

Specifications

KOUCHIBOUGUAC UTILITY HOUSE

**KOUCHIBOUGUAC NATIONAL PARK
KOUCHIBOUGUAC, NEW BRUNSWICK**

ISSUED FOR TENDER










MARCH 20, 2019




**PROJECT NO. 954
PHASE 1**

**PHASE 1 SOUTH KOUCHIBOUGUAC
 UTILITY HOUSE PROJECT #954
 KOUCHIBOUGUAC NATIONAL PARK
 KOUCHIBOUGUAC, NEW BRUNSWICK
 SPECIFICATIONS – ISSUED FOR TENDER
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EKISTICS PLANNING & DESIGN

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REV.	DATE	REVISION(S)	PREPARED BY	CHECKED BY	APPROVED BY

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Wood Environment & Infrastructure Solutions,
 a Division of Wood Canada Limited
 50 Troop Avenue, Unit 300
 Dartmouth, Nova Scotia
 B3B 1Z1 Canada
 Tel (902) 468-2848
 Fax (902) 468-1314
www.woodplc.com

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1.0	SUMMARY OF WORK	
.1	The Work includes construction of a new utility house and related site works and landscaping at Kouchibouguac National Park, Kouchibouguac, New Brunswick.	
1.1	WORK RESTRICTIONS	
.1	Survey for Buried Utilities and Services:	
.1	Before any trenching or excavation work proceeds, take all steps necessary to locate existing services; coordinate with all applicable authorities having jurisdiction to identify locations of buried services; augment location work by using ground penetrating radar (GPR) to verify that each location of planned excavation is free of buried services prior to digging.	
.2	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 local, provincial, and other regulations.	
.2	Schedule work in consultation with Departmental Representative.	
.3	Kouchibouguac National Park is of national significance. Damage to the site is not permitted, and all damage shall be repaired and restored to original or better condition at the direction and sole approval of the Departmental Representative. Repairs, if required, shall be at the sole expense of the Contractor.	

- .4 Smoking Restrictions:
 - .1 Smoking is not allowed anywhere in the vicinity of the new construction works.

1.2 PAYMENT PROCEDURES FOR TESTING

- .1 Related Requirements Specified Elsewhere:
 - .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under various technical specification sections (Sections).
- .2 Appointment and Payment:
 - .1 Departmental Representative will appoint and pay for services of testing laboratory, except follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
 - .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
- .3 Contractor's Responsibilities
 - .1 Provide labour, equipment, and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
 - .2 Notify Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
 - .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
 - .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

1.3 PROJECT MEETINGS

- .1 Preconstruction Meeting:
 - .1 Within two weeks after award of Contract, hold a ½-day meeting to discuss construction strategies and procedure.
 - .2 Departmental Representative(s) and Contractor shall be in attendance.
 - .3 Coordinate time and location of meeting and notify parties concerned minimum 10 days before meeting.

- .4 Agenda to include:
 - .1 Appointment of official representatives of participants in the Work.
 - .2 Schedule of Work: in accordance with CONSTRUCTION SCHEDULE.
 - .3 Schedule of submission of shop drawings, samples, colour chips.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with CONSTRUCTION FACILITIES.
 - .5 Delivery schedule of specified equipment.
 - .6 Site safety and security in accordance with TEMPORARY BARRIERS AND ENCLOSURES.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Departmental Representative-provided products and salvaged items as indicated on drawings.
 - .9 As-built drawings.
 - .10 Maintenance manuals in accordance with CLOSEOUT SUBMITTALS.
 - .11 Take-over procedures, acceptance, warranties in accordance with Closeout Submittals.
 - .12 Monthly progress claims, administrative procedures, holdbacks.
 - .13 Appointment of inspection and testing agencies or firms.
 - .14 Insurances, transcript of policies.
- .2 Progress Meetings:
 - .1 During course of Work schedule progress meetings to coincide with mock-up and other site reviews, as follows:
 - .1 Departmental Representative's trips to site shall coincide with review of critical installation review junctures and mock-up reviews. Coordinate mock-up reviews and site construction reviews to maximize review time efficiency, and minimize visits by strategic planning and coordination.
 - .2 Prepare as many mock-ups for a single review visit as practical.
 - .3 Coordinate mock-up reviews to the extent possible with reviews of pre-foundation pour, and other elements of construction requiring review before being covered or other construction proceeding. Refer to individual sections for review requirements.
 - .2 Contractor and Departmental Representative(s) shall be in attendance, and related trade contractors at Contractor's invitation, or as directed by Departmental Representative, on a meeting-by-meeting basis.
 - .3 Notify parties minimum 10 days prior to meetings.
 - .4 Contractor shall record minutes of meetings and circulate to attending parties and affected parties not in attendance within 5 working days after meeting.
 - .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems that impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.

- .11 Review proposed changes for effect on construction schedule and on completion date.
- .12 Other business.

1.4 CONSTRUCTION SCHEDULE

- .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. Preferably, derive Bar Chart using commercially available computerized project management software.
 - .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.
- .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 period.
 - .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, Substantial Performance and Final Completion as defined times of completion are required.
- .3 Submittals:
 - .1 Provide submittals in accordance with SUBMITTAL PROCEDURES.
 - .2 Submit to Departmental Representative within 15 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring, and reporting of project progress.

- .4 Detailed Project Schedule Requirements:
 - .1 Develop detailed Project Schedule derived from the Contract Documents.
 - .2 Address the scope of work at each building involved in Project separately, building-by-building, lay out the complete schedule of work for each, and coordinate with Master Schedule.
 - .3 Address the scopes of work at the site for the various hard and soft landscaping requirements, seating and related works, and coordinate with Master Schedule.
 - .4 Ensure detailed Project Schedule includes sequencing of the Work and milestones that reflect the work breakdown structure (WBS) for each part of the Work (each building and site works), along with the logical progression of the Work by trade jurisdiction for each building and site works.
 - .5 Submit WBS for review and approval to Departmental Representative within 15 days of Award of Contract.
 - .6 Indicate on detailed Project Schedule when reviews are required before closing-in and/or proceeding with subsequent dependant work.
- .5 Project Schedule Reporting:
 - .1 Update Project Schedule every two weeks 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.
- .6 Project Meetings:
 - .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
 - .2 Weather related delays with their remedial measures will be discussed and negotiated.

1.5 SUBMITTAL PROCEDURES

- .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 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 coordinated with requirements of Work and Contract. Submittals not stamped, signed, dated, and identified as to specific project will be returned without being examined and considered rejected.
 - .4 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract stating reasons for deviations.
 - .5 Verify field measurements and affected adjacent Work are coordinated.
 - .6 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
 - .7 Contractor's responsibility for deviations in submission from requirements of Contract is not relieved by Departmental Representative review.

- .2 Shop Drawings and Product Data:
 - .1 The term 'shop drawings' means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data that are to be provided by Contractor to illustrate details of a portion of Work.
 - .2 As may be required in specification Sections, submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of New Brunswick, Canada.
 - .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
 - .4 Allow 10 working days for Departmental Representative's review of each submission.
 - .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
 - .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
 - .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Specification sections and indication of partial or complete submittal for stated section
 - .5 Other pertinent data.
 - .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract.
 - .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 Single line and schematic diagrams.
 - .9 Relationship to adjacent work.

- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested, except where hand drawn copies are produced or colours have to be chosen or confirmed, in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system, or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards, and safety precautions.
- .15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 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.

- .20 The review of shop drawings is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that the Departmental Representative 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.
 - .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.
- .3 Samples/brochures for colour or texture:
 - .1 Submit for review samples in duplicate or as required 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.
 - .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 Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
 - .6 Make changes in samples that Departmental Representative may require, consistent with Contract.
 - .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.
- .4 Certificates and Transcripts:
 - .1 Immediately after award of Contract, submit Workers' Compensation Board status.
 - .2 Submit transcription of insurance immediately after award of Contract.

1.6 HEALTH AND SAFETY

- .1 References:
 - .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).
 - .2 Province of New Brunswick:
 - .1 Occupational Health and Safety Act (S.N.B. 1983, c. O-0.2) and Regulations,
 - .2 Workers Compensation Act and Regulations.
- .2 Health and Safety Plan:
 - .1 Prior to commencement of Work, develop written Health and Safety Plan specific to the Work. Implement, maintain, and enforce Plan for entire duration of Work and until final demobilization from site.
 - .2 Health and Safety Plan shall include the following components:
 - .1 List of health risks and safety hazards identified by hazard assessment.
 - .2 Control measures used to mitigate risks and hazards identified.
 - .3 On-site Contingency and Emergency Response Plan as specified below.
 - .4 On-site Communication Plan as specified below.

- .3 On-site Contingency and Emergency Response Plan shall include:
 - .1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.
 - .2 Evacuation Plan: prior to entering the Work Site confirm escape routes, marshalling areas, and location of fire fighting equipment.
 - .3 Emergency Contacts: name and telephone number of officials from:
 - .1 Departmental Representative.
 - .2 Pertinent Federal and Provincial Departments and Authorities having jurisdiction.
 - .3 Local emergency resource organizations.
 - .4 Harmonize Plan with Park's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of PCA and Park Management contacts.
 - .4 On-site Communication Plan:
 - .1 Procedures for sharing of work related safety information to Subcontractors, including emergency and evacuation measures.
 - .2 List of critical work activities to be communicated with Park Manager that have a risk of endangering health and safety of Park users.
 - .5 Address all activities of the Work including those of subcontractors and suppliers.
 - .6 Review Health and Safety Plan regularly during the Work. Update as conditions warrant to address emerging risks and hazards, such as whenever a new subcontractor or supplier arrives at Work Site.
 - .7 Departmental Representative will respond in writing where deficiencies or concerns are noted and may request re-submission of the Plan with correction of deficiencies or concerns.
 - .8 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction, weekly.
 - .9 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 - .10 Submit copies of incident and accident reports.
 - .11 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 Filing of Notice:
 - .1 File Notification of Construction Project with Provincial authorities prior to beginning of Work.
 - .4 Meetings:
 - .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.
 - .5 Regulatory Requirements:
 - .1 Do Work in accordance with REGULATORY REQUIREMENTS.
 - .6 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, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

- .7 Province of New Brunswick Compliance Requirements:
 - .1 Comply with Occupational Health and Safety Act and regulations, Workers Compensation Act and Regulations, Workplace Hazardous Materials Information System Regulations.
- .8 Unforeseen Hazards:
 - .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.
- .9 Health and Safety Coordinator:
 - .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have site-related working experience specific to activities.
 - .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 trained 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.
- .10 Posting of Documents:
 - .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.
- .11 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.
- .12 Powder Actuated Devices:
 - .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.
- .13 Work Stoppage:
 - .1 Give precedence to the health and safety of the public, anyone visiting or working at worksite, and wildlife, and protection of the environment over cost and schedule considerations for Work.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Environmental Requirements: refer to specification Section 01 35 43.

1.8 REGULATORY REQUIREMENTS

- .1 Parks Canada:
 - .1 Work shall comply with or exceed the requirements of the following:
 - .1 Canada National Parks Act (S.C. 2000, c. 32), current edition to August 15, 2016.
 - .2 National Parks Building Regulations (C.R.C., c. 1114).
 - .2 References and Codes:
 - .1 Perform Work in accordance with New Brunswick Building Code Act (Bill 75), New Brunswick Regulation 90-128, and National Building Code of Canada (NBC), including amendments up to tender closing date, and other codes and by-laws of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
 - .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes, and referenced documents.
 - .3 Regions and Municipalities:
 - .1 The work shall comply with or exceed the requirements of by-laws and ordinances of the jurisdiction of the project and the direction of authorities having jurisdiction as determined by the Departmental Representative.

