
 - .4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.
- .2 Chemical-Resistant Grout:
 - .1 Epoxy grout: to ANSI A108/A118/A136.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer.
 - .2 Furan grout: to CTI A118.5.

2.8 MEMBRANES

- .1 Uncoupling Membrane:
 - .1 Rigid polyethylene membrane with a grid structure of square cavities 3 mm high each cut back in a dovetail configuration having anchoring fleece laminated to underside complete with manufacturers recommended floor adhesives and setting materials.

2.9 ACCESSORIES

- .1 Straight Edge Strips: Roll formed stainless steel edge strips, 3 mm wide at top edge; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material.
- .2 Transition Edge Strips: Extruded brushed stainless steel edge strips; height as required to suit tile installation; with integral perforated anchoring leg for setting the strip into the setting material.
- .3 Movement Joint Strips: Extruded aluminum profiles joined by a soft thermoplastic movement joint material, with integral perforated anchoring legs for setting the joint into the setting bed; 11 mm wide x height as required to suit application; colour as selected by Departmental Representative from standard range.
- .4 Sealant: in accordance with Section 07 92 00.
 - .1 Sealants: maximum VOC limit 250 g/L.
- .5 Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers and as follows:
 - .1 Job Site Cleaner: Phosphoric acid/nitric acid based cleaning solution mixed in accordance with cleaner manufacturers recommendations and as recommended by tile manufacturer.
 - .2 Maintenance Cleaner: Non-toxic, electrolytic, biodegradable, non-ammonia containing, pH controlled cleaning solution mixed in accordance with manufacturer's recommendations.

2.10 PATCHING AND LEVELLING COMPOUND

- .1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:
 - .1 Compressive strength - 25 MPa.
 - .2 Tensile strength - 7 MPa.
 - .3 Flexural strength - 7 MPa.
 - .4 Density - 1.9.
- .3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in 48 hours after application.

2.11 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 TTMAC Tile Installation Manual 2012/2013, "Ceramic Tile", except where specified otherwise.
 - .2 Apply tile 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 3.0 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 bullnosed.
 - .9 Use bullnose edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
 - .10 Install divider strips at junction of tile flooring and dissimilar materials.
 - .11 Allow minimum 24 hours after installation of tiles, before grouting.
 - .12 Clean installed tile surfaces after installation and grouting cured.
 - .13 Make control joints at 3 m in each direction. Make joint width same as tile joints. Fill control joints with sealant in accordance with Section 07 92 00. Keep building expansion joints free of mortar and grout.
-

3.3 MOVEMENT JOINTS

- .1 Install movement joints in tile Work in accordance with detail 301EJ from TTMAC Installation Manual to suit installation indicated.
- .2 Locate expansion, control, contraction, and isolation joints, as indicated in following table, unless specifically indicated otherwise on the Drawings:

Environment	Minimum	Maximum		Joint Width
Interior	4880 mm	6100 mm		6 mm
Interior/Sunlight	3660 mm	4880 mm		6 mm
Exterior/Normal	2440 mm	3660 mm		10 mm
Exterior/Excessive	2440 mm	3050 mm		13 mm

- .3 Do not saw-cut joints after installing tiles:
 - .1 Locate joints in tile surfaces directly above joints in concrete substrates.
 - .2 Provide floor control joints over structural control joints.
 - .3 Install prefabricated joint profiles in accordance with manufacturer's written instructions, set with top surface of joint profile slightly below top surface of tile.
 - .4 Prepare joints and apply sealants in accordance with requirements of Section 07 92 00.
 - .5 Keep control and movement joints free from setting materials.
- .4 Form an open joint for sealant in tile Work wherever a change in the backing wall material occurs, at all vertical interior corners, around penetrating pipes and fixtures, and where tile abuts other materials or fixtures.

3.4 INSTALLATION SCHEDULE

- .1 Wall Tile
 - .1 Install in accordance with TTMAC detail 305W.
- .2 Floor Tile
 - .1 Install in accordance with TTMAC detail 311F, Detail B.

3.5 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.

3.6 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 02 41 99 –Demolition: Removal of existing floor finishes ready for work of this
- .2 Section 09 30 13 – Ceramic Tiling
- .3 Division 22 – Mechanical: Floor Drains.
- .4 Division 26 – Electrical: Floor mounted accessories.

1.2 REFERENCES

- .1 ASTM International (ASTM)
- .2 ASTM F1913-04(2014), Standard Specification for Vinyl Sheet Floor Covering without Backing
- .3 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Close spaces to traffic during flooring installation and until time period after installation recommended in writing by manufacturer; install flooring and accessories after other finishing operations, including painting and ceiling construction have been completed and as follows:
 - .1 Work of this Section includes floor levelling and patching required to meet resilient flooring manufacturer's installation requirements; Coordinate where differences occur between manufacturer's requirements and actual conditions.
 - .2 Coordinate installation of prefabricated integral cove bases with resilient flooring installation.
 - .3 Install flooring before laboratory millwork and other surface mounted fixtures are installed.

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 resilient 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, edge strips.

- .2 Prefabricated Integral Cove Base: Submit duplicate 100 mm x 100 mm samples of bases representative of colour, pattern, riser height and toe lengths specified. Samples shall represent one completed inside corner and one completed outside corner, with seams sealed and finished.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00.
 - .2 Provide 5% of total installation with a minimum of 3000 mm length and large remnants of each colour and type 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 Prefabricated Integral Cove Base: 5% of total installation with a minimum of 3000 mm of each colour and type
 - .6 Resilient Base and Accessories: 5% of total installation with a minimum of 2400 mm length of each colour and type
 - .7 Deliver to Departmental Representative, upon completion of the work of this section.
 - .8 Store where directed by Departmental Representative.

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 Prefabricated Cove Bases: Deliver prefabricated integral cove bases in accordance with manufacturer's written instructions; store flat on clean, dry floor area, away from construction activities to prevent damage.
- .4 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 specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.7 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 Unbacked Sheet Vinyl Flooring: Homogenous sheet vinyl with a polyurethane coating conforming to ASTM F1913, Type II and the following:
 - .1 Classification: Commercial
 - .2 Wear Layer: Clear UV cured polyurethane
 - .3 Fire Performance: CAN/ULC-S102.2
 - .1 Flame Spread: 100 or less.
 - .2 Smoke Developed: < 300.
 - .4 Colour: selected by Departmental Representative
 - .5 Pattern: Smooth
 - .6 Total Thickness: nominal 2 mm
 - .7 Width: minimum nominal 2000 mm
 - .8 Length: Manufacturers standard roll length
 - .9 Colour: to be selected by Departmental Representative from manufacturer's standard range.
- .2 Prefabricated Integral Cove Base: Fabricated from same materials and dye lots as resilient flooring, in maximum practical lengths, with 38 mm x 38 mm formed aluminum reinforcing bonded to back of base material.
 - .1 Riser: 100 mm
 - .2 Toe: 75 mm
 - .3 Metal Base Cap: Adhesive installation; stainless steel cap as recommended by manufacturer.
- .3 Resilient base: continuous, top set, complete with premoulded end stops and external corners:
 - .1 Type: rubber.
 - .2 Style: cove.
 - .3 Thickness: 3.17 mm.
 - .4 Height: 101.6 mm.
 - .5 Lengths: cut lengths minimum 2400 mm.
 - .6 Colour: selected by Departmental Representative.

- .4 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade and as follows:
 - .1 Adhesives: Solvent free, water resistant primer and adhesive as recommended by flooring or resilient accessory manufacturer to suit resilient products specified and substrate materials and conditions maximum VOC limit 50 g/L, and as follows:
 - .1 Flooring Adhesive: Light bodied adhesive recommended by flooring manufacturer
 - .2 Prefabricated Integral Cove Base Adhesive: Low-VOC premium cove base adhesive as recommended by prefabricated cove base manufacturer.
- .5 Sub-floor filler and leveller: Latex modified, portland cement based formulation provided or approved by resilient product manufacturer for applications indicated; Gypsum based materials will not be accepted for use on this project.
- .6 Chemical Bonding Compound: Product of flooring manufacturer for chemically bonding seams.
- .7 Metal edge strips:
 - .1 Stainless steel, smooth, polished with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .8 External corner protectors: stainless steel, type recommended by flooring manufacturer.
- .9 Edging to floor penetrations: stainless steel type recommended by flooring manufacturer.

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 resilient 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 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.

- .2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .4 Provide a leveling coat over the entire sub-floor.
- .5 Prime concrete slab to resilient 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 two weeks 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. Heat weld according to manufacturer's printed instructions.
- .5 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.
- .6 Cut flooring around fixed objects.
- .7 Continue flooring over areas which will be under built-in furniture.
- .8 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- .9 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .10 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 APPLICATION: PREFABRICATED INTEGRAL COVE BASE:

- .1 Provide prefabricated cove base for all integral base as indicated.
 - .2 Dry fit base; cut and fit material to required lengths; mitre cut inside and outside corners.
 - .3 Dry-fit, and cut metal cover cap prior to base installation.
 - .4 Scribe glue line on walls and floor at edge of base material.
 - .5 Apply adhesive in full spread (100% coverage on two surfaces) for full length of base material. Apply base to wall surface straight and level.
 - .6 Slide cove cap behind base material.
 - .7 Hand roll base material onto wall and floor surface, and remove all bumps, ripples, and fish mouths. Remove all excess adhesive.
 - .8 Seam seal all seams (vertical and horizontal) in base material.
-

3.6 APPLICATION: COVE 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 by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.
- .7 Cove internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.
- .8 Heat weld base in accordance with manufacturer's printed instructions.

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.
 - .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.

3.8 PROTECTION

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

Section 06 20 00 – Finish Carpentry
Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

- .1 The Master Painters Institute (MPI)
 - .1 Maintenance Repainting Manual 2015, Master Painters Institute (MPI), including Identifiers, Evaluation, Systems, Preparation and Approved Product List.
- .2 Environmental Protection Agency (EPA)
 - .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-A2016, Architectural Coatings.

1.3 QUALITY ASSURANCE

- .1 Qualified journeymen 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.
- .2 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .3 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.
- .4 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.
- .5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
- .6 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" E4 ratings based on VOC (EPA Method 24) content levels.
- .2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 rating.

1.5 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 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 in accordance with Section 01 33 00.
 - .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.
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- .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 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 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .2 13 mm gypsum board for finishes over gypsum board and other smooth 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 EXTRA MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 33 00.
- .2 Submit one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
- .3 Deliver to Contractor and store where directed.

1.10 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 33 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 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.
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- .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 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.

1.11 SITE REQUIREMENTS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section 01 35 29.
 - .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.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.12 WASTE MANAGEMENT AND DISPOSAL

- .1 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 Provincial Ministries of Environment and Regional levels of Government.
- .2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .4 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).
- .5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

- .6 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.
- .7 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 Only qualified products with E4 "Environmentally Friendly" rating are acceptable for use on this project.
 - .4 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .2 be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .3 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
 - .5 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).
 - .6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
 - .7 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.
 - .8 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.
 - .9 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E4 rating.
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- .10 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.
- .11 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.
- .12 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.
- .2 Colour schedule will be based upon the selection of two base colours and three accent colours. No more than five colours will be selected for the entire project.
- .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.
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- .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 finish	10 to 25	10 to 35
G4 – satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 – gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of painted surfaces as specified.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Concrete Masonry Units (smooth and split face block and brick):
- .1 INT 4.2D – High Performance Architectural Latex
- .2 Structural Steel and Metal Fabrications:
- .1 INT 5.1B – W.B. Light Industrial Coating gloss level G3
- .3 Galvanized Metal: new doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.:
- .1 INT 5.3B – W.B. Light Industrial Coating gloss level G3
- .4 Galvanized Metal: existing doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.:
- .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1113.
- .2 RIN 5.3B – W.B. Light Industrial Coating gloss level G3
- .5 Gypsum Board: gypsum wallboard:
- .1 INT 9.2B High performance architectural latex finish
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- .6 Dressed Lumber (including mouldings):
 - .1 INT 6.3A – High Performance Architectural Latex

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 Concrete and Masonry: 12%
 - .2 Stucco, Plaster and Gypsum Board: 12%
 - .3 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 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 Contractor. Items shall be securely stored and re-installed after painting is completed by 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.
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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 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 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.
- .3 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.
- .4 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.
- .5 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.
- .6 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 Departmental Representative. Apply paint by brush, roller, or air sprayer. 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 closets and alcoves as specified for adjoining rooms.
- .9 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 Keep sprinkler heads free of paint.
 - .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
 - .8 Paint fire protection piping red.
 - .9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
 - .10 Paint natural gas piping yellow.
 - .11 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.
 - .12 Do not paint interior transformers and substation equipment.
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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 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 corner guards and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS. Indicate VOC's for material as follows:
 - .1 Caulking materials during application and curing.
 - .2 Adhesives.
- .3 Installation Drawings:
 - .1 Indicate on drawings large scale details, materials, finishes, dimensions, anchorage and assembly.
- .4 Samples:
 - .1 Submit duplicate 300 mm long samples of profiles for corner guards.

1.3 QUALITY ASSURANCE

- .1 Test Reports:
 - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates:
 - .1 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect corner guards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Surface Mounted, Metal Corner Guards: Fabricated from single piece, formed metal with eased edges; bend angle turn to match wall condition, and as follows:
 - .1 Material: Stainless steel, Type 304.
 - .2 Thickness: Minimum 1.519 mm.
 - .3 Finish: Directional satin, No. 4
 - .4 Wing Size: Nominal 38 mm x 38 mm
 - .5 Corner Radius: 3 mm
 - .6 Mounting: Oval head, countersunk screws through factory drilled mounting holes.

2.2 ACCESSORIES

- .1 Fasteners: self-tapping stainless steel, flush mounting.
- .2 Adhesive: water resistant type as recommended by manufacturer for substrate.

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 wall and corner guards 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 units on solid backing and erect with materials and components straight, tight and in alignment.
 - .2 Mechanically fasten corner guards as indicated and in accordance with manufacturer's printed 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 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

3.5 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 02 41 99 – Demolition
- .2 Section 02 42 00 – Removal and Salvage of Construction Materials

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 B456-17, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - .3 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A666-15, Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .5 ASTM A924/A924M-17a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .3 CSA International
 - .1 CSA B651-12(R2017), Accessible Design for the Built Environment.

1.3 COORDINATION

- .1 Coordinate with Toilet and Bath Accessories to be removed and reinstalled as indicated in Section 02 42 00.

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 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 Samples:
 - .1 Submit 1 sample for each accessory specified.

- .2 Samples will be returned for inclusion into work.

1.5 CLOSEOUT SUBMITTALS

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

1.6 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.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect 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 A666, 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, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.
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2.2 COMPONENTS

- .1 Grab Bars: Heavy duty, 1.3 mm thick, 32 mm Ø satin finished type 304 stainless steel tube having nominal 1.3 mm wall thickness, welded to 4.8 mm thick mounting plates, anchored using vandal resistant set screws, having 4.8 mm thick plate to fill space between bar and wall to provide anti-ligature design, lengths as shown on Drawings.
- .2 Security Mirrors: 50 mm frame constructed from 2 mm thick steel sheet with satin chrome finish mounted to 1 mm thick 20 stainless steel sheet, polished to mirror finish, fastened to wall with tamper proof security screws and anchors, sizes as shown on Drawings.
- .3 Soap holder: surface mounted, 5 mm thick stainless steel dished tray, self draining, flush, tamperproof screws.
- .4 Curtain Rods: Straight bar curtain shower rod, concealed mounting, security type with welded plate to fill space between rod and ceiling, designed to release curtain under load greater than wet curtain, 32 mm diameter type 304 stainless steel tubing, 0.912 mm thick, include manufacturer's standard mounting hardware and hook and loop fastened vinyl curtain.

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 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to ASTM A123/A123M.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 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.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

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 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.
 - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
 - .4 Toilet and shower compartments: use male to female through bolts.
- .2 Install grab bars on built-in anchors provided by bar manufacturer to NBC and CSA B651.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 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. Exact locations determined by Departmental Representative.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 06 40 00 – Architectural Woodwork: Coordination with custom made cabinets receiving residential appliances.
- .2 Section 09 21 16 – Gypsum Board Assemblies: Coordination with built-in appliances and adjacent partition construction.
- .3 Division 22 – Plumbing: Coordination of pipes and pipe fittings and other materials.
- .4 Division 26 – Electrical: Coordination conduit, wiring and other materials.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Construction Meetings: Arrange a pre-construction meeting in accordance with Section 01 31 19 and as follows:
 - .1 Purpose of meeting will be to discuss coordination issues including, but not limited to: power, water and waste utility requirements; coordination with build-in dimensions and shipping and delivery schedules.
 - .2 Attendees shall include, but not be limited to, the Contractor, Subcontractor responsible for supply and installation of appliances, other Subcontractors responsible for utilities and adjacent built-in construction, and the Departmental Representative.
 - .3 Conduct pre-construction meeting in sufficient time to allow coordination Subcontractors to incorporate appliance dimensions and utility requirements into their portions of the Work.

1.3 SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Product Data: Submit product data for each appliance indicated including operating characteristics, dimensions of individual appliances, and finishes for each appliance.
 - .2 Submit appliance schedule using same designations indicated on Drawings for all appliances used on the project listing manufacturer's name and product number, and location within Project.

1.4 QUALITY ASSURANCE

- .1 Use installers having workers trained and approved by manufacturer for installation and maintenance of appliances required for this Project.
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- .2 Provide residential appliances labelled in accordance with requirements of CSA, ULC, CGA and other standards acceptable to the Authorities Having Jurisdiction.
- .3 Provide residential appliances that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information qualifying for labelling under the Energy Star Program.

1.5 PROJECT CLOSEOUT SUBMISSIONS

- .1 Operation and Maintenance Data: Submit manufacturer's written instructions for operations and maintenance procedures, include name of original installer and contact information in accordance with Section 01 78 00.

Part 2 Products

2.1 COOKING APPLIANCES

- .1 Exhaust Hood:
 - .1 Type: 915 mm wide, under cabinet, vented, vertical discharge range hood.
 - .2 Exhaust Fan: Two speed fan, 85 L/s, built in to hood.
 - .3 Fan Control: Hood-mounted, fan switch, with separate hood light control switch.
 - .4 Duct Type: 178 mm diameter round.
 - .5 Finish: Baked enamel; Colour: White
 - .6 Accessories:
 - .1 Permanent, washable aluminum mesh filters
 - .2 Built-in incandescent lighting

Part 3 Execution

3.1 EXAMINATION

- .1 Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- .2 Examine rough-in for venting and electrical systems to verify actual locations of venting and electrical connections before equipment installation.
- .3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's written instructions.
 - .2 Securely anchor built-in units to supporting cabinets with concealed fasteners; verify that clearances are adequate for proper functioning and rough openings are completely concealed.
 - .3 Place free-standing units in final locations after finishes have been completed in each area; verify that clearances are adequate to properly operate equipment.
-

3.3 CLEANING AND PROTECTION

- .1 Test each residential appliance specified in this Section to verify proper operation; make necessary adjustments.
- .2 Verify that accessories required have been supplied and installed.
- .3 Remove packing material from residential appliances and leave units in clean condition, ready for operation.

3.4 DEMONSTRATION

- .1 Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 It is the responsibility of the Constructor to make requirements for affected related specification sections, and any requirements for alternates and sub situations available to Subcontractors:
 - .1 Subcontractors to receive a complete set of Documents for preparation of their Bids, and to provide a clear understanding of the complete scope-of-work for the Project.
 - .2 Failure to provide required information to Subcontractors during the bid and Construction Phases of the Work will not relieve the Constructor of their responsibility for coordination of the affected Work.
 - .3 Constructor is responsible for any additional costs to the Contractor arising from Subcontractors not receiving a complete package of Documents.
 - .4 Provide complete coordination between Mechanical Divisions to attain a complete and functional building system; Mechanical Divisions include, but are not limited to, the following:
 - .1 Division 21 – Mechanical Common Requirements
 - .2 Division 21 – Fire Suppression
 - .3 Division 22 – Plumbing
 - .4 Division 23 – Heating, Ventilation, and Air Conditioning
 - .5 Division 25 – Integrated Automation
 - .5 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances:
 - .1 Comply with the National Building Code
 - .6 Include costs to obtain permits and to pay for fees and charges, including inspection charges, by Authorities Having Jurisdiction that issue permits; coordinate related inspections; permits, fees, and inspections include, but are not limited to the following:
 - .1 Plumbing
 - .2 HVAC
 - .3 Sprinklers and Fire Protection
 - .7 Documents for the Project, including Specifications and Drawings, are generally diagrammatic and approximately to scale unless specifically detailed otherwise; the establish scope, material, and installation quality, and are not considered as detailed installation instructions.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Cooperate and coordinate with other trades and verify order of installation of overlapping or interconnecting services or equipment before starting Work:
 - .1 Drawings and Specifications: Drawings and specifications are complementary to each other; and what is called for by one is binding as if called for by both and as follows:
 - .1 Examine Contract Documents including drawings and specifications, and work of other trades before starting Work and verify that Work can be satisfactorily completed without changes to the building.
 - .2 Departmental Representative will provide a clarification to identified discrepancies between drawings and specifications that leave the Contractor in doubt as to the true intent and meaning of the documents as follows:
 - .1 During Bid Period: A written Addendum will be issued to address a written request for clarification
 - .2 During Construction: A Construction Communication will be issued to address a written request for information
 - .3 Departmental Representative will respond to Requests for Interpretation and determine the requirements for clarification based only on variances contained in the documents as follows:
 - .1 Clarification based on information and not contained in the documents or in manufacturers written literature will be regarded as a change to the Work
 - .2 Clarification will include effects or influence of other specified products, adjacent construction, adjacent finishes, and methods of construction.
 - .3 Clarification issued during Construction Phase that affects the cost of the Work will be regarded as a Change to the Work.
 - .4 Coordinate installation of the Work with manufacturer's recommended installation details and procedures, supplemented by requirements of Contract Documents; provide adequate access space for maintenance and service of equipment and systems.
 - .5 Coordinate location of access to cleanouts, valves, equipment, and duct access doors above continuous ceilings; coordinate access panel and door requirements with Section 08 31 00.
 - .6 Coordinate installation of Work with adjacent work by others in accordance with requirements listed in Section 01 73 00 and as follows:
 - .1 Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space; remove and replace improperly installed equipment as determined by Departmental Representative

- .2 Refer to electrical, mechanical, structural and architectural drawings when setting out work and coordinate with other applicable components of the Work when setting out locations for ductwork, equipment, and piping so that conflicts are avoided and symmetrical even spacing is maintained.
- .3 Provide coordination drawings showing the work of other trades and contractors involved in areas of potential conflict or congestion at no additional cost to the Contract.
- .4 Coordinate dimensional details with applicable architectural and structural drawings.
- .5 Full size and detailed drawings will take precedence over scale measurements from drawings when laying out the Work.
- .6 Coordinate requirements of, and connect to, equipment specified in other Sections, and to equipment supplied and installed by other contractors or by Departmental Representative; uncrate equipment, assemble, move in place, and install complete, start-up and test; refer to Division 01 equipment furnished by other Divisions.
- .7 Declarations: Coordinate declaration of Substantial Performance and Total Performance with requirements of the Supplementary Conditions of Contract and with Section 01 77 00.