1.9 QUALITY CONTROL

- .1 Definitions:
 - .1 Corrective Action: Steps that are taken to remove the causes of an existing non-conformity or undesirable situation. The corrective action process is designed to prevent the recurrence of non-conformities or undesirable situations. It tries to make sure that existing non-conformities and situations do not happen again. It tries to prevent recurrence by eliminating causes.
 - .2 Hold Point: A mandatory verification point beyond which a Work Process cannot proceed without authorization by Departmental Representative. Hold Points may be nominated by Departmental Representative. The issuance of a Non-Conformance or Corrective Action report by Departmental Representative automatically creates a Hold Point for the Work Processes affected.
 - .3 Non-Conformance: When one or more characteristics of an installation fail to meet specified requirements, it is referred to as Non-conformance. When an installation deviates from specified requirements, it fails to conform. Non-conformance must be identified and rectified.
- .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 will order 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.
- .3 Independent Inspection Agencies:
 - .1 Independent Inspection/Testing Agencies will be selected by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
 - .2 Provide equipment required for executing inspection and testing by appointed agencies.
 - .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
 - .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative, Pay costs for retesting and re-inspection.
- .4 Access to Work:
 - .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
 - .2 Cooperate to provide reasonable facilities for such access.
- .5 Procedures:
 - .1 Notify appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.
 - .2 Submit samples or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays 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.
- .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 will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.
- .7 Reports:
 - .1 Submit electronic copies of inspection and test reports to Departmental Representative.
 - .2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

- .8 Tests and Mix Designs:
 - .1 Furnish test results and mix designs as requested.
 - .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.
- .9 Mock-Ups:
 - .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
 - .2 Construct in locations acceptable to Departmental Representative or as specified in specific Section.
 - .3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
 - .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension because of such default will be allowed.
 - .5 If requested, Departmental Representative will assist in preparing schedule, fixing dates for preparation.
 - .6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.
 - .7 Mock-ups may remain as part of Work.
 - .8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.
- .10 Mill Tests:
 - .1 Submit mill test certificates as requested or required of specification Sections.
- .11 Equipment and Systems:
 - .1 Submit adjustment and balancing reports for mechanical, electrical, and building equipment systems.

1.10 TEMPORARY UTILITIES

- .1 References:
 - .1 National Building Code of Canada 2015
 - .1 Part 8 Safety Measures and Construction and Demolition Sites.
 - .2 National Fire Code of Canada 2015
 - .1 Part 5 Hazardous Processes and Operations.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 Installation and Removal:
 - .1 Provide temporary utilities controls in order to execute work expeditiously.
 - .2 Remove from site all such work after use.
- .3 Water Supply:
 - .1 Provide continuous supply of potable water for construction use.
 - .2 Pay for utility charges at prevailing rates.
 - .3 Arrange for connection with appropriate utility company and pay costs for installation, maintenance, and removal.

- .4 Temporary Heating and Ventilation:
 - .1 Provide and pay for 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 degrees C in areas where construction is in progress.
 - .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
 - .6 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.
 - .7 Permanent heating system of building, not to be used unless authorized in writing by the Departmental Representative. Be responsible for damage to heating system if use is permitted.
 - .8 On completion of Work for which permanent heating system is used, replace filters and replace bearing. Thoroughly clean permanent equipment used during construction.
 - .9 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.
 - .10 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.
- .5 Temporary Power and Light:
 - .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools and equipment as required.
 - .2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Departmental Representative.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .5 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.
- .6 Temporary Communication Facilities:
 - .1 Provide and pay for temporary telephone, fax, and data hook up lines and equipment as required.
- .7 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.

1.11 CONSTRUCTION FACILITIES

- .1 Scaffolding:
 - .1 Scaffolding: to CAN/CSA S269.2-M87 (R2003) - Access Scaffolding for Construction Purposes.
 - .2 Provide and maintain scaffolding, ramps, ladders, platforms, and temporary stairs.
- .2 Hoisting:
 - .1 Provide, operate, and maintain hoists required for moving of materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
 - .2 Hoists to be operated by qualified operator.
- .3 Site Storage/Loading:
 - .1 Confine work and operations of employees by Contract Documents. Do not encumber premises with products.
 - .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.
- .4 Construction Parking:
 - .1 Parking will be permitted on site.
 - .2 Provide and maintain adequate access to project site.
- .5 Security:
 - .1 The Contractor is responsible for the security and safety of the site and building for the duration of the Contract.
 - .2 Provide fencing and additional security as deemed necessary.
- .6 Offices:
 - .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
 - .2 Provide marked and fully stocked first-aid case in a readily available location.
 - .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

- .4 The area of Work is available at Contractor's option for project administrative use.
- .7 Equipment, Tool and Materials Storage:
 - .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment, and materials.
 - .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.
- .8 Sanitary Facilities:
 - .1 Provide temporary sanitary facilities for work force in accordance with governing regulations and ordinances.
 - .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
 - .3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Departmental Representative.
- .9 Protection and Maintenance of Traffic:
 - .1 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
 - .2 Protect travelling public from damage to person and property.
 - .3 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
 - .4 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
 - .5 Dust control: adequate to ensure safe operation at all times.
 - .6 Provide snow removal during period of Work.
- .10 Clean-up:
 - .1 Remove construction debris, waste materials, packaging material from work site daily.
 - .2 Clean dirt or mud tracked onto paved or surfaced roadways.
 - .3 Store materials resulting from demolition activities that are salvageable.
 - .4 Stack stored new or salvaged material not in construction facilities.

1.12 TEMPORARY BARRIERS AND ENCLOSURES

- .1 Installation and Removal:
 - .1 Provide temporary controls in order to execute Work expeditiously.
 - .2 Remove from site all such work after use.
- .2 Weather Enclosures:
 - .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
 - .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
 - .3 Design enclosures to withstand wind pressure and snow loading.
- .3 Dust Tight Screens:
 - .1 Provide dust tight screens or 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.
- .4 Access to Site:
 - .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.
- .5 Fire Routes and Exits:
 - .1 Maintain access to property including overhead clearances for use by emergency response vehicles.
- .6 Protection of Off-Site and Public Property:
 - .1 Protect surrounding private and public property from damage during performance of Work.
 - .2 Be responsible for damage incurred.
- .7 Protection of Building Finishes:
 - .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
 - .2 Provide necessary screens, covers, and hoardings.
 - .3 Be responsible for damage incurred due to lack of or improper protection.

1.13 COMMON PRODUCT REQUIREMENTS

- .1 References:
 - .1 Within text of each specifications section, reference may be made to reference standards.
 - .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
 - .3 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested or to receive test data.
 - .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .2 Quality:
 - .1 Products, materials, equipment, and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source, and quality of products provided.
 - .2 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 disputes 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.

- .3 Availability:
 - .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be reviewed for possible authorization in ample time to prevent delay in performance of Work.
 - .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.
- .4 Storage, Handling and Protection:
 - .1 Handle and store products in manner to prevent damage, adulteration, deterioration, and soiling and in accordance with manufacturer's instructions when applicable.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
 - .3 Store products subject to damage from weather in weatherproof enclosures.
 - .4 Store cementitious products clear of earth or concrete floors, and away from walls.
 - .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
 - .6 Store 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 nameplates.
- .5 Transportation:
 - .1 Pay costs of transportation of products required in performance of Work.
- .6 Manufacturer's Instructions:
 - .1 Unless otherwise indicated in the 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.
- .7 Quality of Work:
 - .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in his or her 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.
- .8 Coordination:
 - .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.
- .9 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.
- .10 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.
- .11 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.
- .12 Fasteners:
 - .1 Fasteners used for exterior applications or at the exterior shell of buildings shall be SAE No. 304 stainless steel.
 - .2 Provide metal fastenings and accessories in same texture, colour, and finish as adjacent materials, unless indicated otherwise.
 - .3 Prevent electrolytic action between dissimilar metals and materials.
 - .4 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.
 - .5 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.
 - .6 Keep exposed fastenings to a minimum, space evenly and install neatly.
 - .7 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
- .13 Fasteners – 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 SAE 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.
- .14 Protection of Work in Progress:
 - .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.
- .15 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.
 - .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.

1.14 PRODUCT OPTIONS AND SUBSTITUTIONS

- .1 Definitions:
 - .1 Acceptable Materials: The term Acceptable Materials is used to specify products by trade name, manufacturer, catalogue number, model number, or similar reference, and is used within the Project Manual as follows:
 - .1 Acceptable Materials listings are based on Departmental Representative's determination that materials meet specified requirements and opinion of applicability to the project requirements.
 - .2 Acceptable Materials listings are deemed to establish the minimum standard of acceptance that Departmental Representative will consider appropriate for the Work.
 - .3 Any product listed in the Acceptable Materials listing may be used to establish the Bid Price, unless an Addendum is issued adding additional Acceptable Materials.
 - .2 Basis-of-Design: The term Basis-of-Design is used to specify a specific material name, manufacturer, catalogue number, model number, or similar reference and is used as follows:
 - .1 Basis-of-Design Materials are used to establish Departmental Representative's minimum criteria for a product based on performance, material properties, appearance, and configuration.
 - .2 Use the Basis-of-Design Material to establish the Bid Price, unless an Addendum is issued adding additional Acceptable Materials.
 - .3 Non-proprietary specification means a specification that includes descriptive, reference standard, or performance requirements, or any combination thereof, but does not include proprietary names of products or manufacturers.
 - .4 Substitution means a proposal from a Contractor to provide a product, material, or item of equipment not specified in the Contract documents but functionally equivalent and readily exchangeable to a specified item, for consideration by Departmental Representative.
- .2 Submittals:
 - .1 Submit complete data substantiating compliance of a product with requirements of Contract Documents. Include the following:
 - .1 Product identification, including manufacturer's name and address.
 - .2 Manufacturer's literature providing product description, applicable reference standards, and performance and test data.
 - .3 Samples, as applicable.

- .4 Name and address of projects on which product has been used and date of each installation.
- .5 For substitutions and requests for changes to accepted products, include in addition to the above, the following:
 - .1 Written verification that the substitute products can be obtained, meet the performance required for the project, and meet requirements of the National Building Code of Canada, 2015.
 - .2 Itemized comparison of substitution with named product(s). List significant variations.
 - .3 Designation of availability of maintenance services and sources of replacement materials.
- .3 Product Options:
 - .1 For products specified by non-proprietary specification:
 - .1 Select any product, assembly, or material that meets or exceeds the specified standards for products specified only by referenced standards and performance criteria.
 - .2 Acceptable Materials: Select any named product, assembly, or material contained in the listing of Acceptable Materials, unless an addendum is issued indicating acceptance of additional Acceptable Materials.
 - .3 Basis-of-Design: Use the named product contained in the Basis-of-Design Material listing, unless an addendum is issued indicating acceptance of additional Acceptable Materials.
- .4 Substitutions:
 - .1 Contractor will assemble requests for substitutions requested by subcontractors and submit to Departmental Representative for review.
 - .2 Departmental Representative will review proposed substitute products for acceptability only when submitted by Contractor; Departmental Representative will not review requests submitted independently by subcontractors.
 - .3 No substitutions will be permitted without Departmental Representative's written acceptance; Contractor will be required to remove products and replace with specified materials or provide a credit to the value of the contract at Departmental Representative's discretion where substitutions are found in the Work that have not been formally accepted by Departmental Representative.
 - .4 Departmental Representative is not obliged to accept any Proposed Substitution offered by Contractor, and reserves the right to dismiss any item with no further explanation.
 - .5 Substitute Products: Where substitute products are permitted, unnamed products may be accepted by Departmental Representative, subject to the following:
 - .1 Substitute products shall be the same type as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.
 - .6 Substitute Manufacturers: Where substitute manufacturers are permitted, unnamed manufacturers may be accepted by Departmental Representative, subject to the following:
 - .1 Substitute manufacturers shall have capabilities comparable to those of the named manufacturer(s). Substitutions shall not require revisions to Contract Documents nor to work of Other Contractors.

- .7 In making a proposal for substitution the Contractor represents:
 - .1 That they have personally investigated the proposal and (unless the proposal explicitly states otherwise) determined that it performs in a similar way or is superior to the product or method specified.
 - .2 That the same guaranty will be furnished as for the originally specified product or construction method.
 - .3 That they will coordinate installation of the accepted substitute into the Work, making such changes in the Work as may be required to accommodate the change.
 - .4 That they will bear costs and waives claims for additional compensation for costs and time that subsequently become apparent arising out of the substitution.

1.15 EXECUTION

- .1 Submittals:
 - .1 Submit written request in advance of cutting or alteration that 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.
 - .6 Tenants of occupied portions of building.
 - .2 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 or tenants.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time the Work will be executed.
- .2 Materials:
 - .1 Required for original installation.
 - .2 Change in Materials: Submit request for substitution in accordance with Submittal Procedures.
- .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 that are to be exposed by uncovering work; maintain excavations free of water.

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

1.16 CLEANING

- .1 Project Cleanliness:
 - .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Departmental Representative or other Contractors.
 - .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
 - .3 Clear snow and ice from access to building, bank/pile snow in designated areas only.
 - .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
 - .5 Provide on-site containers for collection of waste materials and debris.
 - .6 Provide and use marked separate bins for recycling. Refer to WASTE MANAGEMENT AND DISPOSAL.
 - .7 Dispose of waste materials and debris off site.
 - .8 Clean interior areas prior to start of finishing 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.
- .2 Final Cleaning:
 - .1 Clean work prior to final review by Departmental Representative.
 - .2 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
 - .3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
 - .4 Prior to final review remove surplus products, tools, construction machinery and equipment.
 - .5 Remove waste products and debris including that caused by Departmental Representative or other Contractors.
 - .6 Remove waste materials from site in accordance with WASTE MANAGEMENT AND DISPOSAL.
 - .7 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
 - .8 Remove stains, spots, marks, and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and horizontal hard surfaces.
 - .9 Clean lighting reflectors, lenses, and other lighting surfaces.
 - .10 Inspect finishes, fitments, and equipment and ensure specified workmanship and operation.
 - .11 Broom clean and wash exterior walks, steps, and surfaces; rake clean other surfaces of grounds.
 - .12 Remove dirt and other disfiguration from exterior surfaces.
 - .13 Sweep and wash clean paved areas.
 - .14 Clean drainage systems.
 - .15 Remove debris and surplus materials from accessible concealed spaces.

1.17 WASTE MANAGEMENT AND DISPOSAL

- .1 Waste Management Goals:
 - .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Waste Management Plan and Goals.
 - .2 Waste Management Goal is to divert 75% construction and demolition materials considered recyclable from landfill sites, and reduce jobsite waste in compliance with Canadian Construction Association CCA 81 - 2001: A Best Practices Guide to Solid Waste Reduction.
 - .3 Accomplish maximum control of solid construction and demolition waste.
 - .4 Preserve environment and prevent pollution and environment damage.
- .2 Definitions:
 - .1 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
 - .2 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

- .3 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .4 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Returning reusable items including pallets or unused products to vendors.
- .5 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .6 Separate Condition: refers to waste sorted into individual types.
- .7 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .3 Materials Source Separation Program (MSSP):
 - .1 Prepare MSSP and have ready for use prior to project start-up.
 - .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
 - .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
 - .4 Provide containers to deposit reusable and recyclable materials.
 - .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
 - .6 Locate separated materials in areas that minimize material damage.
 - .7 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Transport to approved and authorized recycling facility.
 - .2 Ship materials to site operating under Certificate of Approval.
 - .3 Materials must be immediately separated into required categories for reuse or recycling.
- .4 Storage, Handling and Protection:
 - .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
 - .2 Unless specified otherwise, materials for removal become Contractor's property.
 - .3 Protect, stockpile, store and catalogue salvaged items.
 - .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
 - .5 Protect structural components not removed for demolition from movement or damage.
 - .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
 - .7 Protect surface drainage, mechanical and electrical from damage and blockage.
 - .8 Separate and store materials produced during dismantling of structures in designated areas.
 - .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.

- .5 Disposal of Waste:
 - .1 Do not bury rubbish or waste materials.
 - .2 Burning rubbish and construction waste materials is not permitted on site.
 - .3 Do not dispose of waste, volatile materials, mineral spirits, oil, and paint thinner into waterways, storm, or sanitary sewers.
 - .4 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Reused or recycled waste destination.
 - .5 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

1.18 CLOSEOUT PROCEDURES

- .1 Inspection and Declaration:
 - .1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Field Review.
 - .3 Departmental Representative's Field Review: Departmental Representative and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
 - .2 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract.
 - .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, Fire Commissioner, 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, Departmental Representative, and Contractor. If Work is deemed incomplete by Departmental Representative complete outstanding items and request re-inspection.
 - .4 Declaration of Certificate of Substantial Performance: when Departmental Representative consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.
 - .5 Commencement of Lien and Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

- .6 Final Payment: when Departmental Representative consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .7 Payment of Holdback: after issuance of certificate of Substantial Performance, submit an application for payment of holdback amount.
- .2 Cleaning:
 - .1 In accordance with CLEANING.
 - .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with WASTE MANAGEMENT AND DISPOSAL.

1.19 CLOSEOUT SUBMITTALS

- .1 Submittals in accordance with SUBMITTAL PROCEDURES:
 - .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, submit to the Departmental Representative, two final copies and one digital version of Operating and Maintenance manuals 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 Furnish evidence, if requested, for 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.
 - .9 Submit `redline` marked up construction drawings to the Departmental Representative within 30 days of Substantial Performance and prior to Final Completion.
- .2 Operations and Maintenance Manual Format:
 - .1 Organize data as instructional manual.
 - .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
 - .3 When multiple binders are used correlate data into related consistent groupings. 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, process flow, under Section numbers and sequence of Table of Contents.
 - .6 Provide tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .7 Text: manufacturer's printed data, or typewritten data.
 - .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
 - .9 Provide 1:1 scaled CAD files in .dwg format on high-quality USB flash drive.

- .10 Provide scans of 1:1 scaled CAD drawings and as-built mark-ups in pdf format on high-quality USB flash drive.
- .3 Contents – Each Volume:
 - .1 Table of Contents: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
 - .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
 - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
 - .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- .4 As-Built Drawings and Samples:
 - .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
 - .2 Store record documents and samples in field office apart from documents used for construction. 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.
- .5 Recording Actual Site Conditions:
 - .1 Record information on set of 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: 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: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.
- .6 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.
- .7 Maintenance Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site, location as directed; place and store.
 - .4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Operating and Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .8 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site, location as directed; place and store.
 - .4 Receive and catalogue items. Submit inventory listing to Departmental Representative. Include approved listings in Operating and Maintenance Manual.

- .9 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.
- .10 Warranties and Bonds:
 - .1 Develop warranty management plan to contain information relevant to Warranties.
 - .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
 - .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
 - .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
 - .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
 - .6 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
 - .7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
 - .8 Conduct joint 4-month and 9-month warranty inspection, measured from time of acceptance, by Departmental Representative.
 - .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, pumps, motors, transformers.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.

- .5 Names, addresses and telephone numbers of sources of spare parts.
- .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
- .7 Cross-reference to warranty certificates as applicable.
- .8 Starting point and duration of warranty period.
- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4-month and 9-month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification will follow oral instructions. Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.
- .11 Pre-Warranty Conference:
 - .1 Meet with Departmental Representative to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Departmental Representative.
 - .2 Departmental Representative will establish communication procedures for:
 - .1 Notification of construction warranty defects.
 - .2 Determine priorities for type of defect.
 - .3 Determine reasonable time for response.
 - .3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.
- .12 Equipment Warranty Tags:
 - .1 Tag, at time of installation, each warranted equipment item. Provide durable, oil and water-resistant tag approved by Departmental Representative.
 - .2 Attach tags with copper wire and spray with waterproof silicone coating.
 - .3 Leave date of acceptance until project is accepted for occupancy.
 - .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Contractor.

END OF SECTION

1.1 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2 FIRES

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

1.3 DISPOSAL OF WASTES

- .1 Disposal of wastes, to Section 01 11 00 – General Requirements: Waste Management and Disposal.
 - .1 Do not bury rubbish and waste materials on site. Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.4 DRAINAGE

- .1 Do not pump water containing suspended materials into waterways or drainage systems. Migration to water retention pond is allowed.
- .2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.5 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site unless otherwise indicated on Drawings.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to footprint of new construction, or as additionally designated and approved by Departmental Representative.

1.6 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material.
- .3 Do not dump excavated fill, waste material or debris in waterways.

1.7 POLLUTION CONTROL

- .1 Prior to the commencement of construction activities, prepare an Environmental Protection plan that addresses procedures to follow in the event of a pollution incident, and ensure all staff are aware of these procedures. Provide copy of plan to the Departmental Representative.
- .2 Immediately report any environmental emergency, such as a spill of a contaminant for example, to Environment and Climate Change Canada, Maritimes Regional Office Canadian Coast Guard, Fisheries and Oceans Canada; contact number: 902-426-6030 or 1-800-565-1633.
- .3 Remove temporary erosion and pollution control measures prior to project completion unless directed otherwise.
- .4 Control emissions from equipment to requirements of authority having jurisdiction and directions of Departmental Representative.
- .5 Provide temporary enclosures to protect environment from effects of construction-generated deleterious airborne materials.
- .6 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- .7 Keep paved surfaces clean. Control dust by application of calcium chloride, magnesium chloride or water.

1.8 PERMITS AND APPROVALS

- .1 Obtain copies of any permits or approvals issued by agencies having jurisdiction. Review and comply with the conditions contained in the permit or approval.
- .2 Where permits or approvals are required and not obtained at time of bidding, be responsible for obtaining permits or approvals.
 - .1 List all activities that require approval as identified by the Clean Air Act, Clean Water Act, and Clean Environmental Act, and related Regulations of the Province of New Brunswick, and Parks Canada.
- .3 Inform employees and subcontractors of the terms and conditions of any permit or approval.

1.9 NOTIFICATION

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

END OF SECTION

1.1 REFERENCES

- .1 Identification of existing survey control points and property limit.

1.2 QUALIFICATIONS OF SURVEYOR

- .1 Construction Manager shall contract the services of a Land Surveyor licensed to practice in New Brunswick and acceptable to Departmental Representative
- .2 Surveyor shall be a member in good standing of The Association of New Brunswick Land Surveyors and have a current Certificate of Authorization.

1.3 SURVEY REFERENCE POINTS

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

1.4 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data, in Project record and as-built documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation column locations and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

1.5 EXISTING SERVICES

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

1.6 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.7 RECORDS

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

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting elevations and locations of completed as-built Work, identifying elements not in conformance with Contract Documents.
- .4 Submit final as-built survey on CD or DVD in AutoCAD and SketchUp formats.

1.9 SUBSURFACE CONDITIONS

- .1 Promptly notify Departmental Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Departmental Representative determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE
STANDARDS

- .1 CSA Group (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA O86-14, Engineering Design in Wood.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA O153-13(R2017), Poplar Plywood.
 - .6 CAN/CSA O325.0-16, Construction Sheathing.
 - .7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
 - .8 CSA S269.1-16, Falsework and Formwork.
 - .9 CAN/CSA S269.3-M92(R2013), Concrete Formwork.
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 ADMINISTRATIVE
REQUIREMENTS

- .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure key personnel, site supervisor, Parks Canada Representative, speciality contractor - finishing, forming, concrete producer, testing laboratories attend.
 - .1 Verify project requirements.

1.3 DELIVERY,
STORAGE AND
HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 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 formwork from damages.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Form release agent: Proprietary, non volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non petroleum containing, non-toxic, biodegradable, low VOC.

PART 3 - EXECUTION

- 3.1 FABRICATION AND ERECTION
- .1 Verify lines, levels, and centres before proceeding with formwork and ensure dimensions agree with drawings.
 - .2 Fabricate and erect formwork in accordance with CAN/CSA S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.
 - .3 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
 - .4 Use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners, joints, unless specified otherwise.
 - .5 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
 - .6 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
 - .7 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.
- 3.2 REMOVAL AND RESHORING
- .1 Leave formwork in place for 3 days after placing concrete.
-

3.2 REMOVAL AND
RESHORING
(Cont'd)

- .1 (Cont'd)
 - .1 2 days for walls and sides of beams.
 - .2 2 days for columns.
 - .3 5 14 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework.
 - .4 2 days for footings and abutments.
- .2 Remove formwork when concrete has reached 70 % of its 28 day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

3.3 CLEANING

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

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS
- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .2 ASTM International (ASTM)
 - .1 ASTM A1064/A1064M-18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .3 CSA Group (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA A23.3-14, Design of Concrete Structures.
 - .3 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2018, Reinforcing Steel Manual of Standard Practice.
- 1.2 ADMINISTRATIVE REQUIREMENTS
- .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure key personnel, site supervisor, Parks Canada Representative, speciality contractor - finishing, forming attend.
 - .1 Verify project requirements.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.
-

- 1.3 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in New Brunswick.
 - .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.
 - .2 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Parks Canada Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - .3 Detail lap lengths and bar development lengths to CAN/CSA A23.3.
 - .4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.
 - .3 Quality Assurance Submittals:
 - .1 Upon request, submit in writing to Parks Representative, proposed source of reinforcement material.

- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 Storage and Handling Requirements:
 - .1 Store materials in dry location 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 Substitute different size bars only if permitted in writing by Parks Canada Representative.
-

2.1 MATERIALS
(Cont'd)

- .2 Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.
- .3 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .4 Deformed steel wire for concrete reinforcement: to ASTM A1064/A1064M.
- .5 Welded steel wire fabric:
 - .1 Deformed in accordance ASTM A1064/A1064M, fabricated from as drawn steel wire into flat sheets; sizes as indicated on Drawings.
 - .2 Provide in flat sheets only.
- .6 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.
- .7 Tie wire: 1.5 mm diameter annealed wire, epoxy coated.
- .8 Mechanical splices: subject to approval of Parks Canada Representative.
- .9 Plain round bars: to CSA G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2, SP-66 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Parks Canada Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Parks Canada Representative, weld reinforcement in accordance with CSA W186.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Parks Canada Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
 - .2 Upon request inform Parks Canada Representative of proposed source of supplied material.
-

PART 3 - EXECUTION

- 3.1 FIELD BENDING
- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Parks Canada Representative.
 - .2 When field bending authorized, bend without heat, applying slow and steady pressure.
 - .3 Replace bars, which develop cracks or splits.
- 3.2 PLACING REINFORCEMENT
- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1/A23.2.
 - .2 Prior to placing concrete, obtain Parks Canada Representative's approval of reinforcing material and placement.
 - .3 Maintain cover to reinforcement during concrete pour.
- 3.3 FIELD QUALITY CONTROL
- .1 Inspection or testing by Consultant not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.
- 3.4 CLEANING
- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 This section specifies the requirements for providing all labour, tools, materials and equipment to perform all cast-in-place concrete Work.
- 1.2 RELATED REQUIREMENTS .1 Division 01 - General Requirements.
.2 Section 03 20 00 - Concrete Reinforcing.
- 1.3 REFERENCE STANDARDS .1 American Society for Testing and Materials (ASTM International)
.1 ASTM C109/C109M-16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
.2 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
.3 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.4 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
.5 ASTM C827/C827M-16, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
.6 ASTM C939/C939M-16a, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
.2 Canadian Standards Association (CSA International)
.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.2 CSA A283-06(R2016), Qualification Code for Concrete Testing Laboratories.
.3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- 1.4 ADMINISTRATIVE REQUIREMENTS .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.
-

- 1.4 ADMINISTRATIVE REQUIREMENTS (Cont'd)
- .1 (Cont'd)
 - .1 Ensure site supervisor, Parks Canada Representative, specialty contractor - finishing, forming, concrete producer, testing laboratories attend.
 - .1 Verify project requirements.
- 1.5 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Prior to commencing concrete work, submit shop drawings to Parks Canada Representative for review containing the following for each concrete mix:
 - .1 Cement type.
 - .2 Minimum compressive strength at 28 days.
 - .3 Class of exposure.
 - .4 Nominal size of coarse aggregate.
 - .5 Air content.
 - .6 Slump at time and point of discharge.
 - .2 Provide two (2) copies of WHMIS MSDS.
 - .3 Certificates:
 - .1 Minimum four (4) weeks prior to starting concrete Work, submit to Parks Canada Representative the manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Supplementary cementing materials.
 - .1 For fly ash, upon request provide details of supply, supplier's quality control program, test data for at least three (3) samples from the previous months supply and details of proposed quality control tests to be made between shipment to concrete supplier and use in:
 - .1 Grout.
 - .2 Admixtures.
 - .3 Aggregates.
 - .4 Water.
 - .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA- A23.1.
 - .3 Provide certification that mix proportions selected will produce concrete of specified quality, yield and strength will comply with CSA-A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.
-

1.5 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd) .3 (Cont'd)
.4 Provide written confirmation from concrete supplier the percent replacement of mass of Portland cement for fly ash/supplementary cementing materials for all concrete mix designs.

1.6 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements:
.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
.1 Do not modify maximum time limit without receipt of prior written agreement from Parks Canada Representative and concrete producer as described in CSA A23.1/A23.2.
.2 Deviations to be submitted for review by Parks Canada Representative.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Portland Cement and Supplementary Cementing: to CSA A3000 and CSA A23.1.
.2 Water: to CSA A23.1.
.3 Aggregates: to CSA A23.1. Coarse aggregates normal density.
.4 Admixtures:
.1 Air entraining admixture: to ASTM C260.
.2 Chemical admixture: to ASTM C494. Parks Canada Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
.5 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1.
.1 Compressive strength: 50 MPa at 28 days.
.2 Consistency:
.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 s.
.2 Flowable: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portion) 125 to 145%.

- 2.1 MATERIALS .5 (Cont'd)
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- (Cont'd) .2 (Cont'd)
- .3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125%.
- .3 Acceptable products: SikaGrout 212 as manufactured by Sika Canada Inc., Masterflow 928 as manufactured by BASF Corporation, or approved alternate.
- .6 Curing compound: to CSA A23.1 or to ASTM C309, Type 1-D with fugitive dye.
- .7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.
- 2.2 MIXES .1 General: Where practically possible, concrete supplier to maximize the amount Portland cement replaced with fly ash or another approved cementitious recycled material while maintaining the characteristics listed for each concrete mix listed as well as the workability of each mix. Concrete supplier to provide written confirmation of the percent replacement of Portland cement for fly ash/supplementary cementing materials for all mix designs.
- .2 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give the following properties for all concrete:
- .1 Cement: Type GU.
- .2 Minimum compressive strength at 28 days: 35 MPa.
- .3 Class of exposure: C-1.
- .4 Nominal size of coarse aggregate: 20 mm.
- .5 Slump at time and point of discharge: 80 mm ±30 mm.
- .6 Air content: 5 to 8%.
- .7 Chemical admixtures: type as approved, and in accordance with ASTM C494.
- .8 A concrete mix design shall be provided by the Contractor based on trial mixes that have been designed and tested by a qualified Professional engineer registered or licensed to practice in the Province of New Brunswick and submitted for approval to Parks Canada Representative.
-

- 2.2 MIXES
(Cont'd)
- .2 (Cont'd)
- .9 Air-void network parameters in the hardened concrete shall be demonstrated to meet CSA A23.1 Clause 4.3.3.4 after pumping. Test results shall be submitted for samples obtained after pumping, using the same equipment and heights expected for concrete placement on site.
- .10 Concrete shall be prequalified by testing in accordance with CSA A23.2-21C, except that drying in air at 50% RH shall commence after a total of 7 days of wet curing, and the initial comparator reading (zero-day reading) shall be taken at the end of the wet curing period immediately before the commencement of drying. Concrete shrinkage after 28 days of drying (at the concrete age of 35 days) shall not exceed 0.035% when tested using a prism with a cross section of 100 x 100 mm.

PART 3 - EXECUTION

- 3.1 PREPARATION
- .1 Obtain Parks Canada Representative's written approval before placing concrete.
- .1 Provide 48 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Pumping of concrete is permitted only after approval of equipment and mix.
- .4 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .5 Prior to placing of concrete obtain Parks Canada Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .7 Do not place load upon new concrete until concrete has attained sufficient strength to sustain loads without damage and not until authorized by Parks Canada Representative.
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- 3.1 PREPARATION
(Cont'd)
- .8 Concrete protective cover to reinforcement as noted on the drawings.
- .9 Accurately support bars on plastic coated steel chairs to maintain exact cover requirements.
- .10 In cold weather protect concrete work to CSA-A23.1 and following:
- .1 Cold weather is defined as a period when the mean air temperature drops below 5°C for more than three successive days.
- .2 When air temperature is above 0°C and is forecast to remain so for 48 hours after placing, insulated tarps are acceptable protection provided concrete temperatures are monitored and comply with temperature limits specified in the following paragraph.
- .3 For all other cold weather conditions protect concrete with a windproof enclosure of canvas or other material to allow free circulation of inside air around fresh concrete. Do not let walls of enclosure touch formwork and provide sufficient space for removal of formwork and for finishing. Supply approved heating equipment capable of keeping inside air at sufficiently curing temperatures:
- .1 For an initial three days, at a temperature of not less than 15°C.
- .2 Maintain concrete at temperatures of not less than 10°C for a total period of seven days plus the initial three days specified above.
- .3 At no time shall concrete temperatures exceed 30°C at surfaces.
- .4 Reduce enclosure air temperature at a rate not exceeding 10°C per day until outside air temperature has been reached.
- .5 Take temperature readings both of air and of concrete surfaces at several points within area protected at start and at end of working day. Maintain complete records of temperature readings.
- .4 Confirm concrete has cured without suffering damage. When enclosure is provided, avoid rapid drying of the concrete.
- .11 Monitor concrete temperature and moisture evaporation rates and provide appropriate hot weather protection as defined in CSA-A23.1. Maintain records of all measurements during hot weather periods for review by the Parks Canada Representative.
-

3.2 INSTALLATION/
APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1.
- .2 Sleeves, inserts and openings:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Parks Canada Representative.
 - .2 Where approved by Parks Canada Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed and approved by Parks Canada Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Parks Canada Representative before placing of concrete.
 - .5 Confirm and coordinate locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Core-drilling/cutting:
 - .1 Core-drilling/cutting of holes in any concrete element is not permitted without written consent from the Parks Canada Representative. All proposed core-drilling/cutting must be submitted to the Parks Canada Representative for review prior to execution of work. Request for core-drilling/cutting must have 72 hours notice to allow Parks Canada Representative time to review proposed locations.
- .4 Concrete placement:
 - .1 Place concrete as specified in CSA- A23.1.
 - .2 Inform Parks Canada Representative at least 48 hours before each concrete placing operation.
 - .3 Do not place concrete when it is raining or likely to rain. If rain begins after concrete is placed, protect with waterproof covers until set.
 - .4 Do not permit vertical free fall of concrete mix to exceed 1500mm.
 - .5 For exposed concrete, take special precautions when placing to prevent segregation of concrete, and to avoid cold joints, honeycombing or voids. Do not allow vibrator to touch formwork.

3.2 INSTALLATION/
APPLICATION
(Cont'd)

- .4 (Cont'd)
- .6 Use form vibrators only when sections are too narrow for internal type. Employ a sufficient number of vibrators to ensure complete consolidation of concrete throughout entire volume of each layer. Have available at least one extra vibrator on hand for emergency.
 - .7 Do not use vibrators for the use of moving concrete.
 - .8 Use only tools and handling equipment that are clear of rust or other harmful and foreign material to avoid efflorescence and staining of slabs or hardened concrete.
 - .9 Use concrete pumps to place concrete only with approval of methods, equipment and mix design.
 - .10 Provide continuous supervision during placement of concrete including concrete grout to ensure reinforcing steel is maintained in correct position.
 - .11 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling and without damage to existing structure or Work.
- .5 Grout where indicated using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .6 Finishing and curing:
 - .1 Finish concrete to CSA A23.1.
 - .2 Use smooth form finish for all formed concrete surfaces. Use form facing material that will produce a smooth, hard, uniform texture on the concrete. Do not use material with raised grain, torn surfaces, worn edges, patches, dents or other defects that will impair the texture of the concrete surface. Patch the holes and defects. Completely remove fins.
 - .3 Use smooth steel trowel finish.
 - .4 Rub exposed sharp edges of concrete with carborundum to produce 3mm radius edges unless otherwise indicated.
 - .5 Immediately after placing concrete cure all deck surfaces using a layer of polyethylene placed immediately over wet burlap. Keep the burlap wet at all times. Keep covered for a minimum of 7 days and until a compressive strength of 27 MPa is attained.
 - .6 Tolerance:
-