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 mechanical equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
 - .1 Where stated in respective specification sections, submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .4 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

- .5 Identify materials and equipment submittals by listing manufacturer, trade name, and model number, and as follows:
 - .1 Detailed drawings of bases, supports, operating weight 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.
 - .6 Include copies of applicable brochure or catalogue material.
 - .7 Do not assume that applicable catalogues are available in Department Representative's office.
 - .8 Maintenance and operating manuals will not be considered as suitable submittal material.
 - .9 Leave space on shop drawing to accommodate Departmental Representative review stamp.
 - .10 Clearly mark each shop drawing with identical name or number where equipment is identified by name or number on drawings or in specifications.
 - .11 Clearly identify dimensional and technical data sufficient to verify that equipment meets specified requirements.
 - .12 Clearly identify wiring, piping, service connection data and motor sizes.
 - .13 Clearly mark each submittal sheet using arrows, underlining, or circling to indicate differences between specifications and options proposed for use in the Work, such as differences in sizes, types, model numbers, rating, capacities, and similar criteria.
 - .14 Specifically note specified features included as a part of the submittal, such as special tank linings, pump seals, materials or painting.
 - .15 Strike out non-applicable material.
 - .6 Review shop drawings prior to submittal to Departmental Representative certifying that:
 - .1 Site measurements are verified and correct.
 - .2 Site construction criteria, materials, catalogue numbers and similar data are coordinated with shop drawings and requirements of the Work.
 - .3 Certify review of each shop drawing by placing Subcontractor's and Constructor's review stamps, date and signatures of responsible persons.
 - .4 Verify installed materials and equipment meet specified requirements where shop drawings are not provided to Departmental Representative for review.
 - .7 Use of Metric Units and Conversions in Submittals:
 - .1 Units expressed in these documents are written in Systems International (SI) Metric Units; soft metric conversions are used throughout.
 - .2 Submit shop drawings and maintenance manuals in SI Units; use same SI Units for submittals as stated in specification or drawings.
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1.4 RECORD DRAWINGS

- .1 Provide final record (as-built) drawings in digital format (AutoCAD) and Meet the requirements of Section 01 78 00 – Closeout Submittals.
- .2 Suitably store and protect drawings on site and make available at all times for inspection.
 - .1 Site records:
 - .1 Contractor to produce 1 set of reproducible mechanical drawings and create a sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
 - .5 Drawings to show inverts of underground piping at building entry/exit and below floor slab at each branch, riser base, change in direction as well as at least three points on straight runs.
 - .6 Show locations of access doors and panels and identify the equipment and components that they serve.

1.5 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 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .5 Submit copies of as-built drawings for inclusion in final TAB report.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data of mechanical equipment for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 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.
- .3 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.
- .4 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.
- .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 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .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 reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Furnish spare parts 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. Upon handover, contractor to replace all filters utilized during start-up and construction in all air handling equipment.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.8 WARRANTY

- .1 Provide a written warranty stating that Work executed in this Contract will be free from defective workmanship and materials for a period of one (1) year starting from the date of substantial performance of work in accordance with the requirements specified in Section 01 78 00.
- .2 Warranty makes provision for repair or replacement of any Work that fails or becomes defective during the term of the warranty, providing the operating and maintenance instructions have been complied with by the Departmental Representative.
- .3 Duration of the warranty specified does not, in any way, supplant any other guaranties or warranties provided under the Contract for individual pieces of equipment or systems having a longer period provided by Manufacturers or as called for in the project documents.
- .4 Unless specified otherwise, Departmental Representative will be responsible for routine maintenance requirements as required in the manufacturer's instructions, and will be responsible for supplying filters, grease and belts and other consumables required for routine maintenance.

1.9 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, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .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 FACTORY APPLIED FINISH PAINTING

- .1 Apply prime and final paint coats to equipment and materials supplied as part of this division.
- .2 Use heat resistant paint where conditions require.
- .3 Protect factory finished equipment during construction, and clean at completion of work.
- .4 Field Painting:
 - .1 After equipment has been installed and piping and insulation is completed, clean rust and oil from exposed iron and steel work provided under this Division, whether or not it has been factory prime painted.
 - .2 Touch up any damage to prime and final coat resulting from shipping or installation.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Examination of Existing Conditions
 - .1 Visit and examine the site and note characteristics and features affecting the Work before submitting Bid.
 - .2 Report discrepancies in writing to Departmental Representative prior to Bid closing.
 - .3 No allowances will be made for difficulties encountered or expenses incurred arising from conditions of the site or existing items that are readily visible or known to exist at the time of Bid.
 - .4 Unforeseen conditions or discrepancies that could not be readily ascertained at the time of Bid will be administered as a change to the Contract.

3.2 CUTTING AND PATCHING

- .1 Coordinate requirements of the Work with other Divisions.
-

- .2 Coordinate locations of mechanical penetrations and sleeves through concrete floor structure including slabs, beams, purlins and girders; coordinate sleeving locations with other trades and conditions noted on site.
 - .1 Contractor will prepare coordination drawings for each floor level of the building indicating requirements of all trades penetrating concrete floor construction.
 - .2 Contractor to obtain sign-off from affected mechanical subtrades having penetrations and sleeves before submitting shop drawings to Departmental Representative for review
- .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .5 Provide inserts, holes and sleeves, cutting and fitting required for mechanical work; relocate improperly located holes and sleeves.
- .6 Provide inserts or drill for expansion bolts, hanger rods, brackets, and supports.
- .7 Obtain written approval from Departmental Representative before drilling, coring, cutting or burning structural members; verify that post tensioned or pre-stressed strands are located accurately and avoid cutting or damaging these elements with an adequate margin of safety.
- .8 The Contractor is responsible to patch and make good building where damaged from equipment installation, improperly located holes and similar criteria.

3.3 EXCAVATION AND BACKFILL

- .1 Confirm service invert elevations and locations prior to starting work, set grades to suit inverts.
- .2 Grade the bottom of trench excavations as required.
- .3 In firm, undisturbed soil, lay pipes directly on the soil.
- .4 In rock and shale, excavate to 6" (150 mm) below and a minimum of 8" (200 mm) to either side of the pipe, and backfill to the required invert with granular "A" material compacted to minimum 95% Standard Proctor Density.
- .5 Prepare new bedding under pipe in unstable soil, in fill, and in all cases where pipe bedding has been removed in earlier excavation, particularly near perimeter walls and at manholes and catch basins. Compact to maximum possible density and support the pipe by 8" (200 mm) thick reinforced concrete cradles spanning full length between firm supports. Install reinforcing steel in the cradles or construct piers every 7.87' (2.4 m) or closer, down to solid load bearing strata. Provide a minimum of one (1) pier per length of pipe. Use the same method where pipes cross.
- .6 Where excavation is necessary in proximity to and below the level of any footing, backfill with 2,000 psi (13,800 kPa) concrete to the level of the highest adjacent footing. Proximity is determined by the angle of repose as established by the Departmental Representative.

- .7 Provide support over at least the bottom one-third (1/3) segment of the pipe in all bedding methods. Shape the excavation to fit pipe hubs, couplings and similar items and ensure even bearing along the barrels.
- .8 Keep walls of trenches straight to at least 18" (450 mm) within the pipe design limits. Have excavations inspected at least once a week by authorities. Break-up rocks and boulders and remove these by drilling and wedging. Do not use blasting unless specifically approved by the Departmental Representative.
- .9 Before backfilling, test work for leakage and arrange for the work to be inspected by the Departmental Representative. Remove all shoring during backfilling.
- .10 Backfill trenches within the building with clean sharp sand in individual layers of maximum 6" (150 mm) thickness compacted to a density of 100% Standard Proctor. Hand compact the first layers up to a compacted level of minimum 12" (300 mm) above the top of the pipe. Hand or machine compact the balance up to grade.
- .11 Do not use water for consolidation or during compaction of backfill.
- .12 Fill all depressions to correct grade level with appropriate material, after an adequate period has passed to reveal any settlement. Use maximum possible compaction. Pay all costs required to make good all damage caused by settlement.
- .13 Dispose of surplus excavated materials.
- .14 Do pumping as required to keep excavations free of water.
- .15 Engage the services of an independent Soils Testing Agency to test the final backfill compaction density of each backfilled location. Ensure backfill is compacted to the satisfaction of the Testing Agency and in accordance with the Specification. Prior to applying for a Certificate of Substantial Completion of the Work, submit copy of Testing Agency's report to the Departmental Representative for review. Include a copy of the report in each operating and maintenance instruction manual.

3.4 USE OF PERMANENT SYSTEMS FOR TEMPORARY HEAT

- .1 Coordinate requirements for use of permanent heating systems for temporary heat in accordance with Section 01 51 00; do not use permanent system for temporary heating purposes without written permission from Departmental Representative; protect and restore permanent systems as specified in Section 01 51 00.
- .2 Provide a proposed temporary heat agreement for Departmental Representative to review prior to use of permanent building systems for temporary heat; agreement includes payment schedules for utilities, spare parts listings, and confirmation of warranty.
- .3 The terms of warranty are not modified by the use of permanent systems for temporary heat; equipment manufacturers certify that equipment is in "new" condition at start of warranty period, and as follows:
 - .1 Block-off system components not required for temporary heat in accordance with manufacturer's requirement to maintain warranty.
 - .2 Thoroughly clean and overhaul permanent equipment used during construction period, replace worn or damaged parts before final inspection.
 - .3 Operate heating systems under conditions that allow no temporary or permanent damage.

- .4 Operate with proper safety devices and controls installed and fully operational.
- .5 Operate systems only with treated water as specified.
- .6 Air systems may not be used for temporary heating.
- .7 Provide alarm indicating system failure; connect alarm to independent alarm company system.
- .8 Replace mechanical seals, regardless of condition, with new mechanical seals where pumps are used for temporary heating prior to Total Performance of the Work.
- .9 Avoid thermal shock to heating system during planning, construction and operation of temporary heating system.
- .4 Review temporary heating procedures with Departmental Representative as follows:
 - .1 Obtain acceptance by Departmental Representative for thermal insulation work and automatic control equipment associated with use of permanent heating system for temporary heat.
 - .2 Obtain approval from Departmental Representative and authority having jurisdiction before use of permanent heating system for temporary heat.

3.5 EXISTING SERVICES

- .1 Maintain liaison with Departmental Representative to interrupt, re-route, or connect to water, sewer, heating, or gas systems, with minimum interruption of services.
- .2 Do not shut down or make connections to any existing service without written permission from the Departmental Representative.
- .3 Confirm elevations and locations of existing services prior to and during excavation.
- .4 Route pipes, ducts, conduits and other services to avoid interference with existing installation.
- .5 Cut back and cap existing services not being used, so that finished Work presents a neat and clean appearance.
- .6 Contractor shall be responsible for any damage to existing systems, including insulation and coverings, when making connections.
- .7 Existing facility to be in operation throughout the duration of Construction, with minimum length of system shut-down periods.
- .8 Include overtime work for tie-in piping, ductwork, or wiring at night or on weekends.
- .9 Provide Departmental Representative with as-built drawings of site services in accordance with Section 01 78 00; dimensioned to grid lines, building exterior walls or other permanent building component.

3.6 EQUIPMENT PROTECTION AND CLEAN-UP

- .1 Protect equipment and materials in storage on site during and after installation until final acceptance; leave factory covers in place; take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
 - .2 Protect equipment with polyethylene covers and crates.
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- .3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.
- .4 Clean piping, ducts and equipment of dirt, cuttings and other foreign substances in accordance with Section 01 74 11.
- .5 Protect bearings and shafts during installation: Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .6 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling unit.

3.7 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.8 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.

3.9 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
 - .2 Trial usage to apply to following equipment and systems:
 - .1 Plumbing fixtures
 - .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
 - .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
 - .5 Instruction duration time requirements as specified in appropriate sections.
 - .6 Contractor will record these demonstrations on video tape for future reference.
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3.10 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 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 equipment specified in Division 21 and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Delegated Design:
 - .1 Submit hydraulic load calculations and design plans, stamped and signed by Licensed Professional Engineer, for review before commencement of work.
- .4 Shop Drawings:
 - .1 Submit sprinkler, standpipe, and fire protection systems shop drawings and calculations in accordance with applicable standards and requirements of the Authorities Having Jurisdiction, and as follows:
 - .1 Stamp shop drawings and calculations with seal of delegated design professional engineer.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Shop drawings and product data accompanied by:
 - .1 Detailed hydraulic calculations and pipe routing and sizes
 - .2 Sprinkler head types
 - .3 Certification of compliance to applicable codes.
 - .4 In addition to transmittal letter referred to in Section 01 33 00. Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for sprinkler heads and fire hose cabinet for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 Operation data to include:
 - .1 Include specific make and model of check valves, detector check valves, alarm valves, dry pipe valve and deluge valve assemblies, water flow and tamper switches, backflow preventers, and other trim provided to the project.
 - .2 Include serial numbers and ordering information.
 - .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.
- .4 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .5 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.
- .7 Certifications: Provide proof of the following during the course of the Work:
 - .1 Compliance Certification: Provide certificates from manufacturer indicating tested performance requirements required by Authorities Having Jurisdiction.
- .8 Submit letter stating all sprinkler system installation is completed in compliance to NFPA 13, stamped and signed by a Licensed Professional Engineer.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
 - .2 Furnish spare parts as follows:
 - .1 Include extra sprinkler heads of each sprinkler head type.
 - .2 Include a wrench suitable for each sprinkler head type.
 - .3 Provide six (6) extra sprinkler heads for systems having less than 300 sprinkler heads of each type.
 - .3 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00.
-

- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

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, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect fire suppression equipment 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 Refer to related sections

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that site conditions of are acceptable for installation of fire suppression systems in accordance with manufacturer's written instructions.
 - .1 Visually inspect site conditions where fire suppression systems are to be installed.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.3 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.

3.4 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative will record these demonstrations on video tape for future reference.

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 National Fire Prevention Association (NFPA)
 - .1 NFPA 13-2016, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 25-2017, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN/ULC-S543-09, Standard for Internal Lug Quick Connect Coupling for Fire Hose.
 - .2 CAN/ULC-S543-09-AM1, Amendment 1 to Standard for Internal Lug Quick Connect Coupling for Fire Hose.

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 Delegated Design:
 - .1 Submit hydraulic load calculations and design plans, stamped and signed by Licensed Professional Engineer, for review before commencement of work.
 - .4 Shop Drawings:
 - .1 Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Temperature Rating.
 - .4 Assembly details.
 - .5 Accessories.
 - .5 Samples:
 - .1 Submit samples of following:
 - .1 Each type of sprinkler head.
 - .2 Graphic sample of signs.
 - .6 Test reports:
 - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .7 Certificates:
-

- .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .8 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.
- .9 Field Quality Control Submittals:
 - .1 Manufacturer's Field Reports: manufacturer's field reports specified.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00.
- .2 Manufacturer's Catalog Data, including specific model, type, and size for:
 - .1 Pipe and fittings.
 - .2 Sprinkler heads.
 - .3 Mechanical couplings.
- .3 Drawings:
 - .1 Sprinkler heads and piping system layout.
 - .1 Prepare 760 mm by 1050 mm detailed working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
 - .2 Show data essential for proper installation of each system.
 - .3 Show details, plan view, elevations, and sections of systems supply and piping.
- .4 Field Test Reports:
 - .1 Preliminary tests on piping system.
- .5 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
 - .2 Submit 760 mm by 1050 mm drawings with title block similar to full size contract drawings.
 - .3 Submit as-built drawings in AutoCAD format for recording keeping at completion of project
- .6 Operation and Maintenance Manuals:
 - .1 Provide Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

1.4 QUALITY ASSURANCE

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00.
 - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Storage and Protection:
 - .1 Store materials indoors in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

- .1 Locate sprinkler heads in coordination with existing mechanical and electrical elements, including piping, fittings, valves, hangers, unit heaters, and associated accessories. Avoid interference with lights.
- .2 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .3 Location of Sprinkler Heads:
 - .1 Locate heads in relation to existing obstructions and mechanical system components permitted by NFPA 13 for ordinary hazard occupancy.
- .4 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinkler heads will open.

2.2 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: to NFPA 13.
 - .2 Copper tube: to NFPA 13.
- .2 Fittings and joints to NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
 - .2 Provide threaded fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .3 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
 - .4 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .5 Fittings: ULC approved for use in wet pipe sprinkler systems.
 - .6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .7 Side outlet tees using rubber gasketed fittings are not permitted.
 - .8 Sprinkler pipe and fittings: metal.
- .3 Pipe hangers:
 - .1 ULC listed for fire protection services in accordance with NFPA.

2.3 SPRINKLER HEADS

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type:
 - .1 Type A: upright bronze
- .3 Provide nominal 1.2 cm orifice sprinkler heads.
 - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
 - .2 Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings.
 - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
 - .4 Provide sprinkler heads as indicated on drawings.
 - .5 Deflector: not more than 75 mm below suspended ceilings.
 - .6 Ceiling plates: not more than 25 mm deep.
 - .7 Ceiling cups: not permitted.

2.4 PIPE SLEEVES

- .1 Provide pipe sleeves where piping passes through walls.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls.
- .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
 - .1 Firmly pack space with mineral wool insulation.
 - .2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass.
 - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide hot-dip galvanized steel.
 - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

2.5 ESCUTCHEON PLATES

- .1 Provide split hinge type metal plates for piping passing through walls in exposed spaces.
- .2 Provide polished stainless steel plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

2.6 SIGNS

- .1 Attach properly lettered and approved metal signs to each valve and alarm device to NFPA 13.

2.7 SPARE PARTS CABINET

- .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.
- .2 Install Type A heads in exposed spaces.

3.3 PIPE INSTALLATION

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.

3.4 DISINFECTION

- .1 Disinfect new piping and existing piping.
- .2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.
- .3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.
- .4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.5 FIELD QUALITY CONTROL

- .1 Site Test, Inspection:
 - .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
 - .2 Test, inspect, and approve piping before covering or concealing.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

1.2 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 equipment listed in Divisions 21 through 25, 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 drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .4 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for equipment for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .2 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.
 - .3 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.
 - .4 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.
 - .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 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
 - .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 reproducible as-built drawings with Operating and Maintenance Manuals.
-

- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Furnish spare parts as follows:
 - .1 Shower automatic valve
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

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, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect equipment 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 NOT USED

- .1 Not used.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Examination of Existing Conditions
 - .1 Visit and examine the site and note characteristics and features affecting the Work before submitting Bid.
 - .2 Report discrepancies in writing to Departmental Representative prior to Bid closing.
 - .3 No allowances will be made for difficulties encountered or expenses incurred arising from conditions of the site or existing items that are readily visible or known to exist at the time of Bid.

- .4 Unforeseen conditions or discrepancies that could not be readily ascertained at the time of Bid will be administered as a change to the Contract.

3.2 CUTTING AND PATCHING

- .1 Coordinate requirements of the Work with Section 01 73 29 – Cutting and Patching.
- .2 Coordinate locations of mechanical penetrations and sleeves through concrete floor structure including slabs, beams, purlins and girders; coordinate sleeving locations with other Divisions
 - .1 Contractor will prepare coordination drawings for each floor level of the building indicating requirements of all trades penetrating concrete floor construction.
 - .2 Contractor to obtain sign-off from affected mechanical subtrades having penetrations and sleeves before submitting shop drawings to Departmental Representative for review
- .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .5 Provide inserts, holes and sleeves, cutting and fitting required for mechanical work; relocate improperly located holes and sleeves.
- .6 Provide inserts or drill for expansion bolts, hanger rods, brackets, and supports.
- .7 Obtain written approval from Departmental Representative before drilling, coring, cutting or burning structural members; verify that post tensioned or pre-stressed strands are located accurately and avoid cutting or damaging these elements with an adequate margin of safety.
- .8 The Contractor is responsible to patch and make good building where damaged from equipment installation, improperly located holes and similar criteria.

3.3 EXCAVATION AND BACKFILL

- .1 Refer to other Divisions for requirements affecting this Work.
- .2 Confirm service invert elevations and locations prior to starting work, set grades to suit inverts.
- .3 Provide excavating to facilitate installation of mechanical work, including shoring, pumping, placement of 150 mm compacted sand bedding under and first 300 mm of compacted sand over piping and ducting

3.4 EXISTING SERVICES

- .1 Maintain liaison with Departmental Representative to interrupt, re-route, or connect to water, sewer, heating, or gas systems, with minimum interruption of services.
 - .2 Do not shut down or make connections to any existing service without written permission from the Departmental Representative.
 - .3 Confirm elevations and locations of existing services prior to and during excavation.
-

- .4 Route pipes, ducts, conduits and other services to avoid interference with existing installation.
- .5 Cut back and cap existing services not being used, so that finished Work presents a neat and clean appearance.
- .6 Contractor shall be responsible for any damage to existing systems, including insulation and coverings, when making connections.
- .7 Existing facility to be in operation throughout the duration of Construction, with minimum length of system shut-down periods.
- .8 Include overtime work for tie-in piping, ductwork, or wiring at night or on weekends.
- .9 Provide Departmental Representative with as-built drawings of site services in accordance with Section 01 78 00; dimensioned to grid lines, building exterior walls or other permanent building component.

3.5 EQUIPMENT PROTECTION AND CLEAN-UP

- .1 Protect equipment and materials in storage on site during and after installation until final acceptance; leave factory covers in place; take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- .2 Protect equipment with polyethylene covers and crates.
- .3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.
- .4 Clean piping, ducts and equipment of dirt, cuttings and other foreign substances in accordance with Section 01 74 11.
- .5 Protect bearings and shafts during installation: Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.
- .6 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling unit.

3.6 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.7 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers.

3.8 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.

3.9 DEMONSTRATION

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Domestic water systems.
 - .2 Plumbing Fixtures
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Contractor will record these demonstrations on video tape for future reference.

3.10 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 REFERENCES

- .1 American Society of Mechanical Engineers International (ASME).
 - .1 ASME B16.24-2016, Cast Copper Alloy Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.15-2013, Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
 - .3 ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .4 ASME B16.22-2013, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- .2 ASTM International Inc. (ASTM)
 - .1 ASTM A307-14E1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .2 ASTM B88M-16, 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 Piping 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 Material Safety Data Sheets (MSDS).
- .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-71-2011, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
 - .1 NRCC 47668, National Plumbing Code of Canada (NPC) - 2015.
- .9 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for 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.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management:
 - .1 Separate and recycle waste materials in accordance with Section 01 74 20.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, 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 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ASME B16.15.
- .3 Cast copper, solder type: to ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ASME B16.22.
- .5 NPS 2 and larger: roll grooved to CSA B242.

2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
 - .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
 - .3 Solder: lead free.
 - .4 Teflon tape: for threaded joints.
 - .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.
 - .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.
-

2.4 VALVES

- .1 Refer to section 23 05 23.01 for details.

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.
- .2 Install pipe work in accordance with Section 23 05 01, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ASME standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves.

3.4 PRESSURE TESTS

- .1 Conform to requirements of Section 22 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 h. Let stand for 24 h, 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 h, 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 requirements of authority having jurisdiction.
- .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 domestic hot water storage tank up to design temperature slowly.
 - .4 Monitor 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 TAB in accordance with Section 23 05 93.
 - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .4 Sterilize piping systems for Legionella control.
 - .5 Verify performance of temperature controls.
 - .6 Verify compliance with safety and health requirements.
 - .7 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .8 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
-

.3 Reports:

- .1 In accordance with Section 01 91 13: Reports, using report forms as specified in Section 01 91 13: Report Forms and Schematics.

3.10 OPERATION REQUIREMENTS

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 01.

3.11 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 22 11 16: Domestic Water Piping

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 B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .2 CSA B125.3-12(R2016), Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-2013, Commercial Adhesives.
- .4 National Plumbing 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.

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 Packaging Waste Management: remove for reuse and return packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary, storm, and vent: Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CSA B125.3.

- .2 Wrought copper: to CSA B125.3.
- .2 Solder: lead free, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary, storm, and vent minimum NPS 3, to: CSA B70.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to CSA B70. ASTM C564 or
 - .2 Stainless steel clamps.
 - .2 Hub and spigot:
 - .1 Cold caulking compounds.
- .2 Above ground sanitary, storm and vent: to CSA B70.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 In accordance with Section 22 05 00.
- .2 Install in accordance with National 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 that cleanout rods can probe as far as the next cleanout, at least.
 - .2 Test to ensure traps are fully and permanently primed.
-

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

3.5 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 The supply and installation of Plumbing Fixtures and Trim.
- .2 Products Installed but not Supplied Under this Section:
 - .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
 - .2 Equipment installed by others.
 - .1 Connect with unions.
 - .3 Equipment not installed.
 - .1 Capped for future connection by others.
- .3 Related Sections:
 - .1 Section 01 35 29

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-B45 Series-02(R2013), Plumbing Fixtures.
 - .2 CSA B125.3-12, Plumbing Fittings.
 - .3 CSA-B651-12(R2017), Accessible Design for the Built Environment.
- .2 American Society for Mechanical Engineers (ASME)/Canadian Standards Association(CSA International).
 - .1 ASME A112.18.1-2011/CSA B125.1-11, Plumbing Supply Fittings.
 - .2 ASME A112.18.2-2015/CSA B125.2-15, Plumbing Waste Fittings.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
 - .1 Indicate, for all fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.
 - .2 Size of water and waste connections.
 - .2 Closeout Submittals:
 - .1 Submit 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.
-

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY STORAGE AND DISPOSAL

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .3 Fold up metal and plastic banding, flatten and place in designated area for recycling.