- 3.2 INSTALLATION/
APPLICATION
(Cont'd)
- .6 (Cont'd)
- .6 (Cont'd)
- .1 Finish surfaces to within 3 mm in 1 m as measured with a 1m straight edge placed on surface.
- .7 The temperature of water used for moisture curing shall not be more than 7°C colder than the temperature of the concrete.
- 3.3 REPAIRS
- .1 In the event that the post-finishing survey shows that the concrete surface does not meet the specified tolerances, take corrective action within five (5) working days, or as directed by the Parks Canada Representative.
- .2 Submit proposed corrective action in writing, with complete details of methods, tools, and materials for the Parks Canada Representative's approval. Upon acceptance of the proposed method, a test area is to be prepared, and upon acceptance, will be the standard for the remainder of the repairs.
- .3 Grind down high points to a smooth surface conforming to the specifications and with a surface finish equal to the remainder. If cutting or chipping by hammer is required at high areas, then the area is to be cut low with square saw cut edges, and patched as noted below.
- 3.4 FIELD QUALITY
CONTROL
- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Parks Canada Representative for review to CSA A23.1.
- .2 Test cylinders, a minimum of three (3) cylinders, to be provided as follows:
- .1 Each day's pour.
- .2 Each change of supplier.
- .3 Each 50 m³ or fraction thereof.
- .4 Additional test cylinders at the request of the Parks Canada Representative.
- .5 If Contractor wants to strip formwork early, request additional cylinders to be cast and pay for additional cylinders and testing of the additional cylinders.
-

3.4 FIELD QUALITY CONTROL
(Cont'd)

- .3 Parks Canada Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-Destructive Methods for Testing Concrete: to CSA A23.2.
- .5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
- .6 Secure all cylinders in an approved storage medium, prior to leaving the site.
- .7 The Parks Canada Representative reserves the right to reject any concrete which does not meet all the requirements for the class of concrete specified. The Parks Canada Representative also reserves the right to reject any portion of a placement if there exists evidence that this portion has a strength that is below the minimum acceptable required under this section. The Parks Canada Representative may accept concrete which does not meet the specified strength requirements provided that the structural integrity of the section is not jeopardized.
- .8 Test concrete in accordance with CSA A23.1. If three or more sets of cylinders are cast during one placement, the strength of each class of concrete will be considered satisfactory if the average of all regular sets, 28 day strength tests, equals or exceeds the specified strength. If less than three strength tests are performed, acceptance will be based on the average of the test results conducted on the section. If the concrete fails to meet the specified strength by more than 5 MPa, the Parks Canada Representative may order replacement or reinforcing, at the Contractor's expense, of the sections in the structure.
- .9 Alternatively, at the Parks Canada Representative's discretion, concrete of a specific class which is otherwise acceptable, but fails to meet the specified strength by less than 5 MPa, may be accepted. Coring of the concrete to verify strength will be permitted only for concrete which is to be replaced or reinforced. When coring is permitted, cores shall be taken at locations directed by the Parks Canada Representative.

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS
- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .2 ASTM International (ASTM)
 - .1 ASTM A1064/A1064M-18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .3 CSA Group (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA A23.3-14, Design of Concrete Structures.
 - .3 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2018, Reinforcing Steel Manual of Standard Practice.
- 1.2 ADMINISTRATIVE REQUIREMENTS
- .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure key personnel, site supervisor, Parks Canada Representative, speciality contractor - finishing, forming attend.
 - .1 Verify project requirements.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish, and limitations.
-

- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
(Cont'd)
-
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in New Brunswick.
 - .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.
 - .2 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Parks Canada Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - .3 Detail lap lengths and bar development lengths to CAN/CSA A23.3.
 - .4 Indicate position and size of openings in slabs and walls. Coordinate with trades requiring openings.
 - .3 Quality Assurance Submittals:
 - .1 Upon request, submit in writing to Parks Representative, proposed source of reinforcement material.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials in dry location 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 Substitute different size bars only if permitted in writing by Parks Canada Representative.
-

2.1 MATERIALS
(Cont'd)

- .2 Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.
- .3 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .4 Deformed steel wire for concrete reinforcement: to ASTM A1064/A1064M.
- .5 Welded steel wire fabric:
 - .1 Deformed in accordance ASTM A1064/A1064M, fabricated from as drawn steel wire into flat sheets; sizes as indicated on Drawings.
 - .2 Provide in flat sheets only.
- .6 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.
- .7 Tie wire: 1.5 mm diameter annealed wire, epoxy coated.
- .8 Mechanical splices: subject to approval of Parks Canada Representative.
- .9 Plain round bars: to CSA G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2, SP-66 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Parks Canada Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Parks Canada Representative, weld reinforcement in accordance with CSA W186.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Parks Canada Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.
 - .2 Upon request inform Parks Canada Representative of proposed source of supplied material.
-

PART 3 - EXECUTION

- 3.1 FIELD BENDING
- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Parks Canada Representative.
 - .2 When field bending authorized, bend without heat, applying slow and steady pressure.
 - .3 Replace bars, which develop cracks or splits.
- 3.2 PLACING REINFORCEMENT
- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1/A23.2.
 - .2 Prior to placing concrete, obtain Parks Canada Representative's approval of reinforcing material and placement.
 - .3 Maintain cover to reinforcement during concrete pour.
- 3.3 FIELD QUALITY CONTROL
- .1 Inspection or testing by Consultant not to augment or replace Contractor quality control nor relieve Contractor of contractual responsibility.
- 3.4 CLEANING
- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 This section specifies the requirements for providing all labour, tools, materials and equipment to perform all cast-in-place concrete Work.
- 1.2 RELATED REQUIREMENTS .1 Division 01 - General Requirements.
.2 Section 03 20 00 - Concrete Reinforcing.
- 1.3 REFERENCE STANDARDS .1 American Society for Testing and Materials (ASTM International)
.1 ASTM C109/C109M-16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
.2 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
.3 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.4 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
.5 ASTM C827/C827M-16, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
.6 ASTM C939/C939M-16a, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
.2 Canadian Standards Association (CSA International)
.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
.2 CSA A283-06(R2016), Qualification Code for Concrete Testing Laboratories.
.3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- 1.4 ADMINISTRATIVE REQUIREMENTS .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.
-

- 1.4 ADMINISTRATIVE REQUIREMENTS (Cont'd)
- .1 (Cont'd)
 - .1 Ensure site supervisor, Parks Canada Representative, specialty contractor - finishing, forming, concrete producer, testing laboratories attend.
 - .1 Verify project requirements.
- 1.5 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Prior to commencing concrete work, submit shop drawings to Parks Canada Representative for review containing the following for each concrete mix:
 - .1 Cement type.
 - .2 Minimum compressive strength at 28 days.
 - .3 Class of exposure.
 - .4 Nominal size of coarse aggregate.
 - .5 Air content.
 - .6 Slump at time and point of discharge.
 - .2 Provide two (2) copies of WHMIS MSDS.
 - .3 Certificates:
 - .1 Minimum four (4) weeks prior to starting concrete Work, submit to Parks Canada Representative the manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Supplementary cementing materials.
 - .1 For fly ash, upon request provide details of supply, supplier's quality control program, test data for at least three (3) samples from the previous months supply and details of proposed quality control tests to be made between shipment to concrete supplier and use in:
 - .1 Grout.
 - .2 Admixtures.
 - .3 Aggregates.
 - .4 Water.
 - .2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA- A23.1.
 - .3 Provide certification that mix proportions selected will produce concrete of specified quality, yield and strength will comply with CSA-A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.
-

1.5 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd) .3 (Cont'd)
.4 Provide written confirmation from concrete supplier the percent replacement of mass of Portland cement for fly ash/supplementary cementing materials for all concrete mix designs.

1.6 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements:
.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
.1 Do not modify maximum time limit without receipt of prior written agreement from Parks Canada Representative and concrete producer as described in CSA A23.1/A23.2.
.2 Deviations to be submitted for review by Parks Canada Representative.

PART 2 - PRODUCTS

2.1 MATERIALS .1 Portland Cement and Supplementary Cementing: to CSA A3000 and CSA A23.1.
.2 Water: to CSA A23.1.
.3 Aggregates: to CSA A23.1. Coarse aggregates normal density.
.4 Admixtures:
.1 Air entraining admixture: to ASTM C260.
.2 Chemical admixture: to ASTM C494. Parks Canada Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
.5 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1.
.1 Compressive strength: 50 MPa at 28 days.
.2 Consistency:
.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 s.
.2 Flowable: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portion) 125 to 145%.

- 2.1 MATERIALS .5 (Cont'd)
-
- (Cont'd) .2 (Cont'd)
- .3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125%.
- .3 Acceptable products: SikaGrout 212 as manufactured by Sika Canada Inc., Masterflow 928 as manufactured by BASF Corporation, or approved alternate.
- .6 Curing compound: to CSA A23.1 or to ASTM C309, Type 1-D with fugitive dye.
- .7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.
- 2.2 MIXES .1 General: Where practically possible, concrete supplier to maximize the amount Portland cement replaced with fly ash or another approved cementitious recycled material while maintaining the characteristics listed for each concrete mix listed as well as the workability of each mix. Concrete supplier to provide written confirmation of the percent replacement of Portland cement for fly ash/supplementary cementing materials for all mix designs.
- .2 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give the following properties for all concrete:
- .1 Cement: Type GU.
- .2 Minimum compressive strength at 28 days: 35 MPa.
- .3 Class of exposure: C-1.
- .4 Nominal size of coarse aggregate: 20 mm.
- .5 Slump at time and point of discharge: 80 mm ±30 mm.
- .6 Air content: 5 to 8%.
- .7 Chemical admixtures: type as approved, and in accordance with ASTM C494.
- .8 A concrete mix design shall be provided by the Contractor based on trial mixes that have been designed and tested by a qualified Professional engineer registered or licensed to practice in the Province of New Brunswick and submitted for approval to Parks Canada Representative.
-

- 2.2 MIXES
(Cont'd)
- .2 (Cont'd)
- .9 Air-void network parameters in the hardened concrete shall be demonstrated to meet CSA A23.1 Clause 4.3.3.4 after pumping. Test results shall be submitted for samples obtained after pumping, using the same equipment and heights expected for concrete placement on site.
- .10 Concrete shall be prequalified by testing in accordance with CSA A23.2-21C, except that drying in air at 50% RH shall commence after a total of 7 days of wet curing, and the initial comparator reading (zero-day reading) shall be taken at the end of the wet curing period immediately before the commencement of drying. Concrete shrinkage after 28 days of drying (at the concrete age of 35 days) shall not exceed 0.035% when tested using a prism with a cross section of 100 x 100 mm.

PART 3 - EXECUTION

- 3.1 PREPARATION
- .1 Obtain Parks Canada Representative's written approval before placing concrete.
- .1 Provide 48 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Pumping of concrete is permitted only after approval of equipment and mix.
- .4 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .5 Prior to placing of concrete obtain Parks Canada Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .7 Do not place load upon new concrete until concrete has attained sufficient strength to sustain loads without damage and not until authorized by Parks Canada Representative.
-

- 3.1 PREPARATION
(Cont'd)
- .8 Concrete protective cover to reinforcement as noted on the drawings.
- .9 Accurately support bars on plastic coated steel chairs to maintain exact cover requirements.
- .10 In cold weather protect concrete work to CSA-A23.1 and following:
- .1 Cold weather is defined as a period when the mean air temperature drops below 5°C for more than three successive days.
- .2 When air temperature is above 0°C and is forecast to remain so for 48 hours after placing, insulated tarps are acceptable protection provided concrete temperatures are monitored and comply with temperature limits specified in the following paragraph.
- .3 For all other cold weather conditions protect concrete with a windproof enclosure of canvas or other material to allow free circulation of inside air around fresh concrete. Do not let walls of enclosure touch formwork and provide sufficient space for removal of formwork and for finishing. Supply approved heating equipment capable of keeping inside air at sufficiently curing temperatures:
- .1 For an initial three days, at a temperature of not less than 15°C.
- .2 Maintain concrete at temperatures of not less than 10°C for a total period of seven days plus the initial three days specified above.
- .3 At no time shall concrete temperatures exceed 30°C at surfaces.
- .4 Reduce enclosure air temperature at a rate not exceeding 10°C per day until outside air temperature has been reached.
- .5 Take temperature readings both of air and of concrete surfaces at several points within area protected at start and at end of working day. Maintain complete records of temperature readings.
- .4 Confirm concrete has cured without suffering damage. When enclosure is provided, avoid rapid drying of the concrete.
- .11 Monitor concrete temperature and moisture evaporation rates and provide appropriate hot weather protection as defined in CSA-A23.1. Maintain records of all measurements during hot weather periods for review by the Parks Canada Representative.
-

3.2 INSTALLATION/
APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1.
- .2 Sleeves, inserts and openings:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Parks Canada Representative.
 - .2 Where approved by Parks Canada Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed and approved by Parks Canada Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Parks Canada Representative before placing of concrete.
 - .5 Confirm and coordinate locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Core-drilling/cutting:
 - .1 Core-drilling/cutting of holes in any concrete element is not permitted without written consent from the Parks Canada Representative. All proposed core-drilling/cutting must be submitted to the Parks Canada Representative for review prior to execution of work. Request for core- drilling/cutting must have 72 hours notice to allow Parks Canada Representative time to review proposed locations.
- .4 Concrete placement:
 - .1 Place concrete as specified in CSA- A23.1.
 - .2 Inform Parks Canada Representative at least 48 hours before each concrete placing operation.
 - .3 Do not place concrete when it is raining or likely to rain. If rain begins after concrete is placed, protect with waterproof covers until set.
 - .4 Do not permit vertical free fall of concrete mix to exceed 1500mm.
 - .5 For exposed concrete, take special precautions when placing to prevent segregation of concrete, and to avoid cold joints, honeycombing or voids. Do not allow vibrator to touch formwork.

3.2 INSTALLATION/
APPLICATION
(Cont'd)

- .4 (Cont'd)
- .6 Use form vibrators only when sections are too narrow for internal type. Employ a sufficient number of vibrators to ensure complete consolidation of concrete throughout entire volume of each layer. Have available at least one extra vibrator on hand for emergency.
 - .7 Do not use vibrators for the use of moving concrete.
 - .8 Use only tools and handling equipment that are clear of rust or other harmful and foreign material to avoid efflorescence and staining of slabs or hardened concrete.
 - .9 Use concrete pumps to place concrete only with approval of methods, equipment and mix design.
 - .10 Provide continuous supervision during placement of concrete including concrete grout to ensure reinforcing steel is maintained in correct position.
 - .11 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling and without damage to existing structure or Work.
- .5 Grout where indicated using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .6 Finishing and curing:
 - .1 Finish concrete to CSA A23.1.
 - .2 Use smooth form finish for all formed concrete surfaces. Use form facing material that will produce a smooth, hard, uniform texture on the concrete. Do not use material with raised grain, torn surfaces, worn edges, patches, dents or other defects that will impair the texture of the concrete surface. Patch the holes and defects. Completely remove fins.
 - .3 Use smooth steel trowel finish.
 - .4 Rub exposed sharp edges of concrete with carborundum to produce 3mm radius edges unless otherwise indicated.
 - .5 Immediately after placing concrete cure all deck surfaces using a layer of polyethylene placed immediately over wet burlap. Keep the burlap wet at all times. Keep covered for a minimum of 7 days and until a compressive strength of 27 MPa is attained.
 - .6 Tolerance:
-

- 3.2 INSTALLATION/
APPLICATION
(Cont'd)
- .6 (Cont'd)
- .6 (Cont'd)
- .1 Finish surfaces to within 3 mm in 1 m as measured with a 1m straight edge placed on surface.
- .7 The temperature of water used for moisture curing shall not be more than 7°C colder than the temperature of the concrete.
- 3.3 REPAIRS
- .1 In the event that the post-finishing survey shows that the concrete surface does not meet the specified tolerances, take corrective action within five (5) working days, or as directed by the Parks Canada Representative.
- .2 Submit proposed corrective action in writing, with complete details of methods, tools, and materials for the Parks Canada Representative's approval. Upon acceptance of the proposed method, a test area is to be prepared, and upon acceptance, will be the standard for the remainder of the repairs.
- .3 Grind down high points to a smooth surface conforming to the specifications and with a surface finish equal to the remainder. If cutting or chipping by hammer is required at high areas, then the area is to be cut low with square saw cut edges, and patched as noted below.
- 3.4 FIELD QUALITY
CONTROL
- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Parks Canada Representative for review to CSA A23.1.
- .2 Test cylinders, a minimum of three (3) cylinders, to be provided as follows:
- .1 Each day's pour.
- .2 Each change of supplier.
- .3 Each 50 m³ or fraction thereof.
- .4 Additional test cylinders at the request of the Parks Canada Representative.
- .5 If Contractor wants to strip formwork early, request additional cylinders to be cast and pay for additional cylinders and testing of the additional cylinders.
-

3.4 FIELD QUALITY CONTROL
(Cont'd)

- .3 Parks Canada Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-Destructive Methods for Testing Concrete: to CSA A23.2.
- .5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.
- .6 Secure all cylinders in an approved storage medium, prior to leaving the site.
- .7 The Parks Canada Representative reserves the right to reject any concrete which does not meet all the requirements for the class of concrete specified. The Parks Canada Representative also reserves the right to reject any portion of a placement if there exists evidence that this portion has a strength that is below the minimum acceptable required under this section. The Parks Canada Representative may accept concrete which does not meet the specified strength requirements provided that the structural integrity of the section is not jeopardized.
- .8 Test concrete in accordance with CSA A23.1. If three or more sets of cylinders are cast during one placement, the strength of each class of concrete will be considered satisfactory if the average of all regular sets, 28 day strength tests, equals or exceeds the specified strength. If less than three strength tests are performed, acceptance will be based on the average of the test results conducted on the section. If the concrete fails to meet the specified strength by more than 5 MPa, the Parks Canada Representative may order replacement or reinforcing, at the Contractor's expense, of the sections in the structure.
- .9 Alternatively, at the Parks Canada Representative's discretion, concrete of a specific class which is otherwise acceptable, but fails to meet the specified strength by less than 5 MPa, may be accepted. Coring of the concrete to verify strength will be permitted only for concrete which is to be replaced or reinforced. When coring is permitted, cores shall be taken at locations directed by the Parks Canada Representative.

Part 1 General

1.01 RELATED REQUIREMENTS

- .1 Cast-In-Place Concrete: refer to Structural Drawings.

1.02 REFERENCES

- .1 American Concrete Institute (ACI):
 - .1 ACI 302.1R-15, Guide for Floor and Slab Construction.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 - .2 ASTM D1752-04a(2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .4 Canadian Standards Association (CSA)
 - .1 CSA A23.1-14/A23.2-14 - Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.
 - .2 CSA A23.3-14, Design of Concrete Structures.
 - .3 CAN/CSA A3000-13, Cementitious materials compendium (Consists of A3001, A3002, A3003, A3004 and A3005), Includes Update No. 1 (2014), Update No. 2 (2014), Update No. 3 (2014).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-16, Architectural Coatings.

1.03 PERFORMANCE REQUIREMENTS

- .1 Product quality and quality of work in accordance with Section 01 11 00 - General Requirements: Common Product Requirements.
- .2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.
- .3 Concrete works: refer to structural drawings and specifications for concrete requirements. Concrete shall comply with CSA A23.1, CSA A23.2, CSA A23.3, and CAN/CSA A3000.
- .4 Concrete polishing shall be performed by a company and personnel experienced and skilled in polishing concrete counters for interior finish work. Provide proof of experience and letters of reference upon request by Departmental Representative.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 11 00 - General Requirements: Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.
 - .2 Include application instructions for concrete floor treatments.

- .2 Submit closeout data in accordance with Section 01 11 00 - General Requirements: Closeout Submittals.
 - .1 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions and submit a complete list of floor care products that will be required for on-going maintenance.
- .3 Samples: provide polished finish samples 300 mm x 300 mm of polished countertop surface for approval prior to commencing work to verify colour and overall appearance.
- .4 For items where structural design is required (e.g., concrete counters and attachment to structure), submit shop drawings signed and sealed by a Professional Engineer (P.Eng.) registered in Province of New Brunswick.
- .5 Submit concrete cube tests of concrete at 24 hours, 3 days and 28 days in accordance with Section 01 33 00 - Submittal Procedures.

1.05 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting: Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power: Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area: Make the work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature: Maintain ambient temperature of not less than 10°C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture: Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .6 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 Arrange for ventilation system to be operated during installation of concrete floor treatment materials by use of approved portable supply and exhaust fans.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Provide continuous ventilation during and after coating application.

Part 2 Products

2.01 PERFORMANCE/DESIGN CRITERIA

- .1 Slabs: floors having an overall F number of FF 30 x FL 25; similar to CSA A23.1 Class C Slab Finishing.
- .2 Concrete counters: surfaces having a straightedge value of ± 3 mm over 3050 mm.

2.02 LEVELLING MATERIALS

- .1 Patching and flash patching materials: to Section 03 01 30.71- Concrete Repairs.

2.03 CURING COMPOUNDS

- .1 Select low-VOC, water-based, organic-solvent-free curing compounds.
 - .1 Concrete Curing Compounds: maximum VOC limit 100 g/L in accordance with SCAQMD Rule #1113.

2.04 MIXES

- .1 Mixing, ratios and application in accordance with manufacturer's instructions.

2.05 ACCESSORIES

- .1 Water: potable.
- .2 Joint sealants: to Section 07 92 00 – Joint Sealants.
- .3 Joint Filler Strips:
 - .1 Floor Isolation Joints: ASTM D1751, bituminous impregnated fibreboard, or ASTM D1752, cork or self-expanding cork, 13 mm thick minimum.
 - .2 Edge Joint Filler: ASTM D1751, bituminous impregnated fibreboard, 13 mm thick minimum.
- .4 Control Joint Filler:
 - .1 Two-component, epoxy-urethane, load-bearing, self-levelling sealant; purpose-made for application; commercial grade.

Part 3 Execution

3.01 GENERAL CONCRETING PROCEDURES

- .1 Comply with the requirements of Structural Drawings, and as follows:
 - .1 Avoid over-troweling.
 - .2 Do not finish concrete surfaces when bleed water is present.
 - .3 Keep concrete continuously moist for at least 24 hours.
 - .4 Never add water on site to plant-supplied concrete during placement or finishing.
 - .5 Maintain concrete above 10°C during and for three days after concrete placement.
 - .6 Protect fresh concrete from rapid drying, direct sun and wind.
 - .7 Supply and place layer of sand over vapour retarder to allow some moisture loss at bottom of slab.
 - .8 Never place concrete on frozen substrate.
 - .9 Locate mesh no more than 50 mm below surface of slab. Lap mesh at least one square. Use chairs to support mesh at the correct height during concrete placement (do not use the hook and pull method).
 - .10 Ensure the minimum concrete cover over reinforcing steel is at least 76 mm.
 - .11 Lap steel at least 24 bar diameters, but not less than 300 mm.
 - .12 Install wing insulation at perimeter of grade beams, and insulate exterior vertical face of grade beams. Refer to Section 07 21 13 – Board Insulation for insulation specifications.

3.02 EXAMINATION

- .1 Prepare floor surface in accordance with CSA A23.1.
- .2 Verify that slab surfaces are ready to receive work and elevations are as required.

3.03 PREPARATION OF SLAB

- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
- .2 Saw cut control joints to CSA A23.1, 24-hours maximum after placing of concrete.
- .3 The tops of all floor slabs, including slabs on grade, are to be brought to an even, level or sloping surface as indicated on the drawings, ready to receive the specified finish.
- .4 Interior floors indicated as exposed concrete are to be finished in accordance with the slab finishing schedule on the structural drawings. For slab areas not noted in the finishing schedule, slabs shall be smooth concrete with steel trowel finish.
- .5 Depress floor slabs where shown and as required for floor finishes.
- .6 Remove any curing agents used during concrete installation a minimum of 28 days prior to installation of flooring materials.
- .7 Use mechanical stripping to remove chlorinated rubber or existing surface coatings.
- .8 Use protective clothing, eye protection, and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.04 FINISHING FLOORS AND SLABS

- .1 Finish floors and slabs in accordance with CSA A23.1 and ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces; do not wet concrete surfaces.
- .2 Float (Initial) Finishing:
 - .1 Consolidate surface with power driven floats or by hand floating if area is small or inaccessible to power driven floats.
 - .2 Re-straighten, cut down high spots, and fill low spots.
 - .3 Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
 - .4 Apply float finishing to surfaces receiving trowel finishing and receiving waterproofing.
- .3 Trowel (Final) Finishing:
 - .1 Commence trowel finishing after all bleed water has disappeared and when the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface.
 - .2 Apply first trowelling and consolidate concrete by hand or power-driven trowel after applying float finishing; continue trowelling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance; repair or smooth any surface defects that would telegraph through applied coatings or floor covering.
 - .3 Apply a trowel finishing to surfaces exposed to view or receiving waterproofing, and as directed.
 - .4 Finish surfaces to the tolerances indicated above.
 - .5 Apply to interior floor surfaces.

3.05 CURING

- .1 Comply with the requirements of Structural Drawings, and as follows:
 - .1 Maintain all material and equipment required for curing and protection on hand at the Site prior to placing any concrete.
 - .2 Do not commence curing until after finishing.