Part 2 PRODUCTS

2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CSA-B125 and ASME A112.18.1 and ASME A112.18.2.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.
- .7 Refer to mechanical drawings for fixture specifications.
- .8 Fixture piping:
 - .1 Hot and cold water supplies to each fixture:
 - .1 Chrome plated flexible supply pipes each with handwheel stop, reducers, escutcheon.
 - .2 Waste:
 - .1 Brass P trap with clean out on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.
- .9 Accessibility Standards: Provide plumbing fixtures that meet requirements of CAN/CSA B651 and that provide barrier free access to plumbing fixtures for people with disabilities.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

3.2 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.
- .4 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.3 TESTING

- .1 Verification correct operation of fixtures in accordance with the requirements of Sections 01 91 13.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 22 05 00: Common Work Results for Plumbing.
- .2 Section 22 11 16: Domestic Water Piping
- .3 Section 22 13 17: Drainage Waste and Vent Piping – Cast Iron and Copper
- .4 Section 22 13 18: Drainage Waste and Vent Piping – Plastic

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 plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29. Indicate VOC's.
- .3 Shop Drawings:
 - .1 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details and accessories.
- .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 Manufacturers' Field Reports: manufacturers' field reports specified.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
 - .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 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 plumbing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 WATER HAMMER ARRESTORS

- .1 Copper construction, piston type.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that site conditions are acceptable for plumbing specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect site conditions in area where equipment is to be installed.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 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.

3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
 - .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
 - .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.
-

3.5 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures and where indicated.

3.6 START-UP

- .1 General:
 - .1 In accordance with Section 01 91 13: General Requirements, supplemented as specified herein.
- .2 Timing: start-up only 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.
- .3 Provide continuous supervision during start-up.

3.7 TESTING AND ADJUSTING

- .1 General:
 - .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13: General Requirements, supplemented as specified.
- .2 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
 - .1 Pressure at fixtures: +/- 70 kPa.
 - .2 Flow rate at fixtures: +/- 20%.
- .4 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .5 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.

3.8 CLOSEOUT ACTIVITIES

- .1 Commissioning Reports: in accordance with Section 01 91 13: reports, supplemented as specified.
 - .2 Training: provide training in accordance with Section 01 91 13: Training of O&M Personnel, supplemented as specified.
-

3.9 CLEANING

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

3.10 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.

1.2 USE OF SYSTEMS

- .1 Use of new and existing permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions:
 - .1 Active portion of system is complete, pressure tested, cleaned, flushed out.
 - .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
 - .3 Areas of the building under construction have been closed in, and areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
 - .4 There is no possibility of damage from any cause.
 - .5 Supply ventilation systems are protected by 60% filters, which shall be inspected daily, changed every week, or more frequently as required.
 - .6 Return systems have approved filters over all openings, inlets, outlets.
 - .7 All systems will be:
 - .1 operated as per manufacturer's recommendations or instructions.
 - .2 operated by Contractor.
 - .3 monitored continuously by Contractor.
 - .8 Warranties and guarantees are not thereby relaxed.
 - .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative.
 - .10 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.
- .2 Filters referred to herein are over and above those specified elsewhere in this specification.
- .3 Exhaust systems are not included in any approvals for temporary heating ventilation.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
-

- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.4 DRAINS

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

3.5 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.

3.6 PIPEWORK INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
 - .2 Protect openings against entry of foreign material.
 - .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
 - .4 Assemble piping using fittings manufactured to ANSI standards.
 - .5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
 - .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
 - .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
 - .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
 - .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
 - .10 Group piping wherever possible.
 - .11 Ream pipes, remove scale and other foreign material before assembly.
 - .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
 - .13 Provide for thermal expansion as indicated.
-

- .14 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.
 - .7 Install butterfly valves on chilled water and related condenser water systems only.
 - .8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
 - .9 Install ball valves for glycol service.
 - .10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400mm above floor in Mechanical Rooms.
- .15 Check Valves:
 - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
 - .2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

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

3.8 ESCUTCHEONS

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

3.9 PREPARATION FOR FIRE STOPPING

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

3.10 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 02.
- .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.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

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

3.12 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
 - .2 Request written approval 7 days minimum, prior to commencement of work.
-

- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.

3.13 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B40.100-2013, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200-2008(R2013), Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.
- .3 Green Seal Environmental Standards (GS)
 - .1 GS-11-2015, Standard for Paints and Coatings.
 - .2 GS-36-2013, Standard for Commercial Adhesives.

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 thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Shop drawings to indicate:
 - .1 Units of measurement
 - .2 Dimensions
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Test and Evaluation Reports:
 - .1 Submit certified test reports for thermometers and pressure gauges from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

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 thermometers and pressure gauges indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect thermometers and pressure gauges 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 GENERAL

- .1 Design point to be at mid-point of scale or range.
- .2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

- .1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4.
 - .1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

- .1 100 mm diameter mercury-free, liquid filled activated dial type: to CAN/CGSB-14.5, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished stainless steel case for wall mounting.

2.4 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: brass.

2.5 PRESSURE GAUGES

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.
- .2 Provide:
 - .1 Siphon for steam service.
 - .2 Snubber for pulsating operation.
 - .3 Diaphragm assembly for corrosive service.
 - .4 Gasketed pressure relief back with solid front.
 - .5 Bronze stop cock.
 - .6 Oil filled for high vibration applications.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that site conditions are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect area where thermometers and gauges are to be installed.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

- .1 Install thermometers and gauges so they can be easily read from floor or platform.
 - .1 If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

- .1 Install in wells on piping. Include heat conductive material inside well.
- .2 Install in locations as indicated and on inlet and outlet of:
 - .1 Heat exchangers.
 - .2 Water heating and cooling coils.
 - .3 Water boilers.
 - .4 Chillers.
 - .5 DHW tanks.
- .3 Install wells for balancing purposes.
- .4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

- .1 Install in locations as follows:
 - .1 Suction and discharge of pumps.
 - .2 Upstream and downstream of PRV's.
 - .3 Upstream and downstream of control valves.
 - .4 Inlet and outlet of coils.
 - .5 Inlet and outlet of liquid side of heat exchangers.
 - .6 Outlet of boilers.
 - .7 In other locations as indicated.
 - .2 Install gauge cocks for balancing purposes, elsewhere as indicated.
 - .3 Use extensions where pressure gauges are installed through insulation.
-

3.5 NAMEPLATES

- .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01, identifying medium.

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 thermometer and gauge installation.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).
 - .2 ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 ASTM International
 - .1 ASTM A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
 - .2 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .3 ASTM B283/B283M-17a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
 - .4 ASTM B505/B505M-14, Standard Specification for Copper-Base Alloy Continuous Castings.
 - .5 ASTM B21/B21M-06, Standard Specification for Naval Brass Rod, Bar, and Shapes
 - .6 ASTM B98/B98M-08, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes
 - .7 ASTM B139/B139M-07, Standard Specification for Phosphor Bronze Rod, Bar, and Shapes
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS SP-25-2013, Standard Marking System for Valves, Fittings, Flanges and Unions.
 - .2 MSS SP-80-2013, Bronze Gate, Globe, Angle and Check Valves.
 - .3 MSS SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- .4 Canadian Standards Association (CSA)
 - .1 CSA B242-05 (R2016), Groove- and Shoulder- Type Mechanical Pipe Couplings

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
 - .1 Submit data for valves specified in this Section.

1.3 CLOSEOUT SUBMITTALS

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials/Spare Parts:
 - .1 Furnish following spare parts:
 - .1 Valve seats: one for every 10 valves each size, minimum 1.
 - .2 Discs: one for every 10 valves, each size. Minimum 1.
 - .3 Stem packing: one for every 10 valves, each size. Minimum 1.
 - .4 Valve handles: 2 of each size.
 - .5 Gaskets for flanges: one for every 10 flanged joints.
 - .2 Tools:
 - .1 Furnish special tools for maintenance of systems and equipment.
 - .2 Include following:
 - .1 Lubricant gun for expansion joints..

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:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Provide valves in accordance with the valve schedule that forms part of this Section.
 - .2 Use one manufacturer only for all valves of the same type.
 - .3 Equip valves with renewable seats suitable for the service intended and to provide positive shutoff.
 - .4 Provide composition discs on globe and check valves that are suitable for temperature and fluid or gas encountered.
 - .5 Comply with ANSI B16.18 for solder joint ends.
 - .6 Comply with ASME B1.20.1 for threaded ends.
 - .7 Comply with AWWA C606 and CSA B242 for grooved ends.
 - .8 Comply with ANSI/ASME B16.1 for cast iron flanges with face-to-face distance to ANSI/ASME B16.10.
-

- .9 Comply bronze valves to ASTM B62 as noted.
- .10 Threaded Valve Stem Materials: Naval brass to ASTM B21/B21M; copper silicone alloys to ASTM B98/B98M; or phosphor bronze to ASTM B139/B139M.

2.2 VALVE APPLICATION SCHEDULE

PLUMBING (Cold Water (soft and hard), Hot Water and Hot Water Recirculation)							
STYLE		0 - 50 mm	65 - 75 mm	100 - 150 mm	150 - 200 mm	200 - 250 mm	300 - 400 mm
GATE	Connection	--	Screwed	Flanged	Flanged	Flanged	Flanged
	Valve Item Number	--	1.1	1.5	1.5	1.5	1.5
	Function	--	Isolation	Isolation	Isolation	Isolation	Isolation
BUTTERFLY	Connection	--	Grooved	Grooved	Grooved	Grooved	Grooved
	Valve Item Number	--	7.1 / 7.6	7.1 / 7.6	7.1	7.1	7.5
	Function	--	Isolation	Isolation	Isolation	Isolation	Isolation
GLOBE	Connection	--	Screwed	Flanged	Flanged	Flanged	Flanged
	Valve Item Number	--	2.1	2.6	2.6	2.6	2.6
	Function	--	Isolation/Throttling	Isolation/Throttling	Isolation/Throttling	Isolation/Throttling	Isolation/Throttling
CHECK	Connection	--	Screwed/Grooved	Flanged/Grooved	Flanged	Flanged	Flanged
	Valve Number	--	3.3 / 3.7	3.4 / 3.7	3.4	3.4	3.4
	Function	--	Check	Check	Check	Check	Check
SPRING	Connection	--	Wafer/Grooved	Wafer/Grooved	Wafer/Grooved	Wafer/Grooved	Wafer/Grooved
	Valve Item Number	--	4.2 / 4.4	4.2 / 4.4	4.2 / 4.4	4.2 / 4.4	4.2 / 4.4 / 4.5
	Function	--	Check, Sewage & Sump	Check, Sewage & Sump	Check, Sewage & Sump	Check, Sewage & Sump	Check, Sewage & Sump
BALL	Connection	VicPress	Grooved	Grooved	--	--	--
	Valve Item Number	6.8	6.9	6.9	--	--	--
	Function	Isolation	Isolation	Isolation	--	--	--

FIRE (Standpipe and Sprinklers)							
STYLE		0 - 50 mm	65 - 75 mm	100 - 150 mm	150 - 200 mm	200 - 250 mm	300 - 400 mm
BALL	Connection	Screwed/Grooved	--	--	--	--	--
	Valve Item Number	6.7 / 6.10	--	--	--	--	--
	Function	Isolation (UL)	--	--	--	--	--
GLOBE	Connection	Screwed	Flanged	--	--	--	--
	Valve Item Number	2.5	2.6	--	--	--	--
	Function	Isolation/Throttling	Isolation/Throttling	--	--	--	--
CHECK	Connection	Screwed	--	--	--	--	--
	Valve Item Number	3.2	--	--	--	--	--
	Function	Check	--	--	--	--	--
SPRING	Connection	--	Wafer/Grooved	Wafer/Grooved	Wafer/Grooved	Wafer/Grooved	Wafer/Grooved
	Valve Item Number	--	4.3 / 4.6	4.3 / 4.6	4.3 / 4.6	4.3 / 4.6	4.3 / 4.6
	Function	--	Check (UL)	Check (UL)	Check (UL)	Check (UL)	Check (UL)
GATE	Connection	--	Grooved	Grooved	Grooved	Grooved	--

<i>FIRE (Standpipe and Sprinklers)</i>							
STYLE		0 - 50 mm	65 - 75 mm	100 - 150 mm	150 - 200 mm	200 - 250 mm	300 - 400 mm
	Valve Item Number	--	1.9	1.9	1.9	1.9	--
	Function	--	Isolation	Isolation	Isolation	Isolation	--
BUTTER-FLY	Connection	--	Grooved	Grooved	Grooved	Grooved	Grooved
	Valve Item Number	--	7.4	7.4	7.4	7.4	7.4
	Function	--	Isolation	Isolation	Isolation	Isolation	Isolation

2.3 VALVE PRODUCT SCHEDULE

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
1.0 GATE VALVES	1.1	B62 Bronze Construction, Solid Wedge Disc, Union Bonnet	125 Steam 200 WOG	Threaded or Soldered	Handwheel, Rising Stem
	1.2	B62 Bronze Construction, Solid Wedge Disc, Union Bonnet	200 PSI	Solder	Handwheel, Rising Stem
	1.3	Cast Iron, Solid Wedge Disc	1380 CWP	Flanged	Handwheel, Rising Stem
	1.4	Bronze Construction, Solid Wedge Disc, Bolted Bonnet	125 Steam 200 WOG	Flanged	Handwheel, Non-Rising Stem
	1.5	Cast Iron Construction, Bronze Fitted, Solid Wedge Disc, Bolted Bonnet	125 Steam 200 WOG	Flanged	Handwheel, OS & Y
	1.6	All stainless steel gate valve	1035 CWP	Threaded	Handwheel
	1.7	Cast steel construction, Hard Facing Trim, Solid Wedge Disc, Bolted Bonnet. Bypass where specified for service HP steam	Class 150	Flanged	Handwheel, OS & Y
	1.8	Bronze Construction, Union Bonnet, Solid Wedge Disc, Stainless Steel Seat	200 Steam 400 WOG	Screwed	Handwheel, Rising Stem
	1.9	Cast ductile iron construction, EPDM coated disc, brass stem	1725 kPa CWP	Grooved	Handwheel, Rising or Non-Rising stem.
Approved acceptable manufacturers: Crane, Jenkins, Kitz -					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
2.0 GLOBE VALVES	2.1	Bronze Construction, Swivel Type Metal Disc, Screwed Bonnet	125 Steam 200 WOG	Screwed	Handwheel
	2.2	Bronze Construction, Swivel Type Metal Disc, Bonnet	125 Steam 200 WOG	Solder	Handwheel
	2.3	Bronze Construction, Renuable Teflon Disc, Swivel Type Disc Holer, Union Bonnet	125 Steam 200 WOG	Screwed	Handwheel

	2.4	Bronze Construction, Renuable Teflon Disc, Swivel Type Disc Holer, Union Bonnet	125 Steam 200 WOG	Soldered	Handwheel
	2.5	Bronze Construction, 420 S.S. Union Bonnet	2760 CWP	Screwed	Handwheel, Rising Stem
	2.6	Cast Iron Construction, Bronze trimmed, Bolted Bonnet	125 Steam 200 WOG	Flanged	Handwheel, OS & Y
	2.7	Cast steel construction, plug type disc, bolted bonnet, stellite trim	Class 150	Flanged	Handwheel, OS & Y
	2.8	All stainless steel globe valve	1035 CWP	Threaded	Handwheel
	2.9	Union Bonnet, Renewable Teflon Disc, Swivel Type Disc Holder, Screwed Ends	150 Steam 300 WOG	Screwed	Handwheel, Stem Rising
	Approved acceptable manufacturers: Crane, Jenkins, Nibco -				

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTIO N	OPERATOR
3.0 CHECK VALVES	3.1	Bronze Construction Y-Pattern, Regrind seating, Screwed Cap, Integral Disc	125 Steam 200 WOG	Solder	Swing
	3.2	Bronze Construction, T-Pattern Regrind Seating, Screwed Cap	4140 CWP	Threaded	Swing
	3.3	Bronze Construction Y-pattern, Regrind Seating, Screwed Cap, Integral Disc	125 Steam 200 WOG	Threaded	Swing
	3.4	Cast Iron Construction, Bronze Trimmed, Regrindable Disc, Bolted Cover	125 Steam 200 WOG	Flanged	Swing
	3.5	Cast Steel Construction, Stellite Trim	Class 150	Flanged	Swing
	3.6	All stainless steel check valve	1035 CWP	Screwed	Swing
	3.7	Cast ductile iron body, stainless steel trimmed, coupled cover.	2065 kPa CWP	Grooved	Swing
Approved acceptable manufacturers: Crane, Jenkins, Nibco -					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTIO N	OPERATOR
4.0 SPRING LOADED CHECK VALVES	4.1	Ansi B1.20.1, Forced Brass, 316 Stainless Steel Spring, NBR-70SH Rubber Disc	1965 CWP	Screwed	Spring
	4.2	Cast Iron Body to ASTM 48 Class 40, 316 Stainless Steel Disc, Viton Seat	125 Class	Wafer	Spring
	4.3	Cast Iron Body, Viton A seat, UL approved	1725 CWP	Wafer	Inconel X Spring
	4.4	Ductile Iron Body, Stainless Steel Spring and Shaft	2065 CWP	Grooved	Spring
	4.5	Ductile Iron Body, Stainless Steel Dual Disc, Spring, and Shaft, EPDM seat	1585 CWP	AGS Grooved	Spring

	4.6	Ductile Iron Body, Stainless Steel Spring and Shaft, UL approved.	2065 CWP	Grooved	Spring
Approved acceptable manufacturers: Mueller, Nibco, Victaulic -					

VALVE TYPE	ITEM	PRODUCT	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
5.1 PLUG VALVES	5.1	Eccentric, permanently lubricated, C1 body, resilient plug, SS Bearings, Viton/TFE U-ring seal, Isobutene – Isoprene plug facing	1200 CWP	Threaded	Lever c/w memory stop	
	5.2	Eccentric, Permanently Lubricated, C1 body, Resilient Plug, SS Bearings, Viton/TFE U-ring seal, Isobutene – Isoprene plug facing	1200 CWP	Flanged or Grooved	Lever c/w memory stop	
	5.3	Eccentric, Permanently Lubricated, C1 body, Resilient Plug, SS Bearings, Buna packing, Isobutene – Isoprene plug facing	1200 CWP	Flanged or Grooved	Removable Lever c/w memory stop	
	5.4	Eccentric, Permanently Lubricated, C1 body, Resilient Plug, SS Bearings, Buna packing, Isobutene – Isoprene plug facing	1200 CWP	Flanged or Grooved	Geared, Handwheel c/w memory stop	
	5.5	Tapered, Coated plug, C1 Body	1200 CWP	Threaded	Removable Lever	
	5.6	Tapered, Coated plug, C1 Body	1200 CWP	Flanged	Removable Lever	
	5.7	Eccentric, Ductile Iron Body, EPDM Coated Plug, Welded-in Nickel Seat, 316 SS Bearings	1200 CWP	Grooved	Removable Lever or Gear	
Approved acceptable manufacturers: Rockwell, DeZurik, Victaulic -						

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
6.0 BALL VALVES	6.1	Brass Construction, 2-piece construction, Teflon seats, Seals Buna-N O-ring, Blow out Proof stem	150 Steam 600 WOG	Screwed	Lever
	6.2	Brass Construction, 2-piece construction, Teflon seats, Seals Buna-N O-ring, Blow out Proof stem	150 Steam 600 WOG	Screwed	Wing Handles
	6.3	Brass Construction, 2-piece construction, Teflon seats, Seals Buna-N O-ring, Blow out Proof stem	150 Steam 600 WOG	Soldered	Lever
	6.4	Brass Construction, 2-piece construction, Teflon seats, Seals Buna-N O-ring, Blow out XXXX stem	150 Steam 600 WOG	Soldered	Wing Handles c/w Memory Stop

	6.5	ANSI 150 All stainless steel ball valve	1970 CWP Kitz 150 UTRM (Reduced Bore)	Flanged	Worm Gear
	6.6	Forged Brass, 2-piece Construction, Blow Out Proof Stem, Hard chrome Plated Forged Brass Ball, Teflon seats, Buna-N O-ring, CGA Approved	600 GAS	Screwed	Lever
	6.7	Forged Brass, 2-piece Construction, Blow Out Proof Stem, Hard chrome Plated Forged Brass Ball, Teflon seats, Buna-N O-ring, UL Approved	600 GAS	Screwed	Lever
	6.8	Forged Brass, 2-piece Construction, Blow Out Proof Stem, Hard chrome Plated Forged Brass Ball, Teflon seats,	2065 CWP	Vic-Press	Lever
	6.9	Cast Ductile Iron, 2-piece Construction, Blow Out Proof Stem, Hard chrome Plated Steel Ball, TFE seats.	5515 CWP	Grooved	Lever or gear
	6.10	Cast Bronze, 2-piece Construction, Blow Out Proof Stem, Hard Chrome Plated Brass Ball, TFE seats, with Supervisory Switches. UL approved.	2410 CWP	Grooved / Threaded	Handwheel
Approved acceptable manufacturers: Crane, Nibco, Newman Hattersley -					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
7.0 BUTTERFLY VALVES	7.1	Cast Iron Body, EPDM Resilient Seat, Bronze Disc, 416 SS Shaft, Bronze Bushings Ductile iron body, enamel coated body, EPDM pressure responsive seat.	200 2065 CWP	Lug Grooved	10 Position Lever 10 position lever or Gear
	7.2	Cast Iron Body, EPDM Resilient Seat, Bronze Disc, 416 SS Shaft, Bronze Bushings	200	Lug	Infinite Position Lever c/w Memory Stop
	7.3	Cast Iron Body, EPDM Resilient Seat, Bronze Disc, 416 SS Shaft, Bronze Bushings	200	Lug	Gear Wheel c/w Flag Indicator
	7.4	DI Body, Disc, and Shaft, EPDM Disc Coating, UL approved -	2065 CWP	Grooved -	Gear, Wheel, c/w Flag Indicator & Provision for Monitor
	7.5	DI Body, PPS Coated DI Disc, EPDM seal, SS Shaft	2065 CWP	AGS Grooved	Gear

	7.6	Cast Bronze Body, EPDM Coated Disc, Copper-Tube Dimension Ends.	2065 CWP	Grooved	Lever or Gear
	7.7	Grade CF8M Stainless Steel Body and Disc, Elastomer Seal, 316SS Stem.	2065 CWP	Grooved	Lever or Gear
Approved acceptable manufacturers: Jenkins, Keystone, Crane-					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
8.0 RADIATOR VALVES	8.1	Bronze, Heavy Pattern, Composition Disc	200	Union	Handwheel
	8.2	Bronze, Heavy Pattern, Composition Disc	1380 WP @ 121°C	Union	Lockshield c/w Memory Stop
Approved acceptable manufacturers: Red-White/Toyo, Dahl					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
9.0 DRAIN VALVES	9.1	Hard Chrome Plated Ball, Cap and Drain	1380 WP @ 121°C	Screwed X hose	Lever
Approved acceptable manufacturers: Toyo, Kitz					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
10.0 NEEDLE VALVES	10.1	B62 Bronze Construction	2760 CWP	Screwed	Handwheel Rising Stem
Approved acceptable manufacturers: Jenkins, WH Bolton, Crane					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
11.0 RELIEF VALVES	11.1	Bronze Body, Composition Disc	Heating Water to 1100 kPa	Screwed	Pressure
	11.2	Bronze Body, Composition Disc	Domestic water	Screwed	Temperature and Pressure
	11.3	Brass or Bronze Body, Teflon Disc, SS Spring	LP Steam	Screwed	Pressure
Approved acceptable manufacturers: Sarco, Lunkenheimer					

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
12.0 DIFFERENTIAL PRESSURE RELIEF VALVES	12.1	Brass Body, SS Spring, EP Disc Seat, sizes to 30 mm	300 kPa	Screwed	
	12.2	Cast iron body, coated S.S. seal, viton diaphragm, seat, O-rings, sizes to 38 mm	1379 kPa	Screwed	24 VAC solenoid, normally closed

	12.3	Cast iron body, coated S.S. seal, viton diaphragm, seat, O-rings, sizes ≥ 50 mm	1379 kPa	Flanged	24 VAC solenoid, normally closed
	12.4	Epoxy coated ductile iron body, coated S.S. components, sizes ≥ 13 to 200 mm	1723 kPa	Screwed, Flanged	

VALVE TYPE	ITEM	DESCRIPTION	PRESSURE RATING SERVICE (PSI)	CONNECTION	OPERATOR
13.0 CIRCUIT BALANCING VALVES	13.1	DZR brass (Ametal) copper alloy body, globe type, with EPDM seat, and venturi taps.	2065 kPa	Screwed	Handwheel with memory stop
	13.2	DZR brass (Ametal) copper alloy body, globe type, with EPDM seat, and venturi taps.	2065 kPa	Soldered	Handwheel with memory stop
	13.3	Ductile iron body, globe type, with EPDM seat, and venturi taps.	2065 kPa	Flanged	Handwheel with memory stop
	13.4	Ductile iron body, globe type, with EPDM seat, and venturi taps.	2065 kPa	Grooved	Handwheel with memory stop

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Remove internal parts before soldering.
- .3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2016, Power Piping.
- .2 ASTM International
 - .1 ASTM A125-96(2013)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 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

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

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58 and ASME B31.1.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are 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: 9 mm UL listed.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed.
- .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, UL listed.
- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP 58.
- .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies: As indicated on drawings.
 - .2 Steel brackets: As indicated on drawings.
- .6 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.
- .8 Adjustable clevis: material to MSS SP 58 UL listed, 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.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 58.
- .10 U-bolts: carbon steel to MSS SP 58 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 epoxy coated.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 58.

2.4 RISER CLAMPS

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

2.5 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP 58, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
 - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 58.

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 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops..
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

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

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.10 HOUSE-KEEPING PADS

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

2.11 OTHER EQUIPMENT SUPPORTS

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

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
 - .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
 - .3 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
 - .4 Cast iron pipes: install below joint.
 - .4 Clevis plates:
 - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
 - .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
 - .6 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.
 - .7 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 National Plumbing Code.
- .2 Fire protection: to National Fire Code and requirements of authority having jurisdiction.
- .3 Gas 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 SP 58.

3.4 HANGER INSTALLATION

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

3.5 HORIZONTAL MOVEMENT

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

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:

- .1 Tighten hanger load nut securely to ensure proper hanger performance.
- .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

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

3.8 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-B149.1-15, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2016, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14-2016, Standard for the Installation of Standpipe and Hose Systems.

1.2 SUBMITTALS

- .1 Product Data: submit product data for each item specified.
- .2 Submittals: in accordance with Section 01 33 00.
- .3 Product data to include paint colour chips, other products specified in this section.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
 - .2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.3 QUALITY ASSURANCE

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

Part 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

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

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic, 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 for PWGSC Preventive Maintenance Support System (PMSS):
 - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
 - .2 Equipment in Mechanical Room:
 - .1 Main identifier: size #9.
 - .2 Source and Destination identifiers: size #6.

- .3 Terminal cabinets, control panels: size #5.
- .3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

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

2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
 - .1 Natural gas: to CAN/CSA-B149.1
 - .2 Sprinklers: to NFPA 13.
 - .3 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.
- .2 Pictograms:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .4 Arrows showing direction of flow:
 - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
 - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
 - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
 - .1 To full circumference of pipe or insulation.
 - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
 - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
 - .2 Other pipes: pressure sensitive 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 Departmental Representative.

.2 Colours for legends, arrows: to following table:

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

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
High temp HW Htg. Supply	Yellow	HTHW HTG. SUPPLY++
High temp HW Htg. Return	Yellow	HTHW HTG. RETURN++
Make-up water	Yellow	MAKE-UP WTR
Boiler feed water	Yellow	BLR. FEED WTR
Steam	Yellow	STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET (GRAVITY)
Steam condensate (pumped)	Yellow	ST.COND.RET (PUMPED)
Safety valve vent	Yellow	STEAM VENT
Intermittent blow-off	Yellow	INT. BLOW-OFF
Continuous blow-off	Yellow	CONT. BLOW-OFF
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Acid waste	Yellow	ACID WASTE (add source)
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS
Natural gas	to Codes	
Gas regulator vents	to Codes	
Distilled water	Green	DISTILL. WTR
Demineralized water	Green	DEMIN. WATER
Compressed air (<700kPa)	Green	COMP. AIR LP kPa
Compressed air (>700kPa)	Yellow	COMP. AIR HP kPa
Vacuum	Green	VACUUM
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

Instrument air

Green

INSTRUMENT AIR

2.6 IDENTIFICATION DUCTWORK SYSTEMS

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

2.7 VALVES, CONTROLLERS

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

2.8 CONTROLS COMPONENTS IDENTIFICATION

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

2.9 LANGUAGE

- .1 Identification in English.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

- .1 Provide identification only after painting specified Section 09 91 23 has been completed.

3.3 INSTALLATION

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

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.

- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

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

3.7 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 GENERAL

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 TAB PERSONNEL

- .1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative within 60 days of award of contract.
- .2 Personnel to be member in good standing of AABC and/or NEBB.
- .3 Provide documentation confirming qualifications, successful experience.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
 - .2 Review specified standards and report to Departmental Representative in writing all proposed procedures which vary from standard.
 - .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.
-

1.7 SITE VISITS

- .1 Total of 14 site visits shall be made to correspond with the general monthly site meetings and phasing of the project as held by the Contractor. After each site visit, a written report shall be submitted to the Contractor and Departmental Representative. Site visits shall commence after the start of air and liquid distribution work and be spread over the construction period to the start of the balancing work.
- .2 A review of the installation and access to all valves, dampers, and equipment shall be made at the specified site visits and any additional dampers or valves required for proper balancing shall be forwarded in writing to be reviewed by the Departmental Representative.
- .3 Allow for 4 visits to site to adjust systems for seasonal changes during warranty. Coordinate time of visits with the Departmental Representative. Submit reports to Departmental Representative.
- .4 Begin balancing after equipment start-up and testing and after systems have been completed and are in full working order. Place systems and equipment into full operation and continue operation during each working day of balancing.

1.8 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.

1.9 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.
-

1.10 SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00 Submittal Procedures.
- .2 Provide proof of membership in the Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB). Submit, prior to commencement of TAB:
 - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.
- .3 Informational Submittals: Provide the following submittals electronically during the course of the work:
 - .4 Balancing Agenda:
 - .1 Submit balancing agenda to the Departmental Representative and commissioning contractor for review at least sixty (60) days prior to the start of balancing work. Start balancing work only after agenda has been approved. Include descriptive data, procedure data, and sample forms in agenda.
 - .2 Descriptive Data: General description of each system including associated equipment and different operation cycles, listing of flow and terminal measurements to be performed and selection points for proposed sound measurements.
 - .3 Procedure Data: Procedures for converting test measurements to establish compliance with requirements, specify type of instrument to be used, method of instrument application (by sketch) and correction factors.
 - .4 Sample Forms: Form showing application of procedures to typical systems.
 - .5 Prior to commencement of work on site, the balancing agent shall arrange with the Departmental Representative, a pre-determined test area on site. This is to determine the accuracy of test equipment and to review the balancing methods outlined in the written, pre-approved balancing procedures.
 - .6 At the completion of balancing the first major air system the balancing agent shall notify the Departmental Representative to re-visit the site to evaluate work completed to this time. Provide the Departmental Representative with 5 days written notice, prior to request for site visit.
 - .7 Balance Report:
 - .1 Submit electronic copies of rough balancing reports to the Departmental Representative for review, prior to on-site verification and acceptance of Project.
 - .2 Provide four (4) copies of final reports to contractor for inserting in Operating and Maintenance Manuals as described in Section 21 05 01.
 - .3 Include types, serial number, and dates of calibration of instruments in the reports.

1.11 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, caulking.
- .5 All pressure, leakage, other tests specified elsewhere in Division 23.
- .6 All provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

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 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Laboratory HVAC systems: plus 10%, minus 0%.
 - .2 Office and support space HVAC systems: plus 5%, minus 5 %.

- .3 Hydronic systems: plus or minus 10%.

1.14 ACCURACY TOLERANCES

- .1 Measured values to be accurate to within plus or minus 2% of actual values.

1.15 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.16 SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.
- .3 Submit preliminary TAB Report and final TAB Report as indicated below.

1.17 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 Date testing work is performed.
 - .2 Details of instruments used.
 - .3 Details of TAB procedures employed.
 - .4 Calculations procedures.
 - .5 Summaries.

1.1 TAB REPORT

- 1.1.1 Format in accordance with referenced standard.
- 1.1.2 TAB report to show results in SI units and to include:
 - 1.1.2.1 Project record drawings.
 - 1.1.2.2 System schematics.
- 1.1.3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English, in D-ring binders, complete with index tabs.

1.2 SYSTEM DATA

- 1.2.1 Air Handling Equipment
 - Design Data:
 - Total air flow rate;
 - Fan total static pressure;
 - System static pressure;

Motor kWHP, r/min, amps, Volts, Phase;
Outside air flow rate L/s (cfm);
Fan r/min;
Fan/kWHP;
Inlet and outlet, dry and wet bulb temperatures.

Installation Data:

Manufacturer and model;
Size;
Arrangement discharge and class;
Motor type, kWHP, r/min, voltage, phase, cycles, and load amperage;
Location and local identification data.

Recorded Data:

Supply Air Fan

- ◆ Fan 100% Outside Air
Air flow rate;
Fan total static pressure;
System static pressure;
- ◆ Fan Full Return/Min O/A
Air flow rate;
Fan total static pressure;
System static pressure;

Return Air Fan

- ◆ Fan 100% Exhaust Air
Air flow rate;
Fan total static pressure;
System static pressure;
- ◆ Fan Full Return
Air flow rate;
Fan total static pressure;
System static pressure;

Exhaust Air Fan

- ◆ Fan 100% Exhaust Air
Air flow rate;
Fan total static pressure;
System static pressure;

System static pressure;

- ◆ At every fan section

Fan r/min;
For Axial Fans, note blade pitch angle;
Motor operating amperage;
Inlet and outlet, dry and wet bulb temperatures.

- 1.2.2 Duct Air Quantities - All mains supplying more than 10% of Volume, outside air return air and exhaust (maximum and minimum) major return air openings back to duct shafts.

Duct sizes;
Number of pressure readings;
Sum of velocity measurements;
Average velocity;
Duct recorded air flow rate;
Duct design air flow rate.

- 1.2.3 Air Inlet and Outlets:

Outlet identification location and designation;
Manufacturers catalogue identification and type;
*Application factors;
Design and recorded velocities;
Design and recorded air flow rates;
Deflector vane or diffuser cone settings.

* (Refer to 3.1.3 for supporting information)

1.18 VERIFICATION

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide manpower and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results to be at discretion of Departmental Representative.
- .4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative.

1.19 SETTINGS

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.20 COMPLETION OF TAB

- .1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

1.21 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.
- .2 Smoke management systems:
 - .1 Test for proper operation of all smoke and fire dampers, sensors, and detectors, installed as component parts of air systems specified or modified within the scope of work.

1.22 POST- OCCUPANCY TAB

- .1 Measure DBT, WBT (or %RH), air velocity and NC levels, in occupied zone of following areas:
 - .1 Laboratory H158, Laboratory L527, Laboratory L530
 - .2 Calibration Laboratory
 - .3 Wildlife Evidence Room
- .2 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 3 months of termination of Warranty Period.

Part 2 PRODUCTS

2.1 INSTRUMENT TEST PORTS

- .1 Duct mounted instrument test port to be constructed of heavy duty 1.6 mm zinc-plated steel, with flat neoprene mounting gasket.
- .2 Test port to have cam-lever handle with chain connected to base.
- .3 Leakproof neoprene expansion plug to resist 275 kPa pressure when closed.

Part 3 EXECUTION

3.1 GENERAL PROCEDURE

- .1 Permanently mark, by stick-on labels and/or fluorescent paint, settings on valves, splitters, dampers, and other adjustment devices
- .2 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.
- .3 Where vane anemometer is used to measure supply, return or exhaust air grilles, AK factors shall be determined as follows:
 - .1 Determine and tabulate similar sized grilles being balanced for AK schedule.
 - .2 Traverse all ducts serving grilles (outlined in AK schedule) to verify AK factors.
 - .3 AK factor from schedule, must be approved by Departmental Representative during initial review with balancer on site. (Balancer shall include written procedure for determination of AK factors).
 - .4 No flow hoods are to be used for measurement of exhaust or return air grilles.
- .4 Balancing contractor shall advise mechanical contractor of required revised pulleys, sheaves and impellor shavings to allow proper balancing of systems
- .5 Where axial fans require blade pitch changes, this shall be the responsibility of the balancing contractor
- .6 Where pump impellers require shaving, this shall be the responsibility of the mechanical contractor. All adjustments shall be by qualified millwright. All changes shall be documented and included as part of the balancing report

3.2 AIR SYSTEM PROCEDURE

- .1 Perform balancing, adjusting, and testing with building doors and windows in their normal operation position.

- .2 The following procedure shall be adopted for central systems:
 - .1 Ensure dampers or volume control devices are in fully open position
 - .2 Balance central apparatus to $\pm 5\%$ air flow
 - .3 Balance branches and mains as stated previously
 - .4 Recheck central apparatus
 - .5 Balance all terminal air outlets as stated previously
 - .6 Re-balance central apparatus to $\pm 5\%$
 - .7 Recheck all air outlets.
 - .8 Perform acoustical measurements.
- .3 When balancing air outlets:
 - .1 Rough balance furthest outlets and then balance sequentially back to source.
 - .2 Fine balance furthest outlet back to source.
- .4 Take static pressure readings and air supply temperature readings at 10 points on each system.
- .5 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross sectional area. Take minimum of 4 for rectangular ducts, and 2 on each vertical and horizontal axis for round ducts, traverse readings. If readings are inconsistent across duct, try to obtain straight run of six (6) diameters widths upstream and re-do traverse. Measure air quantities on each system.
- .6 Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control only by duct internal devices such as dampers and splitters
- .7 Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- .8 Verify all terminal unit factory settings for maximum air flow (and minimum if applicable). Adjust terminal unit controller if required. Record adjusted units.
- .9 The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For laboratories, test pressure conditions inside lab and outside in corridor. Front doors, exits, elevator shafts, should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.
- .10 Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 10 Pa minimum and 20 Pa maximum shall be achieved, measured with negligible outside wind velocity

3.3 FIRE DAMPER VERIFICATION

- .1 Visually inspect all fire dampers
 - .1 Installation is straight
 - .2 Wall angles properly installed

- .3 Duct has break away connection
- .4 Fire stopping material where used is properly installed
- .5 Adequate access
- .6 Clearance between sleeve and wall
- .2 Inspect all fire damper blades and tracks prior to test firing. Sheet metal trade to clean all dirty dampers and tracks to satisfaction of balancer.
- .3 Manually remove each fusible link to ensure damper blade drops properly, then reset damper. Mark dropped fire damper with black felt marker.
- .4 If fire damper does not close properly, sheet metal trade to repair installation and balancing agency to retest.
- .5 All fire damper tests shall be witnessed by two parties, certified by Contractor and endorsed by the testing personnel.

3.4 ACOUSTICAL MEASUREMENTS

- .1 Provide full spectrum acoustical measurements for each major area as follows:
 - .1 Laboratories
 - .2 Offices
- .2 Provide additional or repeat acoustical measurements as necessitated by final balancing of each space, system, or piece of equipment.
- .3 Take measurements at maximum air volume conditions.
- .4 Note room reflective conditions at time of readings. (i.e. furnishings, window coverings, etc).

3.5 FIRE DAMPER/FIRE STOP FLAP VERIFICATION

- .1 Visually inspect all fire dampers and fire stop flaps:
 - .1 Installation is straight.
 - .2 Wall angles properly installed.
 - .3 Duct has break away connection.
 - .4 Fire stopping material where used is properly installed.
 - .5 Adequate access.
 - .6 Clearance between sleeve and wall.
 - .2 Inspect all fire damper blades and tracks prior to test firing. Sheet metal trade to clean all dirty dampers and tracks to satisfaction of balancer.
 - .3 Manually remove each fusible link to ensure damper blade drops properly, then reset damper. Mark dropped fire damper with black felt marker.
 - .4 If fire damper does not close properly, sheet metal trade to repair installation and balancing agency to retest.
 - .5 All fire damper tests shall be witnessed by two parties, certified by Contractor and endorsed by the testing personnel.
-

1.3 BALANCING REPORT

- 1.3.1 Submit draft copies of rough balancing reports prior to final acceptance of project.
- 1.3.2 Include types, serial number and dates of calibration of instruments.
- 1.3.3 Record test data on a sepi made from the latest available revised set of mechanical drawings and submit three (3) copies upon completion of the balancing contract for inclusion in equipment and maintenance manuals.
- 1.3.4 Submit with report, fan and pump curves with operating conditions plotted. Submit grille and diffuser shop drawings and diffusion factors.
- 1.3.5 Report shall be indexed as follows:

Air

Summary
Procedure
Instrumentation
Drawings
Equipment Summary
Fan Sheets
Fan Curves
Fan Profile Data
Static Data
Air Monitoring Station Data
Traverse Data and Schedule
Terminal Unit Summary
Outlet Data Summary and Schematics (per system)
Building Schematic
Building Pressurization Data
Weather Conditions at Time of Test

Liquid

Summary
Procedure
Instrumentation
Drawings
Pump Data
Pump Curves
Flow Stations
Coils
Equipment Data
Element Data Summary and Schematics (per system)

3.6 PERFORMANCE VERIFICATION

- .1 All Testing and Balancing work is to be coordinated with the Commissioning requirements of Section 01 91 13.

END OF SECTION

Part 1 GENERAL

1.1 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/IES 90.1-2016, 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 C335/C335M-17, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C411-17, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic- Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM 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, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C795-08(2013), 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-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .4 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-2013, Commercial Adhesives.

- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2017, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard 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.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for 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 Samples:
 - .1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
 - .2 Mount sample on 12 mm plywood board.
 - .3 Affix typewritten label beneath sample indicating service.
- .4 Manufacturers' Instructions:
 - .1 Provide manufacture's written duct insulation jointing recommendations, special handling criteria, installation instructions, and cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Installer shall be a 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.

1.4 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, and ULC markings.
- .3 Packaging Waste Management: remove for reuse in accordance with Section 01 74 20.

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/C335M.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in Part 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in Part 3 of this section).
 - .1 Mineral fibre: to ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to ASTM C553.

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 GSES GS-36.
- .3 Aluminum:
 - .1 To ASTM B209M with moisture barrier as scheduled in Part 3 of this section.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Smooth.
 - .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
 - .1 Stainless steel:
 - .5 Type: 316.
 - .6 Thickness: 0.25 mm sheet.
 - .7 Finish: Smooth.
 - .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 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 Outdoor Vapour Retarder Mastic:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
 - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².
- .6 Tape: self-adhesive, aluminum, 50 mm wide minimum.
- .7 Contact adhesive: quick-setting
 - .1 Maximum VOC limit to GSES GS-36.
- .8 Canvas adhesive: washable.
 - .1 Maximum VOC limit to GSES GS-36.
- .9 Tie wire: 1.5 mm stainless steel.
- .10 Banding: 12 mm wide, 0.5 mm thick stainless steel.
- .11 Facing: 25 mm stainless steel hexagonal wire mesh stitched on both faces of insulation.
- .12 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.

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
 - .2 Apply materials in accordance with manufacturer's instructions and as indicated.
 - .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
 - .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers, and supports are outside vapour retarder jacket.
 - .5 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.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Rectangular warm air ducts	C-1	no	25
Round warm air ducts	C-1	no	25
Supply, return and exhaust ducts exposed in space being served			none
Outside air ducts to mixing plenum	C-1	yes	25
Mixing plenums	C-1	yes	25
Exhaust duct between dampers and louvres	C-1	no	25
Rectangular ducts outside	C-1	special	50
Round ducts outside	C-1	special	50
Acoustically lined ducts	none		

- .2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:

- .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.

- .1 Finishes: conform to following table:

	TIAC Code	
Indoor, concealed	Rectangular none	Round none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3

Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

3.5 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
 - .2 ASTM C335/C335M-17, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411-17, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533-13, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547-17, Standard Specification for Mineral Fiber Pipe Insulation.
 - .7 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921-10(2013), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide(Revised 2005).
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
 - .2 CAN/ULC-S701.1:2017, Standard for Thermal Insulation, Polystyrene Boards
 - .3 CAN/ULC-S702.1:2014-AMD1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification
 - .4 ULC-S702.2-15, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
- .3 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00.
- .5 Quality assurance submittals: submit following in accordance with Section 01 33 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.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Installer shall be a 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.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.6 DELIVERY, STORAGE AND HANDLING

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

Part 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

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

2.2 INSULATION

- .1 Cold Piping: Formed fine fibrous glass or formed mineral fibre pipe insulation meeting requirements of CAN/ULC-S702.1:2014; with factory applied vapour barrier jacket, factory moulded to conform to piping and as follows:
 - .1 K Value: Maximum 0.033 W/m°C at 24°C
 - .2 Service Temperature: 4°C to 100°C
- .2 Hot Piping: Formed fine fibrous glass or mineral fibre pipe insulation meeting requirements of CAN/ULC-S702.1:2014; with factory applied general purpose jacket, factory moulded to conform to piping and as follows:
 - .1 K Value: Maximum 0.033 W/m°C at 24°C
 - .2 Service Temperature: Up to 150°C
- .3 Refrigerant Piping: Foamed plastic of closed cell structure or closed cell elastomer meeting requirements of CAN/ULC S704 and as follows:
 - .1 K Value: Maximum 0.04 W/m°C at 24°C
 - .2 Maximum Water Vapour Transmission Rating:
 - .1 Unjacketed: 0.1 perm
 - .2 Jacketed: 0.1 perm
- .4 Fire Retardant Insulation for PVC Piping: Formed fine fibrous glass or mineral fibre pipe insulation with cover material having flame spread 0 and smoke developed rating of 35 or less, plenum rated where exposed in return air installations or exposed ceiling installations.

2.3 EQUIPMENT INSULATION

- .1 Hot Equipment: Rigid fibrous glass or mineral fibre insulation meeting requirements of CAN/ULC-S702.1:2014 and as follows:
 - .1 K Value: Maximum 0.033 W/m°C at 24°C
 - .2 Service Temperature: -14°C to 200°C
- .2 Cold Equipment except Chillers: Rigid fibrous glass or mineral fibre insulation meeting requirements of CAN/ULC-S702.1:2014; with factory applied reinforced aluminum foil vapour barrier and as follows:
 - .1 K Value: Maximum 0.033 W/m°C at 24°C
 - .2 Service Temperature: -10°C to 100°C
- .3 Chillers: Foamed plastic of closed cell structure or closed cell elastomer meeting requirements of CAN/ULC S704 and as follows:
 - .1 K Value: Maximum 0.04 W/m°C at 24°C
 - .2 Maximum Water Vapour Transmission Rating:
 - .1 Unjacketed: 0.1 perm
 - .2 Jacketed: 0.1 perm

2.4 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, 50 mm wide minimum.

- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.5 CEMENT

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

2.6 VAPOUR RETARDER LAP ADHESIVE

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

2.7 INDOOR VAPOUR RETARDER FINISH

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

2.8 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m².

2.9 JACKETS

- .1 Canvas: 220 g/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive in accordance with ASTM C921. Wheat or vegetable based adhesives will not be permitted.