- .3 Commence curing of exposed surfaces as soon as the concrete has hardened sufficiently to prevent surface damage.
- .4 Continuously moist cure all concrete for a minimum duration of 7 consecutive days at an ambient temperature maintained above 10°C.
- .5 Continuously moist cure concrete by covering with absorptive mat or fabric kept wet by using a system of perforated pipes, mechanical sprinklers, porous hoses, or by other methods that keep all surfaces continuously wet. Initially cure formed surfaces by leaving forms in position and keeping such forms continuously wet.
- .6 Do not use curing water that is more than 11°C cooler than the concrete temperature.
- .7 Do not use curing compound except on slabs as specified in the Contract Documents, and specifically authorized in writing by the Departmental Representative.
- .8 If authorized by the Departmental Representative, apply curing compounds at a uniform rate by mechanical application methods. Provide complete coverage by applying 2 coats at right angles to each other. Minimum coverage is 0.20 L/m². Apply curing compound immediately after finishing and as soon as the free water on the surface has disappeared and no water sheen is visible, but not so late that the compound will be absorbed into the concrete.

3.06 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 - General Requirements: Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 - General Requirements: Cleaning.
- .4 Waste Management: separate and divert waste materials from landfill in accordance with Section 01 11 00 - General Requirements: Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.07 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 - Rough Carpentry.
- .2 Section 07 31 13 – Asphalt Shingles.
- .1 Section 07 46 23 – Wood Siding.
- .2 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .3 Section 08 11 13 – Metal Doors and Frames.
- .4 Section 08 50 13 – Aluminum Windows.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A123/A123M-12, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A269/A269M-14e1 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .4 ASTM A276/A276M-15, Standard Specification for Stainless Steel Bars and Shapes.
 - .5 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .6 ASTM A312/A312M-15, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - .7 ASTM A325-10e1, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .8 ASTM A480/A480M-14b, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - .9 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .10 ASTM A747/A747M-12, Standard Specification for Steel Castings, Stainless, Precipitation Hardening.
 - .11 ASTM A780/A780M-09, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .12 ASTM B188 - 10, Standard Specification for Seamless Copper Bus Pipe and Tube.
 - .13 ASTM B209-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .14 ASTM B221-12, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .15 ASTM B308/B308M-10, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - .16 ASTM B429/B429M-10e1, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

- .17 ASTM B632/B632M-08, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
- .18 ASTM F468-12, Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use.
- .19 ASTM F593-13a, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- .2 American Welding Society (AWS)
 - .1 AWS A5.9/A5.9M:2012, Specification for Bare Stainless Steel Welding Electrodes and Rods.
 - .2 AWS D1.6/D1.6M:2007, Structural Welding Code - Stainless Steel.
 - .3 AWS D18.1/D18.1M:2009, Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications
- .3 CSA International
 - .1 CAN/CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).
 - .2 CSA S16-14, Design of steel structures.
 - .3 CSA S136-12 Package, North American Specification for the Design of Cold Formed Steel Structural Members and S136.1-12 - Commentary on North American specification for the design of cold-formed steel structural members, Includes Update No. 1 (2014), Update No. 2. (2014), Update No. 3 (2015).
 - .4 CSA W47.1-09(R2014), Certification of companies for fusion welding of steel.
 - .5 CSA W55.3-08(R2013), Certification of companies for resistance welding of steel and aluminum.
 - .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
 - .7 CSA W178.2-14, Certification of Welding Inspectors.
- .4 National Association of Architectural Metal Manufacturers (NAAMM)
 - .1 NAAMM AMP 555-92, Code of Standard Practice for the Architectural Metal Industry.
- .5 National Ornamental & Miscellaneous Metals Association (NOMMA)
 - .1 NOMMA Guideline 1: Joint Finishes, 1994.
- .6 SAE International (The Society of Automotive Engineers)
 - .1 SAE steel grades.

1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Submit product data in accordance with Section 01 11 00 - General Requirements: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications, and data sheets.
- .2 Submit shop drawings in accordance with Section 01 11 00 - General Requirements: Submittal Procedures:
 - .1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

- .2 For items where structural design is required (e.g., concrete counters and attachment to structure, etc.), provide shop drawings signed and sealed by a Professional Engineer (P.Eng.) registered in Province of New Brunswick.

1.4 QUALITY ASSURANCE

- .1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Detail and fabricate metal fabrications in accordance with the NAAMM AMP 555.
- .4 Perform Work to the highest standard of modern shop and field practice, by personnel experienced in this Work. Accurately fit joints and intersecting members in true planes with adequate fastening. Build and erect the Work plumb, true, square, straight, level, accurate to the sizes shown, and free from distortion or defects.
- .5 Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- .6 Welding: Qualify procedures and personnel according to the following:
 - .1 Welders shall be qualified by Canadian Welding Bureau for classification of work being performed.
 - .2 The fabricator shall be certified to CSA W47.1, Division 1 or 2.1.
 - .3 Do welding inspection to CSA W178.
 - .4 Resistance welding: to CSA W55.3.
 - .5 Fusion welding: to CSA W59.
 - .6 Stainless steel:
 - .1 Weld stainless steel by the electric arc process, to CSA W59.
 - .2 Use electrodes compatible with and of the same properties as the stainless steel. Grind smooth and polish to match finish.
 - .3 Structural stainless steel welding: to AWS D1.6/D1.6M.
 - .4 Stainless steel tube and pipe: to AWS D18.1/D18.1M.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Exercise due care in storing, handling and erecting all materials and support all materials properly at all times so that no piece will be bent, twisted or otherwise damage structurally or visibly.
- .2 Correct damaged material and where the Departmental Representative deems damage irreparable, replace the affected items at no additional expense to the Departmental Representative or Agency.
- .3 Apply protective covering to face of all exposed finished metalwork before it leaves shop, covering to remain until item installed.
- .4 Fabricate large assemblies so they can be safely and easily transported and handled to their place of installation.

1.6 JOB CONDITIONS

- .1 Coordinate this Work with the remainder of the Work and exercise the necessary scheduling to ensure that all Work is carried out and all items incorporated during the appropriate construction phase.
- .2 Provide instructions and drawings to other trades for setting bearing plates, anchors bolts, and other members that are built into work of other trades.
- .3 Protect other Sections of the Work from damage by this Section of the Work.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections, shapes and plates: to CAN/CSA G40.20/G40.21, Grade 300W.
- .2 Hollow structural sections: to CAN/CSA G40.20/G40.21, Grade 350W, Class C.
- .3 Steel pipe: to ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads, galvanized finish.
- .4 Steel tubing: to ASTM A500, shapes and configuration as indicated, 6 mm wall thickness, sizes and dimensions as indicated.
- .5 Welding materials: to CSA W59.
- .6 Welding electrodes: to CSA W48 Series.
- .7 Solder and flux: to ASTM B32, alloy composition Tin (Sn) for stainless steel, and 85 Tin/15 Zinc for aluminum. Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.
- .8 Emulsified asphalt protective coating for metals: to ASTM D1187/D1187M.
- .9 Fasteners: Bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws, and machine bolts.
 - .1 Unfinished fasteners: In areas not exposed to public, use unfinished bolts conforming to ASTM A307, Grade A, with hexagon heads and nuts. Supply bolts of lengths required to suit the thickness of the material being joined, but not projecting more than 6 mm beyond nut, without the use of washers.
 - .2 Finished fasteners:
 - .1 In areas exposed to public use, bolts, nuts, washers, rivets, lock washers, anchor bolts, machine screws and machine bolts to be hot dip galvanized in accordance with ASTM A153/A153M or CAN/CSA-G164.
 - .2 For joining stainless steel components use stainless steel fasteners of same type.
- .10 Structural bolts: to ASTM A325.
- .11 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours; 40 MPa at 28 days

2.2 FABRICATION

- .1 Form metal fabrications from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

- .2 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
 - .3 Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss. Temperature change (Range): 100 deg F (38 deg C).
- .4 Shear and punch metals cleanly and accurately. Remove burrs.
- .5 Ease exposed edges to a radius of approximately 0.794 mm (1/32 inch), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- .6 Remove sharp or rough areas on exposed traffic surfaces.
- .7 Weld corners and seams continuously to comply with American Welding Society (AWS) recommendations, and the following:
 - .1 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - .2 Obtain fusion without undercut or overlap.
 - .3 Remove welding flux immediately.
 - .4 At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour and finish of welded surfaces match those adjacent.
- .8 Welds to be Type 1 - Ornamental Quality (no visible weld), in accordance with the Voluntary Joint Finish Standards, developed by the National Ornamental & Miscellaneous Metals Association (NOMMA).
- .9 Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- .10 Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- .11 Shop Assembly: preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- .12 Cut, reinforce, drill and tap miscellaneous metalwork as indicated to receive finish hardware, screws, and similar items.
- .13 Ensure exposed welds are continuous for length of each joint.
- .14 Grind or file exposed welds and steel sections smooth and flush with adjacent surfaces. Weld locations not to be visible after application of paint finishes.
- .15 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
- .16 Accurately form connections with exposed faces flush; mitres and joints tight.
- .17 Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

- .18 All welding is to be performed by CWB Certified Welders.

2.3 ANGLE LINTELS

- .1 Steel angles: prime painted, sizes indicated for openings. Provide 150 mm minimum bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Finish: shop-painted where exposed.

2.4 ROUGH HARDWARE

- .1 Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required. Fabricate items to sizes, shapes, and dimensions required.

2.5 MISCELLANEOUS FABRICATIONS

- .1 Material shall be as indicated on Drawings (stainless steel or steel, etc.).
- .2 Miscellaneous Framing and Supports: Provide steel framing and supports for applications indicated that are not a part of structural steel framework, as required to complete work.
- .3 Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitred joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- .4 Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
- .5 Miscellaneous Trim: Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination for assembly and installation with other work.

2.6 FINISHES

- .1 Shop preparation: Prior to applying primer or other finishes, clean metal to equivalent of commercial sand blast SSPC-SP4, remove sandblast in residue.
- .2 Field preparation: Prior to applying primer or other finishes, clean metal to equivalent of Power Tool Cleaning SSPC-SP3, remove residue.
- .3 Hot dip galvanizing: galvanize steel, where indicated, to ASTM A123, minimum zinc coating of 600 g/m². Touch up galvanized surfaces with zinc rich coating, to ASTM A780: DOD-P-21035 zinc rich paint, minimum DFT 8 mils.
- .4 Isolation Coating: Apply an isolation coating to contact surfaces in contact with cementitious materials, wood materials and dissimilar metals except stainless steel.
- .5 Painting: to Section 09 91 00 – Painting.

Part 3 Execution

3.1 ERECTION

- .1 Install Work in accordance with manufacturer's or fabricator's (as applicable) written instructions, and Drawings.
- .2 Coordinate with other trades as required for complete installations.
- .3 Do welding work in accordance with CSA W59 unless specified otherwise.
- .4 Supply finished items to be built-in to those trades along with instructions for proper installation.
- .5 Apply architectural metalwork using hidden mechanical fasteners. Installation shall be by skilled Architectural metalworkers experienced in highest quality work.
- .6 Fasteners to draw adjoining sections together in proper, true alignment, and are capable of field adjustment.
- .7 All fasteners, mountings to be non-loosening and installed so that they will be hidden at completion.
- .8 Install all Work to true, straight lines, accurate to profile, all properly aligned.
- .9 Isolate dissimilar metals in a manner approved by the Departmental Representative to prevent electrolytic action or corrosion.
- .10 Install finish hardware supplied under other Sections required for completion of components of this Section.
- .11 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .12 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .13 Make field connections with high tensile bolts to CSA S16 and weld to prevent loosening.
- .14 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .15 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .16 Repair galvanized areas damaged by welding, flame cutting or during handling, transport or erection in accordance with ASTM A780. Touch-up with organic zinc-rich paint to DOD-P-21035 zinc rich paint, minimum DFT 8 mils.

3.2 MISCELLANEOUS ITEMS

- .1 Supply and install miscellaneous metal fabrications as indicated or specified, or as otherwise required in accordance with the design intent of the project.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 - General Requirements: Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 - General Requirements: Cleaning.