Gauge Number	MSG Nominal Steel Core Thickness	Nominal Sheet Aluminum Thickness
8	4.2 mm	--
10	3.4 mm	--
12	2.7 mm	2.1 mm
14	1.9 mm	1.6 mm
16	1.5 mm	1.3 mm
18	1.2 mm	1.0 mm
20	0.9 mm	0.8 mm
22	0.8 mm	0.6 mm
24	0.6 mm	0.5 mm
26	0.5 mm	--
28	0.4 mm	--
29	0.35 mm	--
30	0.30 mm	--

- .2 Aluminum: Meeting requirements of ASTM B209M and as follows:
 - .1 Thickness:
 - .1 Piping: Nominal 0.5 mm sheet
 - .2 Equipment, Valves and Fittings: Nominal 0.8 mm sheet
 - .3 Installations in Close Proximity to Occupied Areas: Nominal 0.8 mm sheet
 - .2 Finish: Smooth.
 - .3 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
 - .4 Fittings: 0.5 mm thick die shaped fitting covers with factory attached protective liner.
 - .5 Metal Jacket Banding and Mechanical Seals: Stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
 - .6 Exterior Installations: Include integral moisture barrier and weatherproof lap seals and fastenings.
 - .3 Polyvinyl Chloride (PVC): One-piece moulded type and sheet meeting requirements of CAN/CGSB-51.53 with pre-formed shapes as required and as follows:
 - .1 Colours: Match adjacent finish paint
 - .2 Service Temperature Range: -20°C to 65°C
 - .3 Moisture Vapour Transmission: 0.02 perm
 - .4 Thickness: 0.35 mm
 - .5 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation for lap and joint seals
 - .2 Tacks
 - .3 Pressure sensitive vinyl tape of matching colour
 - .4 Interior: UV rated materials in areas exposed to fluorescent fixtures
 - .5 Exterior: UV rated material minimum 0.5 mm thick
 - .4 ABS Plastic: One-piece moulded type and sheet with pre-formed shapes as required and as follows:
 - .1 Colours: Match adjacent finish paint
 - .2 Service Temperature Range: -40°C to 82°C
 - .3 Moisture Vapour Transmission: 0.012 perm
 - .4 Thickness: 0.750 mm
 - .5 Fastenings:
 - .1 Solvent weld adhesive compatible with insulation for lap and joint seals
 - .2 Tacks
 - .6 Locations: Exterior use only
 - .5 REMOVABLE INSULATION COVERS
 - .1 General:
 - .1 All Covers shall be sewn, stapled or "hog-ringed" covers shall not be acceptable.
-

- .2 Covers shall conform to the configuration of the items being insulated.
 - .3 Covers shall include openings for all protrusions such as pipes, packing glands on valves and expansion joints, hangers, supports, instrument lines, and other appurtenances.
 - .4 Covers shall be designed so that no force bending or folding of the cover is necessary for installation.
 - .5 Minimum 50mm wide flaps at terminal ends are to be provided to overlap adjacent covers to ensure a good heat seal.
 - .6 Parting seems shall be at the installed low points (gravitational bottom) of the cover to allow drainage without the use of weep tubes or grommets.
 - .7 Valve bonnets are to be covered, but packing glands shall remain exposed.
 - .8 Valve covers are to be designed such that the bonnet section is sewn to the body section. For larger valves, the cover may be fabricated in two sections, each section containing one half of the valve body and bonnet.
 - .9 Covers with a weight of 18.1 Kg or less are to be fabricated in one piece.
 - .10 Covers with a weight of more than 18.1 Kg are to be fabricated in more than one piece.
 - .2 Insulation Core:
 - .1 The insulation core shall be fabricated in one piece, wherever possible.
 - .2 To prevent insulation settlement, the insulation core shall be secured within the jacket through the weather barrier (outer jacketing), the insulation, and the liner (inner jacketing).
 - .3 Insulating cores with more than one piece shall have staggered joints to prevent hot spots and heat loss. The joint edges shall be butted together and extra securement provided at those edges.
 - .4 Insulation core shall be comprised of 50mm thick fiberglass insulation of non-combustible wool with resilient inorganic glass fibers bonded with a thermosetting resin. Insulation density to be 38 Kg/m³. Insulation thermal conductivity to be 0.044W/m.°C at a mean temperature of 100°C.
 - .3 Jacket:
 - .1 The jacket shall be fabricated in one piece, wherever possible.
 - .2 Gusset walls shall be required for covers with core insulation thickness in excess of 25mm.
 - .3 All seams, except the final closing seam, shall be inside seams. The jackets are to be sewn inside out, then turned correct side out before inserting the insulation core. The final closing seam shall be sewn on the exterior of the jacket. Seams shall be sewn coated fiberglass thread or coated stainless steel thread.
 - .4 Machine stitching shall be used for all sewing. Sewing shall be 6-8 stitches per centimeter.
 - .5 Draw cords are to be placed along the outer edge of the flap and the outer edge of the flap then rolled back inside and double stitched.
 - .6 Draw cords are to be of sufficient length to allow 150mm of cord to protrude from each side of the flap.
-

- .7 The inner and outer jacket shall be comprised of a fiberglass fabric impregnated with silicone rubber. The silicone rubber shall be flame retardant and suitable for high temperature usage. Outer jacket density shall be 595 gms/m².
- .4 Securement devices:
 - .1 The securement belts and D-ring belts shall be of the same material as the weather barrier (exterior jacket).
 - .2 The belts shall be placed 50mm back from the parting seams and on 150mm centers.
 - .3 Fire retardant fastening shall be used to secure belt to the weather barrier after the belt passed through the Stainless Steel D-rings.
- .5 Identification tags:
 - .1 Each cover shall be identified by a permanently attached stainless steel tag.
 - .2 An identification legend shall be mechanically embossed into the tag.
 - .3 The tags shall be located in the same areas on similar type covers.
 - .4 Should a cover require more than one piece for its construction, each piece to be identified and numbered (i.e. 1 of 3).
 - .5 Each tag shall include at least the following information, but may also include any pertinent information required by the end user.
 - .1 Type of item being covered.
 - .2 Location of item.
 - .3 Recording and tracking information.
 - .6 Acceptable manufacturers:
 - .1 Advanced Industrial Systems Inc., Thermo Help Canada Inc., Advanced Thermal Corp.

2.10 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 07 92 10.

2.11 ACCESSORIES

- .1 Canvas Lagging Adhesive: Compatible with insulation and compliant with requirements for ULC listed dilute fire retardant lagging adhesive, washable type.
- .2 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum
- .3 Contact Adhesive: Quick setting type
- .4 Tie wire: 1.5 mm diameter stainless steel
- .5 Bands: Stainless steel, 19 mm wide, 0.6 mm thick
- .6 Thermal Insulating and Finishing Cement: Hydraulic setting or Air drying for use on mineral wool meeting requirements of ASTM C449.
- .7 Vapour Retarder Lap Adhesive: Water based, fire retardant type, compatible with insulation.
- .8 Interior Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.

- .9 Exterior Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation; fibrous glass reinforcing fabric; untreated 305 g/m².
- .10 Sealants: Joint and weatherproofing sealants of type compatible with adjacent materials and as specified in Section 07 92 00.
- .11 All steam piping and any piping over 150mm (6") shall be supported with a calcium silicate settle at each hanger.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 INSTALLATION

- .1 Install insulation and recovery jacket in accordance with TIAC Best Practices Guide, manufacturer's written instructions and requirements of this specification.
- .2 Install insulation so that it is continuous through inside walls; pack around pipes with fireproof self supporting insulation material, properly sealed in accordance with Section 07 84 00.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes; hangers and supports must be outside vapour retarder jacket.
- .5 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided at supports and hanger locations.
- .6 Cold systems:
 - .1 Insulate complete system including, but not limited to:
 - .1 Piping
 - .2 Fittings
 - .3 Valves
 - .4 Unions
 - .5 Flanges
 - .6 Victaulic Couplings and fittings
 - .7 and strainers

- .2 Piping: Seal lap joints with 100% coverage of vapour barrier adhesive; seal butt joints with 50 mm wide strips of vapour barrier sealed with vapour barrier adhesive; apply hydraulic insulating cement for fittings and valves or apply factory fabricated insulation half shells, seal all laps and joints.
 - .3 Do not insulate flexible connections and expansion joints.
 - .4 For piping 25mm or smaller, insulation is not required on strainers, control valves and balancing valves.
 - .5 Terminate insulation bevelled to the pipe and sealed.
 - .7 Hot systems:
 - .1 Insulate:
 - .1 Piping
 - .2 Fittings
 - .3 Valves
 - .4 Victaulic pipe fittings such as tees and elbows
 - .2 Do not insulate:
 - .1 Unions
 - .2 Flanges (except on flanged valves)
 - .3 Strainers
 - .4 Flexible connections
 - .5 Expansion joints;
 - .6 Victaulic couplings directly connected to equipment to facilitate equipment replacement or removal.
 - .3 For piping 25mm or smaller, insulation is not required on strainers, control valves and balancing valves.
 - .4 Terminate insulation bevelled to the pipe and sealed.
 - .5 Piping: Apply hydraulic insulating cement or apply factory fabricated insulation half shells for fittings and valves; flare-out staples may be used to secure jacket laps on hot systems applied on 100 mm centres.
 - .1 Insulate Victaulic couplings with pre-formed removable insulation.
 - .8 Refrigerant Piping: Cover fittings and valves with equivalent thickness of pipe insulation material; apply with edges tightly butted; seal joints with sealant.
 - .9 Equipment: Apply insulation with edges tightly butted, joints staggered and secured in place by metal bands and as follows:
 - .1 Weld on suitable anchors where necessary.
 - .2 Provide sufficient clearance around openings for normal operation of equipment.
 - .3 Finish surface of cold equipment insulation with vapour barrier jacket sealed with vapour barrier adhesive.
 - .4 Make uneven surfaces smooth with insulating cement.
 - .10 Chillers: Insulate evaporator, waterboxes and tube sheets, compressor suction elbow, suction cover and all cold surfaces.
-

- .11 Cold System Pumps: insulate pumps up to motor shaft and all components exposed to system fluid.

3.4 FINISHING

- .1 Finish insulation neatly at hangers, supports and other protrusions.
 - .2 Provide recovering jackets on exposed insulation throughout, including equipment rooms:
 - .3 Interior Exposed Finishing Applications, in accordance with TIAC CPF/1:
 - .1 Apply factory integral service jacket to receive treated fabric jacket applied using recommended fabric adhesive.
 - .2 Cover fittings, valves and strainers not finished with PVC covers with a hard coat cement and finished with treated fitting fabric applied with using recommended fabric adhesive.
 - .3 Locate insulation seams in least visible locations.
 - .4 Finish fabric with one (1) coat of fabric coating.
 - .4 Interior Concealed Finishing Applications in accordance with TIAC CPF/2:
 - .1 Leave insulation on concealed piping left as factory finished with no further finish required.
 - .2 Apply pipe insulation with an integral all service jacket.
 - .3 Secure jacket using appropriate fastenings on 100 mm centres.
 - .4 Locate insulation seams on piping on side of the pipe visible to access point of concealed space, such as: underside of pipe in concealed ceiling applications.
 - .5 Cover longitudinal and circumferential joints with jacket finishing tape neatly applied or secure jacketing using integral self sealing lap and self sealing circumferential joint strips depending on system used.
 - .6 Cover fittings, valves and strainers not finished with PVC covers with a hard coat cement and finish with treated fitting fabric applied with fabric adhesive.
 - .5 Exterior Exposed Finishing Applications (Metal Recovery Jacket), in accordance with TIAC CPF/3:
 - .1 Apply aluminum jacket over the pipe insulation using necessary fastenings on 150 mm centres.
 - .2 Apply metal jacket or preformed metal fittings over insulated fittings, valve bodies, valve bonnets, strainers and flanges to provide a complete jacket system.
 - .3 Lap circumferential joints 50 mm minimum and seal with compatible waterproof lap cement
 - .4 Lock form longitudinal joints and seal.
 - .5 Locate metal jacket seams in least visible locations.
 - .6 Secure with recommended fastenings.
 - .6 Interior/Exterior Exposed Finishing Applications (PVC Recovery Jacket), in accordance with TIAC CPF/4:
 - .1 Apply PVC Jacket over the pipe insulation using necessary fastenings on 100 mm centres.
-

- .2 Cover longitudinal and circumferential joints with finishing tape neatly applied.
 - .3 Apply PVC jacket or preformed PVC fitting covers over insulated fittings, valve bodies, valve bonnets, strainers and flanges to provide a complete jacket system.
 - .4 Locate PVC jacket seams in least visible locations.
 - .5 Secure with appropriate fastenings and jacket finishing tape.
 - .7 Exterior Concealed, in accordance with TIAC CPF/5: Apply 2 ply weatherproof coating to insulated surfaces:
 - .1 First Ply: Apply minimum 1 litre per 1.5 m length of pipe weatherproof coating applied to insulated surfaces, increase application rate based on pipe diameter and manufacture's recommendations.
 - .2 Embed a layer of reinforcing membrane while still wet.
 - .3 Second Ply: Apply minimum 1 litre per 1.5 m length of pipe weatherproof coating applied to insulated surfaces, increase application rate based on pipe diameter and manufacture's recommendations.
-

3.5 INSULATION INSTALLATION THICKNESS SCHEDULE

.1 Insulation thicknesses shall confirm with ASHRAE 90.1 hor at a minimum be as follows;

.1 Insulation thicknesses listed below are based on based on Maximum K Value of least efficient insulation materials such as glass fibre and mineral fibre; thickness can be decreased for higher efficiency insulation materials such as polyurethane while maintaining overall K Value for the installation:

Piping or Equipment	Pipe Sizes mm	Insulation Thickness mm	Recovery Jacket
Domestic Cold Water	13 to 25 32 and over	25 38	Aluminum (exterior) Canvas (shafts) PVC (exposed areas)
Domestic Hot Water Supply and Recirculation Piping	13 to 32 40 and over	25 38	Canvas (shafts) PVC (exposed areas)
Domestic Hot Water Supply and Recirculation Piping (through unconditioned spaces)	13 to 50 65 to 100 125 and over	50 65 75	Canvas (shafts) PVC (exposed areas)
Note: Pipe insulation for piping installed in partitions within conditioned spaces can be reduced by 25mm but not to thickness below 25mm.			

3.6 REMOVABLE INSULATION COVERS

.1 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.1 Removable insulation covers shall be provided for the following:

- .1 Hydronic heating and chilled water system pump assemblies:-pumps, suction diffusers, triple duty valves.
- .2 Hydronic heating and chilled water system valves NPS 2½ and larger -gate, globe and butterfly.
- .3 Hydronic heating and chilled water system flex connections, expansion joints.
- .4 Hydronic heating and chilled water system expansion tanks.
- .5 Hydronic heating and chilled water system air separators.
- .6 Hydronic heating and chilled water system plate and frame heat exchangers.
- .7 Hydronic heating and chilled water system shell and tube heat exchangers removable heads.
- .8 Balancing valves NPS 2½ and above.

- .9 Two-Way Control valves NPS 2½ and larger.
- .10 Three-Way Control valves NPS 2½ and larger.
- .11 Steam traps.
- .12 Steam control vavles.

3.7 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
 - .1 ASTM A480/A480M-17, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-17, 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 for.
 - .3 ASTM A653/A653M-17, 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 Association (NFPA)
 - .1 NFPA 90A-2018, Standard for the Installation of Air-Conditioning and Ventilating Systems.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 2007.
- .6 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 metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

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 metal ducts 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 Section 01 35 21.

Part 2 PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	B
- .2 Seal classification:
 - .1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 SEALANT

- .1 Low VOC Characteristics:
 - .1 Adhesives and sealants: in accordance with Section 07 92 00.
 - .2 Adhesives and sealants: VOC limit to GS-36.
- .2 Sealant: synthetic latex emulsion water based type with a service temperature of -17°C to 105°C.

2.3 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.4 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: standard radius with centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius with, centreline radius: 1.5 times diameter of duct.

- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single 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.
 - .2 Round main and branch: enter main duct at 45 degrees 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 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 Short radiused elbows, or as indicated on drawings.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.5 FIRE STOPPING

- .1 Provide 50 mm x 50 mm x 3 mm retaining angles ready for and firestops and smoke seals.
- .2 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00.
- .3 Fire stopping material and installation must not distort duct.

2.6 GALVANIZED STEEL

- .1 Steel Sheet: Tension levelled, Forming Steel (FS) designation, Type A, Grade 230 in accordance with ASTM A653/A653M.
 - .2 Thickness: Minimum base metal thickness as noted for specific configuration or thicker as required to meet design loads.
 - .3 Galvanizing Designation: Z350 applied evenly to both sides.
 - .4 Thickness, Fabrication and Reinforcement: to SMACNA requirements.
 - .5 Joints: to meet SMACNA requirements.
 - .6 Finish in exposed areas shall be ready for painting, ductwork to match ceiling finish. Refer to floor plans for extent of ductwork to be exposed.
-

2.7 PRE-MANUFACTURED FLEXIBLE DUCTS:

- .1 Flexible duct is not permitted.

2.8 FASTENERS

- .1 Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts; weld fume hood exhaust ducts.

2.9 BUILT-UP PLENUMS

- .1 Fabricate plenums and casings to configurations shown on Drawings.
- .2 Construct plenums of galvanized panels joined by standing seams on outside of casing riveted or bolted on approximately 300 mm centres.
- .3 For central fume hood exhaust system the plenum construction shall match duct material.
- .4 Reinforce with suitable angles and provide diagonal bracing as required. Tightly fit at apparatus and caulk with sealant.
- .5 Reinforce door frames with steel angle tied to horizontal and vertical plenum supporting angles; install hinged access doors where shown, specified or where required for access to equipment for cleaning and inspection.
- .6 Fabricated acoustic plenums of galvanized steel from 1.519 mm back facing and 0.759 mm perforated front facing with 2.5 mm diameter holes on 5 mm centres; construct panels 75 mm thick packed with nominal 72 kg/m³ glass fibre acoustical insulation.
- .7 Provide necessary baffling in mixed air plenums to ensure good mixed air temperature with variations of not more than $\pm 3^{\circ}\text{C}$ under all operating conditions.
- .8 Fabricate fan plenums and plenums downstream of fan to match thickness of ducts.
- .9 Fabricate plenums between fan and upstream apparatus using 1.519 mm material.
- .10 Fabricate plenums between filters and upstream apparatus using 1.214 mm thick material.

2.10 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 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 concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps:

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions are acceptable for metal duct installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect elements to which ductwork hangers will be attached.
 - .2 Visually inspect elements which will be penetrated by ductwork.
 - .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .4 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

- .1 Do work in accordance with NFPA 90A, SMACNA, and drawings as indicated.
 - .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 as indicated.
 - .4 Install breakaway joints in ductwork on sides of fire separation.
 - .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
 - .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
 - .7 Where acoustic duct lining is noted, ductwork sizing stated on drawings represents clear inside dimensions.
-

3.3 CONSTRUCTION

- .1 Construct ductwork from site measurements and not from plans and shop drawings exclusively; failure to do so will not constitute an extra to the Contract.
- .2 Complete metal ducts within themselves with no single partition between ducts; cross brace ducts for rigidity where width of duct exceeds 450 mm; open corners are not acceptable.
- .3 Lap metal ducts in direction of air flow; hammer down edges and slips to leave interior of duct smooth.
- .4 Construct ductwork using materials in thicknesses indicated; reinforced and sealed for pressure class indicated, and as follows:
 - .1 Increase duct size gradually, not exceeding 15° divergence wherever possible; do not exceed 30° divergence upstream of equipment; do not exceed 45° convergence downstream of equipment.
 - .2 Construct tees, bends and elbows with radius of not less than 1.5 times the width of duct on centreline; provide double wall air foil type turning vanes where turning radius is not possible and where rectangular elbows are specified; provide turning vanes of perforated metal type with fibreglass inside, where acoustical lining is provided.
- .5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag; caulk duct joints and connections using sealant as ducts are being assembled; seal seams on fresh air and exhaust ducts watertight with mastic or high velocity duct sealant.
- .6 Weld stainless steel ductwork and ensure a smooth finish on all interiors.
- .7 Fabricate continuously welded round and oval duct fittings two gauge thicknesses heavier than duct gauges indicated in SMACNA Standard.
- .8 Set plenum doors 150 mm above floor; arrange door swings so that fan static holds door in closed position.
- .9 All supply and return ductwork shall be galvanized as per section 2.
- .10 All fume hood exhaust ductwork shall be 316 stainless steel continuously welded as per section 2. Horizontal runs shall be sloped at minimum 2.5 cm per 3 meters downward in the direction towards the shaft where a drip point complete with drain valve shall be provided.

3.4 HANGERS

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA, or as follows, whichever is more stringent:

<u>Duct Size</u>	<u>Spacing</u>
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.5 WATERTIGHT DUCT

- .1 Provide watertight duct for:
 - .1 Fresh air intake.
 - .2 Minimum 3000 mm from duct mounted humidifier in all directions.
 - .3 As indicated.

- .2 Form bottom of horizontal duct without longitudinal seams.
 - .1 Weld joints of bottom and side sheets.
 - .2 Seal other joints with duct sealer.
- .3 Slope horizontal branch ductwork down towards fume hoods served.
 - .1 Slope header ducts down toward risers.
- .4 Fit base of riser with drain pan and 32 mm drain connected, with deep seal trap discharging to open funnel drain or as indicated on drawings.

3.6 DUCT SEALING

- .1 Seal all supply, return and exhaust duct joints, longitudinal as well as transverse, using the following:
 - .1 Low Pressure Ductwork:
 - .1 Slip Joints: Apply heavy brush-on high pressure duct sealant. Apply second application after the first application has completely dried out. Where metal clearance exceeds 1.519 mm use heavy mastic type sealant.
 - .2 Flanged Joints: Soft elastomer butyl or extruded form of sealant between flanges followed by an application of heavy brush-on high pressure duct sealant.
 - .3 Other Joints: Heavy mastic type sealant.
 - .2 Medium and High Pressure Ductwork: Combination of woven fabrics and sealing compound followed by an application of high pressure duct sealant.
- .2 Duct tapes as sealing method are not permitted.
- .3 Surfaces to receive sealant should be free from oil, dust, dirt, moisture, rust and other substances that inhibit or prevent bonding.
- .4 Prior to sealing all ductwork, demonstrate sealing of a section of each type of duct and obtain approval from the Departmental Representative.
- .5 Do not insulate any section of the ductwork until it has been inspected and approved of duct sealant application.
- .6 All existing ductwork to remain shall be sealed with sprayable water based duct sealant. Sealant shall be indoor grade, listed for up to 15" w.g., flame and smoke development shall be 0/5.
 - .1 Sealant shall be a synthetic latex emulsion water based type with a service temperature from 0F to 220F.
 - .2 Standard of acceptance: ProSeal Spray by Ductmate Industries Inc.
 - .3 Contractor to carryout video scope of existing ductwork prior to duct sealant being applied and following the duct sealant being applied to assure the duct has been fully sealed.
 - .4 Pressure test of ductwork existing ductwork shall be carried out prior to making connections to new distribution system.

3.7 LEAKAGE TESTS

- .1 Refer to Section 23 05 94.
 - .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
 - .3 Do leakage tests in sections.
 - .4 Make trial leakage tests as instructed to demonstrate workmanship.
 - .5 Do not install additional ductwork until trial test has been passed.
 - .6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
 - .7 Complete test before performance insulation or concealment Work.
-

3.8 INSTALLATION

- .1 Locate ducts with sufficient space around equipment to allow normal operation and maintenance activities.
- .2 Coordinate the location of duct access doors as specified in Section 23 33 00.
- .3 Provide openings in ductwork where required to accommodate thermometers and controllers.
- .4 Provide pitot tube openings where required for testing of systems, including metal cap with spring device or screw to prevent air leakage; install insulation material inside a metal ring where openings are provided in insulated ductwork.
- .5 Interrupt duct linings at fire, balancing, backdraft and smoke dampers so as not to interfere with operation of devices; provide sheet metal edge protection over linings on both side of damper device.
- .6 Shield ductwork from dust and construction material during construction; clean any ductwork found to be dirty at no extra cost to the Contract.
- .7 Install ducts associated with fans subject to forced vibration with flexible connections immediately adjacent to equipment, refer to Section 23 33 00.
- .8 Do not use flexible duct to change direction.
- .9 Provide a minimum of **three (3)** duct diameters of straight metal duct between box inlet and flexible connector.
- .10 Connect diffusers or troffer boots to low pressure ducts with **300 mm** maximum stretched length of flexible duct; hold in place with sealant, and strap or clamp.
- .11 Prove that ductwork is substantially air tight before covering or concealing.
- .12 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

3.9 CLEANING

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
 - .1 ASTM A653/A653M-17, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process. (Metric).
- .3 Green Seal Environmental Standards (GS)
 - .1 GS-36-2013, Standard for Adhesives for Commercial Use.
- .4 Sheet Metal Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.
 - .3 SMACNA IAQ Guideline for Occupied Buildings Under Construction, 2007.
- .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 metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test and Evaluation Reports:
 - .1 Certification of Ratings:
 - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

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 metal ducts 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 GALVANIZED STEEL

- .1 Steel Sheet: Tension levelled, Forming Steel (FS) designation, Type A, Grade 230 in accordance with ASTM A653/A653M.
- .2 Thickness: Minimum base metal thickness as noted for specific configuration or thicker as required to meet design loads.
- .3 Galvanizing Designation: Z350 applied evenly to both sides.
- .4 Thickness, Fabrication and Reinforcement: to SMACNA requirements.
- .5 Joints: to meet SMACNA requirements.
- .6 Finish in exposed areas shall be ready for painting, ductwork to match ceiling finish. Refer to floor plans for extent of ductwork to be exposed.

2.2 SEAL CLASSIFICATION

- .1 Classification as follows:

<u>Maximum Pressure Pa</u>	<u>SMACNA Seal Class</u>
2500	A
1500	A
1000	A
750	B

- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets, sealant, tape or combination thereof.

2.3 SEALANT

- .1 Sustainability Characteristics:
 - .1 Adhesives and sealants: in accordance with Section 07 92 00.
 - .2 Adhesives and sealants: VOC limit to GS-36.
- .2 Oil resistant, water-borne polymer type flame resistant high velocity duct sealing compound.
 - .1 Temperature range of minus 30 degrees C to plus 93 degrees C.

2.4 TAPE

- .1 Tape: polyvinyl treated, open weave fibre glass, 50 mm wide.

2.5 BUILT-UP PLENUMS

- .1 Fabricate plenums and casings to configurations shown on Drawings.
- .2 Construct plenums of galvanized panels joined by standing seams on outside of casing riveted or bolted on approximately 300 mm centres.
- .3 For central fume hood exhaust system the plenum construction shall match duct material.
- .4 Reinforce with suitable angles and provide diagonal bracing as required. Tightly fit at apparatus and caulk with sealant.
- .5 Reinforce door frames with steel angle tied to horizontal and vertical plenum supporting angles; install hinged access doors where shown, specified or where required for access to equipment for cleaning and inspection.
- .6 Fabricated acoustic plenums of galvanized steel from 1.519 mm back facing and 0.759 mm perforated front facing with 2.5 mm diameter holes on 5 mm centres; construct panels 75 mm thick packed with nominal 72 kg/m³ glass fibre acoustical insulation.
- .7 Provide necessary baffling in mixed air plenums to ensure good mixed air temperature with variations of not more than $\pm 3^{\circ}\text{C}$ under all operating conditions.
- .8 Fabricate fan plenums and plenums downstream of fan to match thickness of ducts.
- .9 Fabricate plenums between fan and upstream apparatus using 1.519 mm material.
- .10 Fabricate plenums between filters and upstream apparatus using 1.214 mm thick material.

2.6 HANGERS AND SUPPORTS

- .1 Hangers and supports: in accordance with Section 23 05 29.
 - .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.
 - .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA or the following table, whichever is more stringent.

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 concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp or steel plate washer.
 - .3 For steel beams: manufactured beam clamps.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that site conditions are acceptable for metal duct installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate area where ductwork is to be installed.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied

3.2 GENERAL

- .1 Do work in accordance with NFPA 90A, SMACNA, and drawings as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate band hangers 100 mm beyond insulated duct.
 - .2 Ensure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.

3.3 HANGERS

- .1 Band hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: SMACNA or as follows, whichever is more stringent:

<u>Duct Size</u>	<u>Spacing</u>
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 CONSTRUCTION

- .1 Construct ductwork from site measurements and not from plans and shop drawings exclusively; failure to do so will not constitute an extra to the Contract.
- .2 Complete metal ducts within themselves with no single partition between ducts; cross brace ducts for rigidity where width of duct exceeds 450 mm; open corners are not acceptable.
- .3 Lap metal ducts in direction of air flow; hammer down edges and slips to leave interior of duct smooth.
- .4 Construct ductwork using materials in thicknesses indicated; reinforced and sealed for pressure class indicated, and as follows:
 - .1 Increase duct size gradually, not exceeding 15° divergence wherever possible; do not exceed 30° divergence upstream of equipment; do not exceed 45° convergence downstream of equipment.
 - .2 Construct tees, bends and elbows with radius of not less than 1.5 times the width of duct on centreline; provide double wall air foil type turning vanes where turning radius is not possible and where rectangular elbows are specified; provide turning vanes of perforated metal type with fibreglass inside, where acoustical lining is provided.
- .5 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breathe, rattle, vibrate or sag; caulk duct joints and connections using sealant as ducts are being assembled; seal seams on fresh air and exhaust ducts watertight with mastic or high velocity duct sealant.
- .6 Weld stainless steel ductwork and ensure a smooth finish on all interiors.
- .7 Fabricate continuously welded round and oval duct fittings two gauge thicknesses heavier than duct gauges indicated in SMACNA Standard.
- .8 Set plenum doors 150 mm above floor; arrange door swings so that fan static holds door in closed position.
- .9 All supply and return ductwork shall be galvanized as per section 2.
- .10 All fume hood exhaust ductwork shall be 316 stainless steel continuously welded as per section 2. Horizontal runs shall be sloped at minimum 2.5 cm per 3 meters downward in the direction towards the shaft where a drip point complete with drain valve shall be provided.

3.5 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA guidelines.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

3.6 LEAKAGE TESTS

- .1 Refer to Section 23 05 94.
 - .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
-

- .3 Perform leakage tests in sections.
- .4 Perform trial leakage tests, as instructed to demonstrate quality of work.
- .5 Do not install additional ductwork until trial tests have been achieved.
- .6 Test section minimum of 30 m long with not less than 3 branch takeoffs and two 90 degrees elbows.
- .7 Complete tests before performing insulation or concealment Work.

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.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

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 dampers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

- .1 Manufacture to SMACNA standards.

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 as indicated.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon 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: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Maximum leakage: 21 L/s/m² at 250 Pa.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that site conditions are acceptable for damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect site conditions in area where dampers are to be installed.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install where indicated.
 - .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.
-

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 REFERENCES

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-2018, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S112-10, Standard Test Method of Fire Test of Fire Damper Assemblies.
 - .2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
 - .3 ULC-S505-2004, Standard for Fusible Links for Fire Protection Service.

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 fire and smoke dampers and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate the following:
 - .1 Fire dampers.
 - .2 Smoke dampers.
 - .3 Fire stop flaps.
 - .4 Operators.
 - .5 Fusible links.
 - .6 Design details of break-away joints.

1.3 CLOSEOUT SUBMITTALS

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit maintenance materials in accordance with Section 01 78 00.
 - .2 Provide:
 - .1 6 fusible links of each type.

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, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect fire and smoke dampers 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 1 74 20.

Part 2 PRODUCTS

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type B, and bear label of ULC, meet requirements of NFPA 90A and authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN/ULC-S112.
 - .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
 - .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated.
 - .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.
 - .3 Top hinged: offset single damper, square, guillotine type, sized to maintain full duct cross section, for size of duct as indicated on drawings.
 - .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
 - .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.
 - .6 Equip fire dampers with steel sleeve or frame installed disruption ductwork or impair damper operation.
 - .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
 - .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
 - .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition of floor slab depth or thickness.
-

- .10 Unless otherwise indicated, the installation details given in SMACNA Install Fire Damp HVAC and in manufacturer's instructions for fire dampers shall be followed.

2.2 FIRE STOP FLAPS

- .1 Fire smoke flaps: ULC listed and labelled and fire tested in accordance with CAN/ULC-S112.2.
- .2 Construct of minimum 1.5 mm thick sheet steel with 1.6 mm thick non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .3 Flaps held open with fusible link conforming to ULC-S505 and close at 74 degrees C.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that site conditions are acceptable for fire and smoke damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect the area where the fire and smoke dampers are to be installed.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper. See Section 23 33 00.
- .5 Co-ordinate with installer of fire stopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

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 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 diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.
 - .6 Dimensions.

1.2 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00.
 - .2 Include:
 - .1 Keys for volume control adjustment.
 - .2 Keys for air flow pattern adjustment.

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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect diffuser, registers and grilles 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 in accordance with Section 01 74 20.
-

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.

2.2 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Frames where set into gypsum board and as indicated on drawings.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: as indicated on drawings.

2.3 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

- .1 As indicated on drawings.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 As indicated on drawings.

2.6 DIFFUSERS

- .1 As indicated on drawings.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that site conditions are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect area where the diffuser, grille, or register is to be installed.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
-

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in areas which may be subject to accidental impact.

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 REFERENCES

- .1 Definitions:
 - .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
- .2 Reference Standards:
 - .1 CSA Group
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

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 and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Shop drawings:
 - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .3 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .4 Submit drawings and product data to Departmental Representative for review.
 - .5 If changes are required, notify Departmental Representative of these changes before they are made.
 - .4 Certificates:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction inspection authorities for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
-

- .4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
- .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .5 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.

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

- .4 Develop Construction Waste Management Plan and 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 Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

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

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .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 26 05 34 except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as indicated on mechanical drawings.

2.4 WARNING SIGNS

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

2.5 WIRING TERMINATIONS

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

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid, matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Nameplates for Critical Power Panels: same as above, except with blue lamicoid
 - .3 Sizes as follows:

<u>NAMEPLATE SIZES</u>			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [____]" as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

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

2.8 CONDUIT AND CABLE IDENTIFICATION

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

<u>System</u>	<u>Prime</u>	<u>Auxiliary</u>
up to 250 V	Yellow	

Telephone	Green	
Other	Green	Blue
Communication		
Systems		
Fire Alarm	Red	
Emergency	Red	Blue
Voice		
Other	Red	Yellow
Security		

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 gray.

2.10 SERVICE INTERRUPTIONS

- .1 Coordinate all service interruptions in advance with the Departmental Representative, in accordance with 01 14 00 Work Restrictions and provide:

- .1 List of all scheduled interruptions
 - .2 Areas and equipment affected by each interruption
 - .3 Duration of each interruption

- .2 Minimum of 48 hour notice required for all service interruptions

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 Do complete installation in accordance with CSA C22.1 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.
 - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 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 in accordance with Section 26 05 32.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1100 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1200 mm.
 - .5 TV height: 1600mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 400 mm.
 - .5 Wall mounted telephone and interphone outlets: 1100 mm.
 - .6 Fire alarm stations: 1200 mm.
 - .7 Fire alarm horn/strobe: 2300 mm.
 - .8 Television outlets: 1200 mm.

- .9 Doorbell pushbuttons: 1100 mm.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.8 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00.
 - .1 Circuits originating from branch distribution panels.
 - .2 Lighting and its control.
 - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .4 Systems: fire alarm, communications.
 - .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.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - 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.

3.9 SYSTEM STARTUP

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.10 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 SUMMARY

- .1 This section includes requirements for selective demolition of electrical safety and security components including removal of conduit, junction boxes and panels to source (home run removal) and incidentals required to complete work described in this Section.

1.2 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative ready for reuse.
- .4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .5 Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 RELATED REQUIREMENTS

- .1 Section 02 41 99 –Demolition
- .2 Section 02 42 00 – Removal and Salvage of Construction Materials

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate Departmental Representative's occupancy during selective demolition with Section 01 35 13.
- .2 Scheduling: Sequence of operations for demolition will proceed in stages in accordance with Contractor's Construction Schedule.

1.5 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA):
 - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures

- .2 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.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Obtain necessary permits before starting work of this Section
 - .2 Provide copies of Certificate of final inspection and approval from the Authorities Having Jurisdiction to Departmental Representative at completion of demolition work.

Part 2 Products

2.1 NOT USED

2.2 DEBRIS

- .1 Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise as being retained and reconditioned for re-use in new construction.
- .2 Demolished Materials: Demolished materials become the property of the Contractor.
- .3 Salvaged Materials: Carefully remove materials designated for salvage and store in a manner to prevent damage or devaluation of materials.
- .4 Hazardous Waste Materials:
 - .1 Luminaire ballasts in demolished building may contain PCB's.
 - .1 Carefully remove ballasts and store separately from other construction waste using storage barrels and procedures in accordance with the Authorities Having Jurisdiction.
 - .2 Store and dispose of PCB contaminated ballasts and other hazardous materials accordance with requirements of the Authorities Having Jurisdiction.
 - .2 Fluorescent lamps in demolished building may contain mercury.
 - .1 Carefully remove lamps and store separately from other construction waste using storage procedures in accordance with the Authorities Having Jurisdiction.
 - .2 Store and dispose of fluorescent lamps and other hazardous materials accordance with requirements of the Authorities Having Jurisdiction.

Part 3 Execution

3.1 EXAMINATION

- .1 Visit site, thoroughly examine and become familiar with conditions that may affect the work of this Section before submitting Bid; Departmental Representative will not consider claims for extras for work or materials necessary for proper execution and completion of the contract that could have been determined by a site visit:
 - .1 Examine site and local conditions to determine any difficulties in carrying out work indicated and specified prior to submitting Bid.
 - .2 Examine site carefully and record exact condition of existing materials being removed or demolished.

3.2 PREPARATION

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations:
- .2 Demolition: Coordinate Section specific requirements with Demolition specifications contained in Section 02 41 99 and as follows:
 - .1 Disconnect all electrical circuits and panel feeders; maintain electrical service and main distribution panel as is.
 - .2 Remove all existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
 - .3 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove any tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
 - .4 Coordinate work of this Section to avoid interference with work by other Sections.
 - .5 Disconnect panel feeders back to the main distribution panel and re-label the respective circuit breaker as "SPARE".
 - .6 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.
 - .7 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
 - .8 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.3 PROTECTION

- .1 Prevent movement, settlement or damage of adjacent services and parts of existing buildings to remain. Provide bracing required.
-

- .2 Take precautions to support services and, if safety of buildings being demolished or of adjacent structures or services appears to be endangered, cease operations and notify the Departmental Representative.
- .3 Prevent debris from blocking drainage inlets. Protect mechanical and electrical systems that must remain in operation.
- .4 Arrange demolition work so that interference with the use of the buildings by the Departmental Representative and users is minimized.
- .5 Prevent debris from endangering the safe access to and egress from occupied buildings.
- .6 Conform to the requirements of the referenced regulations as minimum.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.18.1-13, Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX- J-023/1).
 - .2 CAN/CSA-C22.2 No.18.2-06(R2016), Nonmetallic Outlet Boxes.
 - .3 CSA C22.2 No.18.3-12, Conduit, tubing, and cable fittings (Tri-national standard, with ANCE NMX-J-017 and UL 514B).
 - .4 CAN/CSA-C22.2 No.18.4-15, Hardware for the Support of Conduit, Tubing, and Cable (Bi-National standard, with UL 2239).
 - .5 CSA C22.2 No. 18.5-13, Positioning devices (Bi-national standard, with UL 1565).
 - .6 CSA C22.2 NO. 65-13, Wire connectors (Tri- national standard, with UL 486A-486B and NMX-J-543-ANCE).
- .2 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.

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.

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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan and 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 Construction Waste Management Plan and Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: 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 NEMA to consist of:
 - .1 Connector body and stud clamp for stranded, round copper conductors.
 - .2 Clamp for stranded, round copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.4.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and cables and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

- .2 Install fixture type connectors and tighten to CSA C22.2 No.65. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with NEMA.

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 PRODUCT DATA

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

1.2 DELIVERY, STORAGE AND HANDLING

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

1.3 REFERENCE

- .1 CSA Group
 - .1 C22.2 NO. 123-16 (R2016) - Metal Sheathed Cables
 - .2 C22.2 NO. 174-M1984 (R2017) - Cables and Cable Glands for Use in Hazardous Locations

Part 2 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.
- .3 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .4 Insulation:
 - .1 Cross-linked polyethylene XLPE.
- .5 Inner jacket: polyvinyl chloride material.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

2.2 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
 - .2 Type: AC90 - sheath over cable assembly and under armour.
 - .3 Armour: interlocking type fabricated from aluminum strip.
 - .4 Type: PVC jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.
 - .5 Connectors: anti short connectors.
-

2.3 VARIABLE FREQUENCY DRIVE CABLES

- .1 Variable Frequency (Speed) Drive Cables: Provide variable frequency drive cables meeting the requirements of CSA C22.2 No. 123 and CSA C22.2 No. 174 from all VFD's to each designated motor load, comprised as follows:
 - .1 Sectored ground design consisting of 3 bare bonding conductors
 - .2 1000 volt rated cross linked polyethylene insulated phase conductors
 - .3 FT4 rated PVC outer jacket
 - .4 Sized to suit project requirements

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

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

3.2 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20.
- .2 Cable Colour Coding: to Section 26 05 00.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 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.
- .6 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.
- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

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

3.4 INSTALLATION OF ARMoured CABLES

- .1 Group cables wherever possible on channels.
-

3.5 INSTALLATION OF VARIABLE FREQUENCY DRIVES

- .1 Install and connect to all variable frequency drives (VFD's) supplied with mechanical equipment, and in accordance with VFD cable manufacturers installation requirements.
- .2 Provide input power supply to VFD's; provide VFD cable from VFD to designated motor.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.0.4-17 (R2017), Bonding of Electrical Equipment
 - .2 CSA C22.2 No.41-13 (R2013), Grounding and Bonding Equipment
 - .3 CSA T527-94 (R1999), Grounding and Bonding for Telecommunications in Commercial Buildings
- .2 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
 - .2 Operations and Maintenance 2009.

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 grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

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

1.5 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

Part 2 PRODUCTS

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, sized per Code or as indicated.
- .2 Insulated grounding conductors: green, copper conductors, sized per Code or as indicated.
- .3 Ground bus: copper, size size 6 mm x 50 mm x 0.6 m long, complete with insulated supports, fastenings, connectors.
- .4 Non-corroding accessories necessary for grounding system shall be mechanical type made of silicon bronze, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Where EMT is used, run ground wire in conduit.
 - .2 Install connectors in accordance with manufacturer's instructions.
 - .3 Protect exposed grounding conductors from mechanical injury.
 - .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
 - .5 Soldered joints not permitted.
 - .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Bonding conductor shall be installed within the conduit.
 - .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
 - .8 Bond single conductor, metallic armoured cables to ground at supply end, and provide non metallic entry plate at load end and run separate ground conductor.
 - .9 Ground all low tension conduits that terminate in telecom rooms/closets/panels and at cable trays, using grounding clamps or grounding bushings.
 - .10 Equipment Grounding: Install grounding connections from the equipment ground bus to typical equipment included in, but not necessarily limited to the following list. Service equipment, transformers, switch gear, panels, duct systems, frame of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.
-

- .11 Communications Grounding: Extend existing grounding system to provide grounding and bonding system for all communication systems.
- .12 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.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1, 24th Edition.

1.2 SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 PRODUCTS

2.1 SPLITTERS

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

2.2 JUNCTION AND PULL BOXES

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

2.3 CABINETS

- .1 Construction: welded sheet steel as indicated hinged door, handle, latch, lock with 2 keys and catch

- .2 Type E Empty: surface return flange mounting.
- .3 Type T Terminal: surface return flange containing 19 mm fire retardant treated plywood backboard.

Part 3 EXECUTION

3.1 SPLITTER INSTALLATION

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

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

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

3.3 IDENTIFICATION

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1, 24th Edition.

1.2 SUBMITTALS

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

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.
- .6 Shallow depth boxes where required for flush mounting, coordinate with architectural drawings

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 CONDUIT BOXES

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

2.4 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 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 NO. 18.1-13, Metallic Outlet Boxes.
 - .2 CAN/CSA-C22.2 NO. 18.2-06(R2016), Nonmetallic 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 CAN/CSA-C22.2 No. 18.4-15(R2015), Hardware for the Support of Conduit, Tubing, and Cable.
 - .5 CSA C22.2 No. 45.1-07(R2017), Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and NMX-J-534-ANCE-2007).
 - .6 CSA C22.2 No. 56-17(R2017), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
 - .7 CSA C22.2 No. 83-M1985(R2017), Electrical Metallic Tubing.
 - .8 CSA C22.2 No. 211.2-06(R2016), Rigid PVC (Unplasticized) Conduit.
 - .9 CSA-C22.2 No. 227.3-15(R2015), Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

1.2 SUBMITTALS

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

1.3 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
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- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.
- .4 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- .6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

2.2 CONDUIT FASTENINGS

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

2.3 CONDUIT FITTINGS

- .1 Fittings: to CSA C22.2 No. 18.3 and CAN/CSA- C22.2 No. 18.4, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for NPS 1 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in other unfinished areas.
- .3 Flexible metal conduit only acceptable for connection to motors in dry areas, and final connections to surface or recessed fixtures (maximum 3 meters).
- .4 Use EMT for vertical runs in partitions.
- .5 No horizontal wiring runs through partition studs will be accepted.
- .6 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.
- .7 Use flexible metal conduit for connection to motors in dry areas, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .9 Use explosion proof flexible connection for connection to explosion proof motors.
- .10 Install conduit sealing fittings in hazardous areas.
 - .1 Fill with compound.
- .11 Minimum conduit size for lighting and power circuits: NPS $\frac{3}{4}$ 19 mm.
- .12 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .13 Mechanically bend steel conduit over 19 mm diameter.
- .14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .15 Install fish cord in empty conduits.
- .16 Run 2-NPS 1 25 mm spare conduits up to ceiling space and 2-NPS 1 25 mm spare conduits down to ceiling space from each flush panel.
 - .1 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 surface type box.
- .17 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .18 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
 - .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
 - .3 Run conduits in flanged portion of structural steel.
 - .4 Group conduits wherever possible on suspended or surface channels.
-

- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

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

3.5 CONDUITS UNDERGROUND

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

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.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 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(R2015), Special Use Switches.
 - .4 CSA C22.2 No.111-10(R2015), General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors 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 15/20 A, 120V, single pole, switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

- .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

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

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

2.4 SOURCE QUALITY CONTROL

- .1 Cover plates from one manufacturer throughout project.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

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

3.3 CLEANING

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

3.4 PROTECTION

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

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 Institute of Electrical and Electronics Engineers (IEEE)
 - .1 IEEE C62.41-2002(R2008), Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 Canadian Standards Association (CSA):
 - .1 CAN/CSA-E598-Series-98(R2017), Luminaires
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 UL1598 (2008-09-17), Standard for Safety of Luminaires
- .4 Illuminating Engineering Society of North America (IESNA)
 - .1 IESNA LM-79-08(2008), Electrical and Photometric Measurements of Solid-State Lighting Products
 - .2 IESNA LM-80-15(2015-06-26), Approved Method for Measuring Lumen Maintenance of LED Light Sources
 - .3 IESNA TM-21-11(2011), Luminaire Classification System for Indoor Luminaires

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
 - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
-

- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 20.
- .4 Divert unused metal materials from landfill to metal recycling facility.
- .5 Disposal and recycling of fluorescent lamps as per local regulations.
- .6 Disposal of old PCB filled ballasts.

1.5 COORDINATION

- .1 Confirm compatibility and interface with other materials with luminaire and ceiling system, and report discrepancies to the Departmental Representative; defer ordering materials until discrepancies are clarified.
- .2 Supply plaster frames, trim rings, and back boxes to other trades, as the work requires.
- .3 Coordinate with mechanical subcontractor to avoid conflicts between luminaires, supports and fittings with mechanical equipment; do not suspend fixtures from mechanical equipment, pipes or ducts.

1.6 WARRANTY

- .1 Replace completely free of charge:
 - .1 Fluorescent lamps burning out within 12 months of takeover.
 - .2 Ballasts that fail or exceed their original noise level rating within 12 months of takeover.

Part 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- .1 Metal Parts: Free of burrs and sharp corners and edges.
- .2 Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- .3 Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.2 DIFFUSERS AND GLOBES:

- 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - .1 Lens Thickness: At least 3.175 mm minimum unless otherwise indicated.
 - .2 UV stabilized.
- 2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 RECESSED FIXTURES

- .1 Supply recessed fixtures complete with trim type required for ceiling system installed.

- .2 Before ordering, confirm the ceiling construction details and architectural finish for each area.
- .3 Recessed pot-light style fixtures: Provide pre-wired type with junction box forming an integral part of the assembly with satisfactory access complete with necessary plaster rings, supports, and other required accessories for complete installation.
- .4 Recessed fluorescent fixtures: Maintain maximum 150 mm depth, including mounting yokes or bridges with distance from back face of fixture or lens to centre of lamp minimum 65 mm; design reflector and lamp positions to provide high efficiency, even brightness and lack of lamp lines.

2.4 SUSPENDED FIXTURES

- .1 Coordinate supply of ceiling support for fixtures so that they are suitable for ceiling system installed.

2.5 DRIVERS FOR LED FIXTURES

- .1 Electronic Driver for LED Fixtures: Comply with UL 1310 Class 2 requirements for dry and damp locations.
- .2 Rated for 50,000 hours of life, unless otherwise noted.
- .3 Sound Rating: Class A.
- .4 Total Harmonic Distortion Rating: 20 percent or less.
- .5 Current Crest Factor: 1.5 or less.
- .6 Drivers shall typically operate one luminaire, unless noted otherwise on the light fixture schedule.
- .7 Driver shall operate from 50/60 Hz input source of 120 volts, and sustained variations of $\pm 10\%$ (Voltage & Frequency) with no damage to the driver or solid state circuitry.
- .8 Operating Temperature:
 - .1 Interior: 15C to 30C
 - .2 Exterior: -40C to 35C
- .9 Surge Protection: Automatic, withstand line transients as defined in ANSI C62.41, Category A
- .10 Dimming:
 - .1 Dimming shall be compatible with lighting control system, typically 0 - 10V low voltage dimming
 - .2 Dimming range shall be 1% - 100% of full light output
 - .3 Drivers shall be dimmable to 1% minimum flicker free and shall meet IEC 60929 Annex E for max mA draw of 2mA.
 - .4 Drivers and dimmers to be fully matched and compatible for the quantity of fixtures being dimmed.
 - .5 Any substitution to the dimming driver control mechanism which requires extra wiring or materials for the lighting control system to operate shall be paid for by the fixture manufacturer.

- .11 Drivers shall have a Power Factor greater than 0.98.

2.6 LAMPS

- .1 LED Light Sources
 - .1 Photometrics of fixture to be tested according to LM79 requirements
 - .2 Minimum L70 lamp life within the fixture of 50,000 as measured according to LM80 and TM21
 - .3 CRI \geq 82; R9 \geq 35
 - .4 Colour temperature range from 2700 - 5000 K, as noted on the luminaire schedule; Binning to \pm 200K
 - .5 Interior LEDs (within luminaires) suitable for an ambient temperature range of 15C to 30C

2.7 FINISHES

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

2.8 LUMINAIRES

- .1 As indicated in luminaire schedule.

Part 3 EXECUTION

3.1 SUPPORTS

- .1 Recessed Fixtures:
 - .1 In areas without suspended ceilings, support fluorescent fixtures directly from the building structure by rod hangers and inserts
 - .2 Provide plaster frames or plaster trim as required and turn same over to the ceiling section for installation
 - .3 Support fixtures equal to or larger than 610 mm in width by four hangers per fixture, minimum, independent of ceiling supports or T-bars
 - .4 Support fixtures smaller than 610 mm in width by two hangers per fixture, minimum, independent of ceiling supports or T-bars
 - .5 Install recessed fixtures to permit removal from below, to gain access to outlet or pre-wired fixture box.
 - .6 Connect recessed fixtures to boxes with flexible conduit and approved fixture wire.
- .2 Suspended Fixtures:
 - .1 Install suspended linear fluorescent fixtures with airplane cable and fittings having field adjustable length.
 - .2 Fixtures shall be installed level unless specifically noted otherwise on Drawings, with less than 10 mm variation over 2440 mm.

- .3 Fixtures shall be mounted at the same height above the floor unless specifically noted otherwise on Drawings.

3.2 LUMINAIRE WIRING

- .1 Connect recessed luminaires to outlet boxes with flexible conduit using 90°C wire.

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.

3.4 CLEANING

- .1 Specular reflector protection to remain in place through construction
- .2 Align luminaries and clean diffusers, baskets and remove reflector protection prior to final acceptance.
- .3 Clean in accordance with Section 01 74 11.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION



DRAFT

Limited Investigation of Mould Growth – Building FBH “Horizon”

Beaver Creek Institution, 2000 Beaver Creek Drive, Gravenhurst,
Ontario

Prepared for:

**Public Works and
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Senior Environmental Specialist

March 3, 2015

Pinchin File: 100550



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EXECUTIVE SUMMARY

Public Works and Government Services Canada retained Pinchin Ltd. (Pinchin) to perform an investigation of potential mould growth in Building FBH “Horizon Building” (FBH) at the Beaver Creek Institution located at 2000 Beaver Creek Drive in Gravenhurst, Ontario. The assessment for mould growth was performed proactively to verify if mould growth was present prior to planned construction work in FBH. The assessment was conducted in stages from January 29 to February 13, 2015 and addressed the 12 ranges in FBH (Range A through Range M, noting that there is no Range I). The investigation included interviews, inspections, and intrusive testing.

The assessment in a given range was limited to the Kitchen (Hx01), Washroom (Hx03), Toilet 1 (x03A), and Toilet 2 (x03B). All ranges are constructed in typical fashion. The “x” in the room numbers above is assigned based on the Range (A, B, etc.). The investigation was limited primarily by the fact that each range was occupied and that destructive testing performed had to be repaired immediately so that inmates could re-occupy the range at completion of the investigation. As such, items such as ceramic wall tile, millwork and other fixed items could not be removed and replaced during the investigation.

Mould growth was found on drywall finishes in varying amounts in all ranges examined. Bulk sampling of materials suspected of being mouldy generally confirmed the presence of mould to varying degrees of growth. Air sampling performed at the time of the assessment found confirmed mould growth was having an impact on airborne spore concentrations in Ranges A, G, K, L, and M but was not impacting airborne spore concentrations in Ranges B, C, D, E, F, H, and J. Water damage and mould growth was found beneath sinks in some kitchens. Buckets were placed to catch water leaks beneath the sinks at some locations.

The likely cause of mould growth on drywall finishes adjacent to showers identified by this investigation was the use of construction materials (gypsum panels), which are prone to develop mould growth when they become wet, covered by fibreglass panels used to create shower enclosures. The use of fibreglass panels as a wall finish in a shower requires diligent inspection, repair and replacement of sealants. In our experience, typical shower construction within similar institutional facilities is to construct shower enclosures using concrete and ceramic tile to facilitate housekeeping and as finishes reach the end of their useful lifetime can be repaired systematically without leading to extensive mould growth. Water damage and mould growth found beneath sinks in kitchens was caused by leaks and then compounded by a lack of corrective maintenance.

Hazardous Materials (lead, mercury and silica based materials) should be handled appropriately to minimize worker exposure. Note that lead and silica work performed within the mould removal work site does not require precautions additional to those identified for mould work.

Pinchin offers the following recommendations to address mould growth found.

1. Communicate the findings of this report.
2. Arrange for the preparation of a detailed Scope of Work for the mould remediation recommended below, and finalize an inspection and oversight plan.
3. Remove the lower 4' of drywall and batt insulation in all Ranges assessed by this report using CCA Level III procedures. Millwork on walls common to showers should be removed within the mould abatement work area.
4. Hazardous materials affected by renovation work should be handled as follows:
 - a. Handle copper pipes removed as part of remedial work using Type 1 procedures as prescribed by the Ontario Ministry of Labour Guideline “Lead on Construction Projects.”
 - b. Do not break fluorescent light tubes. Remove prior to demolition activities and recycle.
 - c. Demolition of finishes with ceramic tile or other grout should be performed using Type 1 procedures as prescribed by the Ontario Ministry of Labour Guideline “Silica on Construction Projects.”
5. Finalize an inspection and oversight plan for mould the remediation, considering the following possible inspections:
 - a. Milestone Inspection – Clean Site Preparation
 - b. Milestone Inspection – Post-Remediation Inspection
 - c. Milestone Inspection – Post-Remediation Air Sampling
6. Clean the floors, other building surfaces, furnishings and contents in areas immediately adjacent to the remediation work areas, following normal custodial practices.
7. Implement drying procedures as necessary. Ensure all surfaces are dry before installation of new finishes.



TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	Statement of Understanding	1
1.2	Scope of Work	1
2.0	METHODOLOGY	2
2.1	Interviews and Inspections	2
2.2	Test Methods and Criteria	3
2.3	Laboratory Based Test Methods	4
2.4	Review of WESA Report	4
3.0	FINDINGS	5
3.1	Results of Interviews	5
3.2	Facility Description.....	6
3.3	Hazardous Materials Identified by the Assessment	6
3.4	Results of Inspections and Testing.....	7
3.5	Summary of Measurements	29
3.5.1	<i>Temperature and Relative Humidity</i>	29
3.5.2	<i>Moisture Readings</i>	29
4.0	CONCLUSIONS AND RECOMMENDATIONS.....	29
4.1	Discussion of Water Damage and Mould Growth	29
4.2	Mould Remediation and Inspection	30
4.3	Communication	30
5.0	RECOMMENDATIONS.....	31
6.0	LIMITATIONS.....	31

APPENDICES

APPENDIX I	Site Map
APPENDIX II	Typical Range Site Plan
APPENDIX III	Drawings Hatched to Show the Locations of Mould Growth Found and Sampling Locations
APPENDIX IV	Lab Certificates
APPENDIX V	Site Photos



LIST OF TABLES

Table I – Parameters Tested, Recommended Limits and Instruments or Methods Used	3
Table II – Facility Description	6
Table III – Range A Kitchen	8
Table IV – Range A Washroom, Rooms A03A, A03B, and Portion of Corridor	9
Table V – Range B Kitchen	10
Table VI – Range B Washroom, Rooms B03A, B03B, and Portion of Corridor	11
Table VII – Range C Kitchen.....	12
Table VIII – Range C Washroom, Rooms C03A, C03B, and Portion of Corridor	13
Table IX – Range D Kitchen.....	14
Table X – Range D Washroom, Rooms D03A, D03B, and Portion of Corridor	14
Table XI – Range E Kitchen.....	15
Table XII – Range E Washroom, Rooms E03A, E03B, and Portion of Corridor	15
Table XIII – Range F Kitchen	16
Table XIV – Range F Washroom, Rooms F03A, F03B, and Portion of Corridor.....	17
Table XV – Range G Kitchen	18
Table XVI – Range G Washroom, Rooms G03A, G03B, and Portion of Corridor	19
Table XVII – Range H Kitchen	20
Table XVIII – Range H Washroom, Rooms H03A, H03B, and Portion of Corridor	21
Table XIX – Range J Kitchen	22
Table XX – Range J Washroom, Rooms J03A, J03B, and Portion of Corridor	23
Table XXI – Range K Kitchen	23
Table XXII – Range K Washroom, Rooms K03A, K03B, and Portion of Corridor	24
Table XXIII – Range L Kitchen.....	25
Table XXIV – Range L Washroom, Rooms L03A, L03B, and Portion of Corridor	26
Table XXV – Range M Kitchen	27
Table XXVI – Range M Washroom, Rooms MB03A, M03B, and Portion of Corridor	28

1.0 INTRODUCTION

1.1 Statement of Understanding

Pinchin Ltd. (Pinchin) was retained by Public Works and Government Services Canada (PWGSC, Client) to conduct an investigation of potential mould growth in Building FBH “Horizon Building” (FBH) at the Beaver Creek Medium Security Institution located at 2000 Beaver Creek Drive in Gravenhurst, Ontario. Past renovation work in a similarly constructed building had found mould growth in the areas assessed in FBH by this assessment. This assessment was performed prior to planned renovation work scheduled in FBH.

FBH contains administrative space and 12 isolated spaces that are used to house male inmates. The isolated spaces are called “Ranges” and are numbered Range A through Range M. All 12 Ranges are occupied by a number of inmates with varying levels of capacity. The assessment in a given range was limited to the Kitchen (Hx01), Washroom (Hx03), Toilet 1 (x03A), and Toilet 2 (x03B). All ranges are constructed in typical fashion. The “x” in the room numbers above is assigned based on the Range (A, B, etc.).

Prior to conducting the assessment, Pinchin was provided a copy of the WESA Inc. report “Draft Designated Substance and Hazardous Materials Survey Report at Fenbrook Institution, Operated by Correctional Service of Canada, Gravenhurst, Ontario”, dated February 28, 2011, WESA File KB9465-00. The findings of the WESA report are discussed in Section 2.4 of this report.

1.2 Scope of Work

Rachel Northey and Chris Moose of Pinchin performed the investigation in stages over the period of January 29 to February 13, 2015. The scope of this investigation was limited to four areas in each Range as described above. The investigation was limited by a number of factors:

- All Ranges were occupied. Inmates were moved temporarily to allow for the investigation, and once complete, inmates returned.
- Destructive testing was limited to areas that could be readily repaired during the investigation. Repairs made needed to be durable to ensure the safety of inmates and staff.
- Items such as ceramic wall tiles, fibreglass shower liners, millwork (cupboards, sinks, etc.) were not removed as they could not be readily reinstated in the short window of time allowed by the investigation.

- Existing wall and ceiling hatches were periodically inaccessible as the mechanical fastening device had been painted over or was damaged by previous maintenance activities.

The investigation involved the following activities:

- Interview to provide a summary of site history, locations where past mould growth was found, and the presence of any known leaks or floods;
- Review of past environmental reports;
- Spot readings of moisture content of building materials;
- Walkthrough inspection for factors that could degrade air quality, including water damage or mould growth;
- Spot measurements of the airborne concentration of the following parameters:
 - temperature; and
 - Relative Humidity (RH).
- Collection of samples and laboratory analysis for measurement of the following parameters (including reference and quality assurance samples):
 - Thirty spore trap mould air samples; and
 - Forty-three bulk and tape-lift samples.

2.0 METHODOLOGY

2.1 Interviews and Inspections

Pinchin interviewed site maintenance staff and the PWGSC representatives present, to discuss the history of the building, findings of past renovation work, maintenance practices, water damage and any history of flooding.

Pinchin performed a walkthrough inspection for indications of suspect mould growth and/or water damage on accessible building materials, paying particular attention to areas where past water damage had been reported during the interview.

Based on the physical inspection, the investigator inspected concealed conditions via existing access panels and by cutting access holes into the drywall walls where site conditions would allow for speedy temporary repair that didn't compromise the safety of inmates or staff.

The investigator used a moisture meter to test for elevated moisture levels in building materials. Temperature and relative humidity measurements were collected in each area assessed and compared to similar areas in other Ranges.

2.2 Test Methods and Criteria

The following table presents the parameters measured in this investigation, the instruments and sampling/analytical methods used, the applicable units of measurement, and the criteria selected by Pinchin for the evaluation of the results.

Table I – Parameters Tested, Recommended Limits and Instruments or Methods Used

Parameter	Unit of Measurement	Recommended Limit	Instrumentation or Test Method
Temperature, T	°C	21 to 25 °C, winter clothing ¹ 24 to 27 °C, summer clothing	Delmhorst® TH-3500
Relative Humidity, RH	%RH	Maximum long term, 65% ²	
Moisture in building materials (Note: detects surface moisture only, may not detect deeper moisture)	% moisture	Threshold for mould growth: ³ Drywall, 0.7% Wood materials, 17%	Delmhorst® BD-2100
Airborne mould (spore trap method)	Spores per cubic metre of air	Compare test area to reference areas ⁴ Consider water-damage indicator moulds Reference results of Pinchin Ambient Mould Index (PAMI) ©	Allergenco-D® sampler, laboratory analysis by Direct Microscope Examination

1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Thermal Comfort Conditions for Human Occupancy* [ANSI/ASHRAE Standard 55-2010]. Atlanta, GA: ASHRAE, 2010.

2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): *Ventilation for Acceptable Indoor Air Quality* [ANSI/ASHRAE Standard 62.1-2013]. Atlanta, GA: ASHRAE, 2013.

3 Macher, J. (Ed): *Bioaerosols, Assessment and Control*. Cincinnati OH: American Conference of Governmental Industrial Hygienists, 1999.

4 Health Canada: *Fungal Contamination in Public Buildings: Health Effects and Investigation Methods*. Ottawa ON: Health Canada, 2004. Due to below 0° outdoor temperatures, no outdoor air samples were collected.

Table I – Parameters Tested, Recommended Limits and Instruments or Methods Used

Parameter	Unit of Measurement	Recommended Limit	Instrumentation or Test Method
Mould in bulk, swab, tape-lift samples (DME)	Presence or absence of Mould Growth, to genus, and Light, Moderate or Heavy density ⁵	Current guidelines recommend remediation of all interior mould growth, regardless of species	Direct Microscope Examination with staining

Air sampling pumps were calibrated before and after use.

2.3 Laboratory Based Test Methods

The analysis for mould was performed at the Pinchin Environmental Microbiology Laboratory, Mississauga. The Pinchin laboratory is independently accredited to ISO/IEC 17025:2005 for mould and bacteria analysis, by the American Industrial Hygiene Association (AIHA)⁶ and the Quebec Ministry of Sustainable Development, Environment and the Fight against Climate Change (MDDEP).⁷

The spore trap mould air sample results include a report from the Pinchin Ambient Mould Index database (PAMI) ©. PAMI is a compilation of over 20,000 outdoor spore trap mould air samples analysed in the Pinchin laboratory, since 2006. The database has been analysed by month and region (18 regions across Canada) to report statistical data on means, medians, confidence intervals, etc. As a measure of the ranges in outdoor mould concentrations, the PAMI data can assist in the interpretation of indoor mould air sample results.

2.4 Review of WESA Report

The following information (relevant to this assessment, i.e. present in assessed areas) was provided by the WESA report:

- A review for the following materials was performed as part of the assessment:

⁵ The density of mould growth is ranked by the Pinchin Environmental Microbiology Laboratory as: Light (covers less than about 10% of specimen); Moderate (covers 10-20% of specimen); or Heavy (covers more than about 20% of specimen).

⁶ Accredited by the American Industrial Hygiene Association Laboratory Accreditation Program LLC (AIHA LAP LLC) under the Environmental Microbiology Laboratory Accreditation Program (EMLAP), for Bulk, Surface and Air testing for moulds, and for Legionella testing (Lab ID 158835).

⁷ Accredited by the Quebec Ministry of Sustainable Development, Environment and the Fight against Climate Change (MDDEP) and the (Quebec) Institut de recherche Robert-Sauvé en santé et sécurité au travail (IRSST), under the Programme d'accréditation des laboratoires d'analyse (PALA) for Air Microbiology for Airborne Heterotrophic Plate Count, Airborne Mould and Yeast (Viable), Airborne Mould (DME), and Legionella.

- Asbestos-containing materials;
- Lead based paints, wiring, and plumbing (including solder);
- Mercury containing equipment;
- Potential sources of silica;
- PCB containing equipment; and
- Visible mould growth.
- The assessment was limited to Fenbrook Institution and did not consider Beaver Creek Institution.
- Findings were as follows:
 - No asbestos is expected based on the age of construction.
 - Trivial amounts of lead in paint were found by testing (<50 µg/g).
 - Mercury was identified in fluorescent light tubes and potentially in some thermostats.
 - Silica is present in concrete, cement block.
 - PCBs were not identified in light ballasts.
 - Mould growth and water damage was identified in showers and in peeling floor tile in Residences.

3.0 FINDINGS

3.1 Results of Interviews

Maria McGibbon, Manager Environmental Regulations and Sustainability, reported the following:

- Mould growth has been found in similar buildings in the areas around the showers and kitchens at the Beaver Creek site; and
- Inmates will leave the showers running with cold water in an attempt to lower the temperature in the Range.

Maintenance staff did not report any flooding in areas to be assessed.

3.2 Facility Description

Table II – Facility Description

Item	Details
Construction Date	1997
Number of Floors	2
Area of Building	26,673 square feet
Area of Typical Range	Approximately 2,000 square feet
Structure	Concrete and steel
Foundation Type	Slab on grade construction
Exterior Cladding	Metal siding
HVAC	Forced air roof top HVAC equipment
Roof	Flat
Flooring	Exposed concrete, vinyl roll flooring
Interior Walls	Drywall, concrete block
Ceilings	Drywall

The investigation work was conducted on a series of days. The weather conditions on each day were as follows;

- January 29 – Low of -5 °C, High of -19 °C, snowing
- February 5 – Low of -14 °C, High of -24 °C, sunny conditions;
- February 6 – Low of -5 °C, High of -24 °C, overcast conditions with snow squalls;
- February 12 – Low of -7 °C, High of -25 °C, sunny conditions;
- February 13 – Low of -14 °C, High of -31 °C, flurries, overcast conditions.

3.3 Hazardous Materials Identified by the Assessment

Hazardous materials are defined as:

- Asbestos-containing materials;
- Lead based paints, wiring, and plumbing (including solder);
- Mercury containing equipment;
- Potential sources of silica; and
- PCB containing equipment.

Designated Substances (asbestos, lead, mercury, and silica) were identified based on the physical findings of the assessment accompanied with the information provided by the WESA report.

Pinchin has identified the following Hazardous Materials (excluding mould growth) typical in each area investigated:

- Trivial amounts of lead are present in paints.
- Solder on copper pipes contains lead.
- Mercury is present in fluorescent light tubes as a vapour.
- Silica is present in all concrete, concrete block, mortars, grout, etc.

3.4 Results of Inspections and Testing

This section presents the findings of the walkthrough investigation and any tests for mould performed. Appendix I presents the site plan for the entire site. Appendix II presents a drawing of two typical ranges and is hatched to show locations that weren't typically accessible for investigation (ceramic tile, millwork, and presence of concealed piping). Appendix III presents drawings showing the locations of mould growth found by the investigation. The analytical certificates for the mould tests are given in Appendix IV. Appendix V shows photos of typical mould growth found.

A portion of the corridor around the washrooms was investigated to allow for destructive testing. Only the wall common to the washroom was reviewed.



Table III – Range A Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range A Kitchen <i>Mould/water damage location:</i> Millwork under sink.	<i>Temperature:</i> 21.3 °C <i>Relative Humidity:</i> 19.7% <i>Sample ID:</i> Air Sample: 1031216 – Impacted Tape Lift Sample: B1121506 – Slight <i>Stachybotrys</i> mould growth Bulk Sample: B001 – Heavy <i>Monodictys</i> , <i>Cladosporium</i> , <i>Acremonium</i> , <i>Penicillium</i> and <i>Stachybotrys</i> mould growth on fibreboard <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 3 square feet (ft ²) water damaged and mouldy fibreboard forming millwork <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seal around sink and pipes



Table IV – Range A Washroom, Rooms A03A, A03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range A Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 21.7 °C <i>Relative Humidity:</i> 19.6% <i>Sample ID:</i> Air Sample: 1031196 – Impacted Air Sample: 1031203 – Impacted Tape Lift Sample: B1121279 – Heavy <i>Chaetomium</i> , <i>Aspergillus</i> and <i>Stachybotrys</i> mould growth on drywall B1121276 – Heavy <i>Stachybotrys</i> , and <i>Aspergillus</i> mould growth on drywall. <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in both shower units



Table V – Range B Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range B Kitchen <i>Mould/water damage location:</i> Millwork under sink	<i>Temperature:</i> 21.7 °C <i>Relative Humidity:</i> 12.8% <i>Sample ID:</i> Air Sample: 1262799 – No impact Bulk Sample: B0001 – Slight <i>Ulocladium</i> , <i>Penicillium</i> and <i>Aspergillus</i> mould growth on drywall installed on millwork beneath sink <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured.	<i>Description and estimated quantity:</i> 3 ft ² mouldy fibreboard forming millwork <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seal on sink and pipes

Table VI – Range B Washroom, Rooms B03A, B03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range B Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 21.7 °C <i>Relative Humidity:</i> 14.1% <i>Sample ID:</i> Air Sample: 1262813 – No impact Tape Lift Samples: B1128653 – Moderate <i>Stachybotrys</i> and <i>Aspergillus</i> mould growth on drywall B1125898 – Moderate <i>Stachybotrys</i> , <i>Tritirachium</i> and <i>Aspergillus</i> mould growth on drywall B1124640 – Heavy <i>Stachybotrys</i> and <i>Ulocladium</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table VII – Range C Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range C Kitchen <i>Mould/water damage location:</i> Water damage only	<i>Temperature:</i> 21.7 °C <i>Relative Humidity:</i> 17.0% <i>Sample ID:</i> Air Sample: 1031205 – No impact Tape Lift Sample: B1128718 – No mould growth found in staining on millwork beneath sink <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured.	<i>Description and estimated quantity:</i> 4 ft ² Water damage to millwork <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Leaks and seal around sink may be broken

Table VIII – Range C Washroom, Rooms C03A, C03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range C Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 22.4 °C <i>Relative Humidity:</i> 15.4% <i>Sample ID:</i> Air Sample: 1031195 – No impact Tape Lift Samples: B1124646 – Slight <i>Penicillium</i> mould growth on drywall where paint was peeling in the washroom B1121299 – Heavy <i>Taeniolella</i> and <i>Stachybotrys</i> mould growth on drywall B1121296 – Heavy <i>Stachybotrys</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 sq ft mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table IX – Range D Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range D Kitchen <i>Mould/water damage location:</i> None found	<i>Temperature:</i> 18.3 °C <i>Relative Humidity:</i> 17.1% <i>Sample ID:</i> Air Sample: 1031200 – No Impact <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> None found <i>Odours:</i> None detected	<i>Source of water infiltration:</i> None found

Table X – Range D Washroom, Rooms D03A, D03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range D Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 20.2 °C <i>Relative Humidity:</i> 17.2% <i>Sample ID:</i> Air Sample: 1031206 – No impact Tape Lift Sample: B1121497 – Heavy <i>Stachybotrys</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower unit. Assumed broken seal in other shower unit.

Table XI – Range E Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range E Kitchen <i>Mould/water damage location:</i> None found	<i>Temperature:</i> 18.6 °C <i>Relative Humidity:</i> 24.5% <i>Sample ID:</i> Air Sample: 1031210 – No impact <i>Moisture Testing</i> Moisture testing found wet conditions on drywall at millwork	<i>Description and estimated quantity:</i> None found <i>Odours:</i> None detected	<i>Source of water infiltration:</i> None obvious, but wet finishes found

Table XII – Range E Washroom, Rooms E03A, E03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range E Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 19.3 °C <i>Relative Humidity:</i> 20.6% <i>Sample ID:</i> Bulk Sample: B001 – Heavy <i>Stachybotrys</i> mould growth on drywall Tape Lift Sample: B1121034 – Slight <i>Penicillium</i> and <i>Stachybotrys</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table XIII – Range F Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range F Kitchen <i>Mould/water damage location:</i> Water damage only	<i>Temperature:</i> 21.8 °C <i>Relative Humidity:</i> 12.6% <i>Sample ID:</i> Air Sample: 1262820 – No impact Tape Lift Sample: B1121035 – No mould growth found on staining on millwork <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> Water damaged millwork found <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Pipe leaks and broken seal around sink

Table XIV – Range F Washroom, Rooms F03A, F03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 1 st Floor Range F Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 22.8 °C <i>Relative Humidity:</i> 12.4% <i>Sample ID:</i> Air Sample: 1262818 – No impact Tape Lift Sample: B1121300 – No mould growth found Tape Lift Sample: B1121250 – Moderate <i>Stachybotrys</i> and <i>Ulocladium</i> mould growth on drywall B0001 – Heavy <i>Stachybotrys</i> , <i>Ulocladium</i> and <i>Aspergillus</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured.	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table XV – Range G Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range G Kitchen <i>Mould/water damage location:</i> Millwork under sink	<i>Temperature:</i> 22.7 °C <i>Relative Humidity:</i> 25.7% <i>Sample ID:</i> Air Sample: 1031202 – Impacted <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 4 ft ² Water damage found on millwork. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Pipe leaks and broken seal around sink

Table XVI – Range G Washroom, Rooms G03A, G03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range G Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers.	<i>Temperature:</i> 23.3 °C <i>Relative Humidity:</i> 22.6% <i>Sample ID:</i> Air Sample: 1031199 – No impact Bulk Sample: B001 – Heavy <i>Stachybotrys</i> and <i>Monodictys</i> mould growth on drywall. Tape Lift Sample: B1121521 – Heavy <i>Stachybotrys</i> and <i>Aspergillus</i> mould growth <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table XVII – Range H Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range H Kitchen <i>Mould/water damage location:</i> None found	<i>Temperature:</i> 22.8 °C <i>Relative Humidity:</i> 12.2% <i>Sample ID:</i> Air Sample: 1262807 – No impact <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> None found <i>Odours:</i> None detected	<i>Source of water infiltration:</i> None found

Table XVIII – Range H Washroom, Rooms H03A, H03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range H Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 23.8 °C <i>Relative Humidity:</i> 11.2% <i>Sample ID:</i> Air Sample: 1262817 – No impact Tape Lift Samples: B1128467 – No mould growth detected on washroom wall B1128193 – No mould growth detected on washroom ceiling B1121531 – Moderate <i>Stachybotrys</i> mould growth on drywall in shower B1121286 – Heavy <i>Stachybotrys</i> and <i>Monodictys</i> mould growth on drywall B1121290 - Heavy <i>Stachybotrys</i> and <i>Aspergillus</i> mould growth on drywall B1121258 – Moderate <i>Stachybotrys</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured.	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table XIX – Range J Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range J Kitchen <i>Mould/water damage location:</i> Millwork under sink	<i>Temperature:</i> 21.0 °C <i>Relative Humidity:</i> 9.3% <i>Sample ID:</i> Air Sample: 1262798 – No impact Bulk Sample: B0001 – Heavy <i>Stachybotrys</i> mould growth on drywall installed over millwork beneath sink <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured.	<i>Description and estimated quantity:</i> 3 ft ² of mouldy drywall and fibreboard. Water damage to millwork. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals around sink and pipe leaks

Table XX – Range J Washroom, Rooms J03A, J03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range J Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 21.9 °C <i>Relative Humidity:</i> 11.5% <i>Sample ID:</i> Air Sample: 1031204 – No impact Tape Lift Samples: B1121709 – Heavy <i>Stachybotrys</i> mould growth on drywall B1121042 – Heavy <i>Stachybotrys</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table XXI – Range K Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range K Washroom <i>Mould/water damage location:</i> None found	<i>Temperature:</i> 22.2 °C <i>Relative Humidity:</i> 11.4% <i>Sample ID:</i> Air Sample: 1031194 – Impacted <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> None found, but results indicate concealed mould growth is present <i>Odours:</i> None detected	<i>Source of water infiltration:</i> None found

Table XXII – Range K Washroom, Rooms K03A, K03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range K Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 22.9 °C <i>Relative Humidity:</i> 15.6% <i>Sample ID:</i> Air Sample: 1031201 – No impact Tape Lift Samples: B1121260 – Fungal fragments detected on washroom wall. Fungal fragments are typically present where mould growth is present. B1121292 – No mould growth found on washroom ceiling B1121274 – Heavy <i>Stachybotrys</i> mould growth on drywall B1121301 – Heavy <i>Stachybotrys</i> mould growth on drywall B1121668 – Heavy <i>Stachybotrys</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation. <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

Table XXIII – Range L Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range L Kitchen <i>Mould/water damage location:</i> Millwork under sink	<i>Temperature:</i> 21.7 °C <i>Relative Humidity:</i> 18.2% <i>Sample ID:</i> Air Samples: 1031226 – No impact 1031223 – No impact Tape Lift Sample: B1121038 – No mould growth found by testing water staining on millwork Bulk Sample: B0002 – Heavy <i>Aspergillus</i> and <i>Monodictys</i> mould growth on millwork <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 3 ft ² of mouldy fibreboard. Water damage to other sections of fibreboard <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seal around sink and pipes



Table XXIV – Range L Washroom, Rooms L03A, L03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range L Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 22.6°C <i>Relative Humidity:</i> 15.6% <i>Sample ID:</i> Air Sample: 1031214 – Impacted Tape Lift Samples: B1128513 – Heavy <i>Stachybotrys</i> mould growth on drywall B1121295 – No mould growth found on shower wall surface B1128733 – Moderate <i>Stachybotrys</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units



Table XXV – Range M Kitchen

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range M Kitchen <i>Mould/water damage location:</i> Millwork under sink	<i>Temperature:</i> 22.2 °C <i>Relative Humidity:</i> 10.9% <i>Sample ID:</i> Air Sample: 1031221 – Impacted Tape Lift Sample: B1128044 – Heavy <i>Chaetomium</i> mould growth on fibreboard beneath sink <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured.	<i>Description and estimated quantity:</i> 3 ft ² <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seal around sink and pipes

Table XXVI – Range M Washroom, Rooms MB03A, M03B, and Portion of Corridor

	Results	Description of mould/water damage	Potential Source of mould/water damage
<i>Room and Floor:</i> 2 nd Floor Range M Washroom <i>Mould/water damage location:</i> Wall cavities surrounding showers	<i>Temperature:</i> 23.7 °C <i>Relative Humidity:</i> 15.0% <i>Sample ID:</i> Air Sample: 1031198 – No impact Tape Lift Samples: B1121280 – Heavy <i>Stachybotrys</i> and <i>Aspergillus</i> mould growth on drywall B1121048 – Heavy <i>Stachybotrys</i> and <i>Aspergillus</i> mould growth on drywall <i>Moisture Testing</i> Moisture testing found dry conditions at all locations measured.	<i>Description and estimated quantity:</i> 120 ft ² of mouldy drywall and batt insulation <i>Odours:</i> None detected	<i>Source of water infiltration:</i> Broken seals in shower units

A series of samples were taken as references to allow for comparison between areas suspected to contain mould growth and those that were not. Reference air samples were taken at the Guard's Desk and blank tape lifts were collected. The sample numbers are:

- Air Samples:
 - 1031215 – Guard Desk, No impact
 - 1031214 – Blank, No impact
 - 1031221 – Blank, No impact
 - 1262812 – Blank, No impact
 - 1262805 – Front Desk, No impact
- Tape Lifts;
 - B1121607 – Blank

- B1122746 – Blank
- B1128734 – Blank,
- B1128160 – Blank

3.5 Summary of Measurements

3.5.1 Temperature and Relative Humidity

The indoor spot measurements of temperature ranged from 18.3 to 23.8 °C. Relative humidity ranged from 9.3 to 25.7 %RH.

3.5.2 Moisture Readings

Except at one location in Range E, all moisture readings collected found finishes were dry (moisture content 0.7% or less).

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Discussion of Water Damage and Mould Growth

Mould growth was identified in every Range inspected in varying amounts. Given the similarity in construction, similar amounts of mould growth should be expected at each location where mould growth has been confirmed and presumed by this investigation. Millwork adjacent to walls found wet and/or mouldy should be assumed mouldy and removed at the time of remediation.

Bulk sampling of materials suspected of being mouldy generally confirmed the presence of mould to varying degrees of growth. Air sampling performed at the time of the assessment found mould growth was having an impact on airborne spore concentrations in Ranges A, G, K, L and M but was not impacting airborne spore concentrations in Ranges B, C, D, E, F, H, and J. Water damage and mould growth was found beneath sinks in some kitchens. Buckets were placed to catch water leaks beneath the sinks at some locations.

The likely cause of mould growth on drywall finishes adjacent to showers identified by this investigation was the use of construction materials (gypsum panels), which are prone to develop mould growth when they become wet, covered by fibreglass panels used to create shower enclosures. The use of fibreglass panels as a wall finish in a shower requires diligent inspection, repair and replacement of sealants. In our experience, typical shower construction within similar institutional facilities is to construct shower enclosures using concrete and ceramic tile to facilitate housekeeping and as finishes reach the end of their useful lifetime can be repaired systematically without leading to extensive mould growth. Water

damage and mould growth found beneath sinks in kitchens was caused by leaks and then compounded by a lack of corrective maintenance.

4.2 Mould Remediation and Inspection

Mould growth in buildings can be a risk factor for adverse health effects.⁸ The mould growth found in this investigation should be remediated following currently accepted procedures. Pinchin recommends that mould remediation follow the procedures set by the Canadian Construction Association (CCA).⁹ The work should be performed by a contractor with appropriate training, experience and insurance coverage. Ensure that remaining building materials are dry prior to reinstating mould-susceptible finishes, to prevent future mould growth.

Hazardous Materials (lead, mercury and silica based materials) should be handled appropriately to minimize worker exposure. Note that lead and silica work performed within the mould removal work site does not require precautions additional to those identified for mould work.

Pinchin recommends that the Client retain services for the inspection and testing of this remediation project. Health Canada and other authorities recommend independent inspection of medium and large scale mould abatement, to protect the occupants and building from cross-contamination. Pinchin would be pleased to provide services for project oversight and testing. The following inspections are recommended as a minimum.

1. Milestone Inspection – Clean Site Preparation
2. Milestone Inspection – Post-Remediation Inspection
3. Milestone Inspection – Post-Remediation Air Sampling

4.3 Communication

The findings of this report should be communicated to Correctional Services Canada staff as recommended by current mould guidelines and in workplaces, as required by occupational health and safety legislation.

⁸ US Environmental Protection Agency: Mold Remediation in Schools and Commercial Buildings. US EPA. 2001.

⁹ Canadian Construction Association: Mould Guidelines for the Canadian Construction Industry, [Guide 82]. Ottawa, ON: CCA, 2004

5.0 RECOMMENDATIONS

Pinchin offers the following recommendations to address mould growth found.

1. Communicate the findings of this report.
2. Arrange for the preparation of a detailed Scope of Work for the mould remediation recommended below, and finalize an inspection and oversight plan.
3. Remove the lower four feet of drywall and batt insulation in all Ranges assessed by this report using CCA Level III procedures. Millwork on walls common to showers should be removed within the mould remediation work area.
4. Hazardous materials affected by renovation work should be handled as follows:
 - a. Handle copper pipes removed as part of remedial work using Type 1 procedures as prescribed by the Ontario Ministry of Labour Guideline “Lead on Construction Projects.”
 - b. Do not break fluorescent light tubes. Remove prior to demolition activities and recycle.
 - c. Demolition of finishes with ceramic tile or other grout should be performed using Type 1 procedures as prescribed by the Ontario Ministry of Labour Guideline “Silica on Construction Projects.”
5. Finalize an inspection and oversight plan for mould the remediation, considering the following possible inspections:
 - a. Milestone Inspection – Clean Site Preparation
 - b. Milestone Inspection – Post-Remediation Inspection
 - c. Milestone Inspection – Post-Remediation Air Sampling
6. Clean the floors, other building surfaces, furnishings and contents in areas immediately adjacent to the remediation work areas, following normal custodial practices.
7. Implement drying procedures as necessary. Ensure all surfaces are dry before installation of new finishes.

6.0 LIMITATIONS

Work performed by Pinchin was conducted in accordance with generally accepted engineering or scientific practices current in this geographical area at the time the work was performed. No warranty is either expressed or implied, or intended by the agreement executed with the Client, or by furnishing oral or written reports or findings. The Client acknowledges that subsurface and concealed conditions may vary from those encountered or inspected. Pinchin could only comment on the conditions observed on the



date(s) the assessment was performed. The work was limited to those areas of concern identified by the Client or outlined in our proposal. Other areas of concern might exist but were not investigated within the scope of this assignment. Any budget estimates provided are preliminary and subject to verification unless otherwise agreed.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings or as to other legal matters mentioned in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretations and these interpretations may change over time and we undertake no, and expressly disclaim, obligation to advise the Client of such change. Pinchin accepts no responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The liability of Pinchin or our officers, directors, shareholders or staff will be limited to the lesser of the fees paid or actual damages incurred by the Client. Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered (Claim Period), to commence legal proceedings against Pinchin to recover such losses or damage unless the laws of the jurisdiction which governs the Claim Period which is applicable to such claim provides that the applicable Claim Period is greater than two years and cannot be abridged by the contract between the Client and Pinchin, in which case the Claim Period shall be deemed to be extended by the shortest additional period which results in this provision being legally enforceable.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party other than the Client, unless the Client, in writing, requests information to be provided to a third party or unless disclosure by Pinchin is required by law. Unless consented to by Pinchin, which consent may be reasonably and/or arbitrarily withheld, any use by a third party, or reports or documents authored by Pinchin, or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted by any party.

The information provided in this report is based upon analysis of available documents, analytical results, records and drawings, and personal contacts and interviews. In performing the assessment, Pinchin has relied in good faith on information provided by the individuals noted in this report. Pinchin has assumed that the documents, analytical results, records and drawings, and information provided by the individuals noted in this report, including information provided in contacts and personal interviews, is factual and



accurate. Pinchin accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of negligence, omissions, misinterpretations or fraudulent acts of persons interviewed or contacted, or contained in reports that were reviewed, and makes no representation or warranty as to the qualifications of any such persons or the reliability of information or reports provided by them, whether or not such persons were introduced to the Client by Pinchin.

Pinchin did not attempt to identify locations of deposition of mould spores or particles, or minor mould growth that would not exhibit any signs of spotting/staining on building materials. Pinchin would not be able to identify locations of concealed mould growth within wall cavities and other hidden locations without performing intrusive inspections. The degree of mould growth noted in the report may change with time if water or humidity issues continue or develop after the assessment date(s). Any sources of water infiltration or high humidity must be corrected to prevent the continuation or occurrence of mould growth. Air sampling results (if any) will apply only to the time and conditions of the testing and may not be used to reliably predict conditions on other days.

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Template: Master Report for Investigation of Mould Growth and IAQ, February 17, 2015

APPENDIX I
Site Map

APPENDIX II
Typical Range Site Plan

APPENDIX III

Drawings Hatched to Show the Locations of Mould Growth Found and Sampling Locations

APPENDIX IV
Lab Certificates

APPENDIX V
Site Photos



Photo 1 – Range A, conditions under sink, mould growth discovered under newspaper, tray and jars set to collect water dripping from pipes.



Photo 2 – Range A, typical view of shower ceiling, peeling paint and dusty exhaust vent.



Photo 3 – Range B, bottom of shower, water pooling near drain.



Photo 4 – Range B, mould growth inside wall cavity.



Photo 5 – Range C, typical conditions inside wall cavity surrounding showers.



Photo 6 – Range C, paint peeling off of walls in washroom.



Photo 7 – Range D, mould growth inside wall cavity.

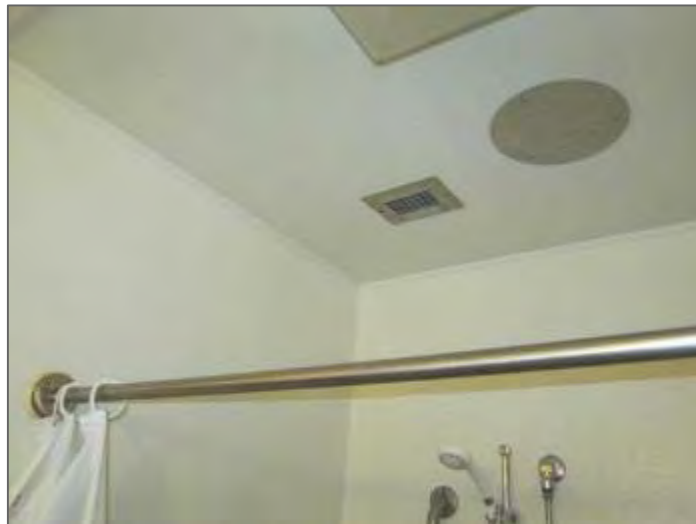


Photo 8 – Range D, plastic wall covering in accessible shower.



Photo 9 – Range E, mould growth inside wall cavity.



Photo 10 – Range E, visible moisture on drywall inside wall cavity.



Photo 11 – Range F, damage to drywall inside wall cavity.

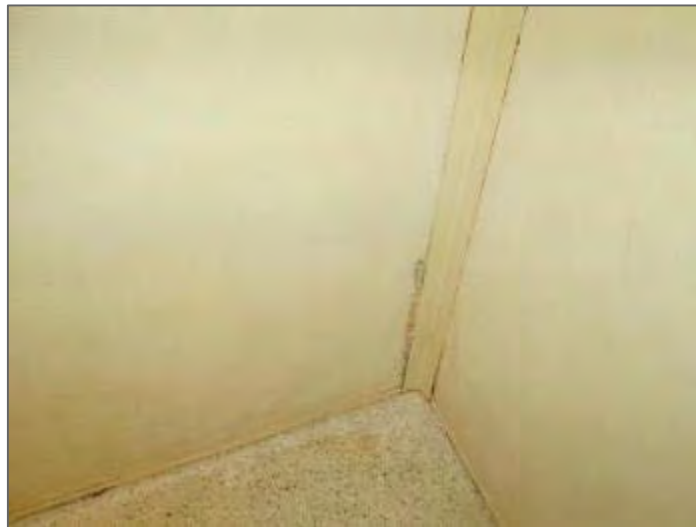


Photo 12 – Range F, typical shower, plastic wallboard with plastic corner joints and caulking.



Photo 13 – Range G, water damaged counter top in kitchen.



Photo 14 – Range G, mirror mounted in shower, mould growth behind mirror.



Photo 15 – Range H, rust forming on corner of drywall and paint bubbling from moisture.



Photo 16 – Range H, typical pipe chase in washroom.



Photo 17 – Range J, mould growth under kitchen sink.

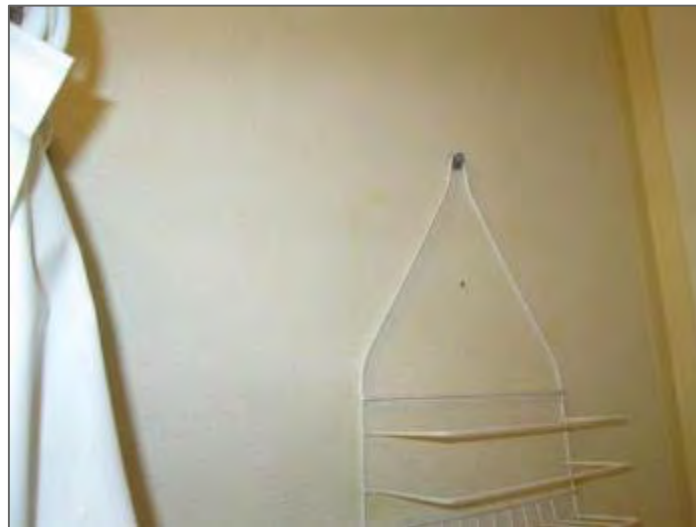


Photo 18 – Range J, rack hanging in shower, hole not water tight.



Photo 19 – Range K, mould growth inside wall cavity.

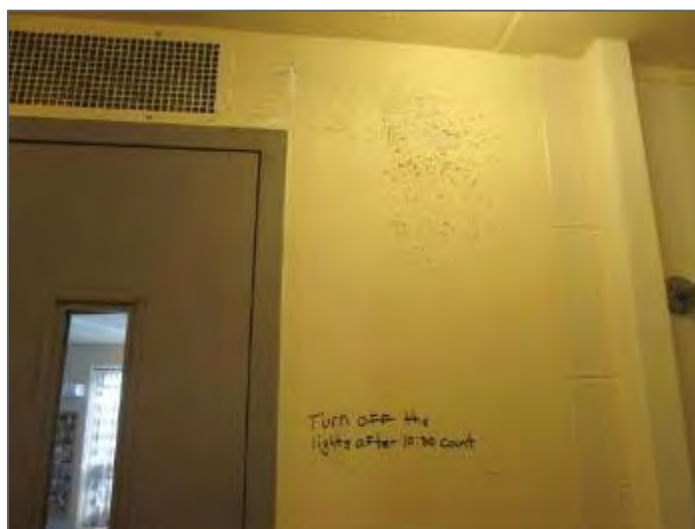


Photo 20 – Range K, paint peeling off walls in washroom.



Photo 21 – Range L, water damage and mould growth inside wall cavity.



Photo 22 – Range L, water damage and mould growth under kitchen sink.



Photo 23 – Range M, mould growth and water damage under kitchen sink.



Photo 24 – Range M, mould growth and rusted stud within wall cavity.