- .4 Waste Management: separate and divert waste materials from landfill in accordance with Section 01 11 00 - General Requirements: Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 31 13 – Asphalt Shingles.
- .2 Section 07 46 23 – Wood Siding.
- .3 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .4 Section 08 11 13 – Metal Doors and Frames.
- .5 Section 08 50 13 – Aluminum Windows.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
 - .4 ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
 - .5 ASTM D5055-12, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
 - .6 ASTM D5456-11a, Standard Specification for Evaluation of Structural Composite Lumber Products.
 - .7 ASTM E1333-10, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
 - .8 ASTM F1667-15, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 American Wood Preservers Association (AWPA):
 - .1 AWPA Book of Standards, 2012.
- .3 CSA Group (CSA)
 - .1 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .2 CAN/CSA O80 Series-08, Wood Preservation
 - .3 CSA O112 Series-M1977 (R2006), CSA Standards for Wood Adhesives.
 - .4 CSA O121-08, Douglas Fir Plywood.
 - .5 CSA O122-06 (R2011), Structural Glued-Laminated Timber.
 - .6 CSA O141-05 (R2009), Softwood Lumber.
 - .7 CSA O151-09, Canadian Softwood Plywood.
 - .8 CAN/CSA-O325-07, Construction Sheathing.
- .4 National Lumber Grading Association (NLGA):
 - .1 NLGA SPS2-2010, Special Products Standards on Machine Stress-Rated Lumber.
 - .2 Standard Grading Rules for Canadian Lumber 2010.
- .5 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.

- .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .6 Truss Plate Institute of Canada (TPIC)
 - .1 Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses – Limit States Design, 2011.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 11 00 – General Requirements: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.
 - .2 Submit MSDS sheets or official manufacturer literature stating no added urea-formaldehyde was used in the manufacturing of composite wood.
- .2 Submit engineered shop drawings in accordance with Section 01 11 00 - Project General Requirements: Submittal Procedures.
 - .1 Provide shop drawings signed and sealed by professional engineer registered in Province of Work responsible for design.
 - .2 Indicate details of construction, profiles, jointing, fastening, and other related details.
 - .3 Indicate materials, thicknesses, finishes, and hardware.

1.4 QUALITY ASSURANCE

- .1 Lumber identification: Grade stamp of an agency certified by the Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: Grade mark in accordance with applicable CSA standards.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver wood products bundled or crated to provide adequate protection during transit. Inspect wood products for damage upon delivery and remove and replace damaged materials.
- .2 Store materials a minimum of 150 mm off the ground on blocking. Keep materials under cover and dry. Provide for air circulation within and around stacks and under temporary coverings.
- .3 Protect sheet materials to prevent breaking of corners and damage to surfaces.

Part 2 Products

2.1 GENERAL

- .1 Use CLS grade marked lumber conforming to the Standard Grading Rules for Canadian Lumber published by the National Lumber Grades Authority.
- .2 Framing and board lumber: in accordance with requirements of National Building Code of Canada (NBC) and amendments.

2.2 MATERIALS

- .1 Western Red Cedar Lumber, Furring and Blocking:
 - .1 Western Red Cedar: solid wood lumber, graded to meet NLGA Grading Standards and WRCLA, S4S.
 - .2 Grade: WRCLA Custom Clear.
 - .3 Texture: finely machined.
 - .4 Moisture Content: seasoned.

- .2 Lumber: kiln dried, Stud Grade to CAN/CSA-O141, softwood, S-P-F, S4S, graded and stamped in accordance with National Lumber Grading Association (NLGA) Standard Grading Rules for Canadian Lumber and as follows:
 - .1 Moisture Content: maximum 8% at time of installation.
 - .2 Maximum moisture content when used for attachment of drywall: 8%.
 - .3 Stud (No.3) Grade or better, having the following minimum properties:
 - .1 Sizes: 38 mm or 89 mm wide by maximum 140 mm depth as noted on drawings.
 - .2 Bending at extreme fibre (F_b): 7.0 MPa.
 - .3 Longitudinal shear (F_v): 1.0 MPa.
 - .4 Compression parallel to grain (F_c): 7.0 MPa.
 - .5 Compression perpendicular to grain (F_{cp}): 5.3 MPa.
 - .6 Tension parallel to grain (F_t): 3.2 MPa.
 - .7 Modulus of elasticity (E/ E_{05}): 9000/5500 MPa.
 - .8 Finger jointed material will not be acceptable without written acceptance from the Departmental Representative.
- .3 Lumber: kiln dried, Structural Light Framing and Structural Joists and Planks to CAN/CSA O141, softwood, S-P-F, S4S, graded and stamped in accordance with National Lumber Grading Association (NLGA) Standard Grading Rules for Canadian Lumber and as follows:
 - .1 Moisture Content: maximum 8% at time of installation.
 - .2 Maximum moisture content when used for attachment of drywall: 8%.
 - .3 Grade: No. 2 or better, and having the following minimum properties:
 - .1 Sizes: 38 mm or 89 mm wide by depth as indicated on drawings.
 - .2 Bending at extreme fibre (F_b): 11.8 MPa.
 - .3 Longitudinal shear (F_v): 1.0 MPa.
 - .4 Compression parallel to grain (F_c): 11.5 MPa.
 - .5 Compression perpendicular to grain (F_{cp}): 4.6 MPa.
 - .6 Tension parallel to grain (F_t): 5.5 MPa.
 - .7 Modulus of elasticity (E/ E_{05}): 9500/6500.
- .4 Light-frame trusses: in accordance with Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses – Limit States Design, The Truss Plate Institute of Canada.
- .5 Sheathing for structural shear wall and diaphragms:
 - .1 Douglas Fir (DFP) Exterior Grade plywood to CSA O121, $\frac{3}{4}$ -inch thick.
- .6 Roof sheathing:
 - .1 Douglas Fir (DFP) Exterior Grade plywood to CSA O121, tongue and groove system, $\frac{5}{8}$ -inch thick.
- .7 Wall sheathing:
 - .1 Douglas Fir (DFP) Exterior Grade plywood to CSA O121, $\frac{5}{8}$ -inch thick.
- .8 Interior Mechanical Room Walls and Ceiling:
 - .1 Douglas Fir (DFP) Exterior Grade plywood to CSA O121, $\frac{1}{4}$ -inch thick.
- .9 Panels shall have no added urea formaldehyde.

2.3 MISCELLANEOUS LUMBER

- .1 Provide lumber for support or attachment of other construction, including furring, blocking, nailing strips, ground, rough bucks, cants, curbs, fascia, backing sleepers, and similar members.
- .2 Fabricate miscellaneous lumber from dimension lumber of sizes indicated, and into shapes shown on drawings.
- .3 Moisture Content: 19% maximum for lumber items not specified to receive wood preservative treatment.
- .4 Grade: for dimension lumber sizes provide No. 2 or Standard grade lumber per NLGA. For board-sized lumber, provide sheathing grade, S2S.

2.4 WOOD PRESSURE TREATMENTS

- .1 Where lumber or plywood is indicated as preservative treated or is specified to be treated, treat in accordance with CAN/CSA O80.9M and AWPA.
- .2 Wood preservatives containing arsenic or chromium are not permitted.
- .3 Pressure treat above ground items with Copper Azole (CA-B) preservative to a minimum AWPA retention of 1.6 kg/m³. After treatment, kiln-dry lumber and plywood to maximum moisture content of 19% and 15% respectively. Treat indicated items and the following:
 - .1 Wood cants, nailing strips, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapour barriers, and waterproofing.
 - .2 Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry and concrete.
 - .3 Wood framing members less than 200 mm above grade.
 - .4 Wood floor plates installed over concrete slabs directly in contact with earth.
- .4 Pressure treat wood members in contact with ground or freshwater with Copper Azole (CA-B) preservative to a minimum AWPA retention of 3.4 kg/m³
- .5 Fire Rated Plywood Panels: to CAN/SCA O80.9M, CAN/CSA O80.20M and CAN/CSA O80.27M, pressure impregnated, and as follows:
 - .1 Flame Spread Classification: FSC 25 maximum.
 - .2 Smoke developed of not more than: 75.
 - .3 Acceptable materials:
 - .1 Dricon FRT, by Lonza.
 - .2 D-Blaze Fire Retardant Treated Wood, by Viance.
 - .3 Pyro-Guard, by Hoover Treated Wood Products, Inc.
- .6 Complete fabrication of treated items before treatment where possible. If cut after treatment apply field treatment to cut surfaces.
- .7 Wood Preservatives: Maximum allowable VOC limit 350 g/L in accordance with SCAQMD Rule #1113 - Architectural Coatings.

2.5 FRAMING CONNECTORS AND HANGERS

- .1 Fabricated zinc-coated steel products tested or designed in accordance with CSA O86.1 and CSA S16.1, and as required to construct framing as required.
- .2 Acceptable Materials:
 - .1 Simpson Strong Tie Company Inc., or similar with same or better material properties and performance characteristics.

2.6 ACCESSORIES

- .1 General purpose adhesive: to CSA O112 Series.
- .2 Nails, spikes, and staples: to ASTM F1667, stainless steel for exterior work, in contact with cedar, and pressure preservative and fire retardant treated materials; hot dipped galvanized for all other purposes.
- .3 Screws for Fastening to Cold-Formed Metal Framing: to ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened; double hot dipped galvanized.
- .4 Rough Hardware (bolts, nuts, washers, etc.): double hot dip galvanized in conformity to CSA G164 or Grade A low carbon steel, conforming to ASTM A307.
- .5 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.
- .6 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy type approved by Departmental Representative.
- .7 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, fibre, formed to prevent dishing; hot dip galvanized. Bell or cup shapes not acceptable.
- .8 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead plugs, recommended for purpose by manufacturer; hot dip galvanized.
- .9 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy type approved by Departmental Representative.

Part 3 Execution

3.1 COMPLIANCE

- .1 Comply with requirements of National Building Code of Canada and the requirements of this specification Section.
- .2 Accurately frame and properly assemble rough carpentry work. Include all necessary nails, fasteners or other connectors.

3.2 FASTENINGS AND ROUGH HARDWARE

- .1 Unless indicated otherwise, fasten to hollow masonry units with toggle bolts; to solid masonry or concrete surfaces with expansion shields and bolts.
- .2 Where screws are required use lead or inorganic fibre plugs. Wood or organic plugs not permitted.
- .3 Powder actuated fasteners may be used in lieu of bolts if approved by the Departmental Representative in writing prior to materials arriving on site.
- .4 Provide all rough hardware such as nails, bolts, nuts, washers, screws, clips and strap metal.

3.3 BLOCKS, PLATES, STRAPPING AND FURRING

- .1 Install wood plates where indicated. Erect plumb and true. Rigidly support and securely anchor to masonry, concrete, and metal stud framing, as required.
- .2 Provide and install wood strapping or furring indicated on drawings or as required.
- .3 Strapping: Shimmed out plumb, square and true to line. Use 19 mm x 64 mm at 406 mm on centre, unless indicated otherwise.
- .4 Furring: As indicated.

- .5 Install at least one row of solid blocking to wood stud walls not more than 2440 mm high, two rows if over 2440 mm high.
- .6 Install blocking behind all sheathing and wallboard joints, and where required for items to be fixed to walls.

3.4 SHEATHING INSTALLATION

- .1 Install wall sheathing horizontally to wood framing using minimum 50 mm long coated nails at 150 mm along edges and 305 mm along vertical members in the middle of the sheets.
- .2 Leave 2 mm to 3 mm between sheets to allow for shrinkage of wood framing.
- .3 Install blocking behind all sheathing joints.

3.5 ROOF FRAMING AND PLATES

- .1 Wood exposed to weather and water shall be pressure preservative treated.
- .2 Unexposed wood in contact with roofing membranes shall not be pressure preservative treated.
- .3 Construct wooden roof curbs around openings in the roof for vents, ducts, and flues. Curbs to be of height that will provide a minimum projection of 200 mm above the roof membrane. Ensure base for curb is same thickness as insulation.
- .4 Form sloped tops to all wood parapet plates and wood upstands more than 38 mm wide to roofs that receive metal flashings. Tops shall slope not less than 1 in 12. If details are at variance notify the Departmental Representative prior to construction for further instructions.
- .5 Provide continuous wood backing for flashings.
- .6 Provide solid wood or plywood sheathing and backing to receive membrane and metal flashings to roofer's requirements conforming to CRCA Manual. Fasten plywood sheathing securely to the walls of parapets with mechanical fasteners; nails will not be acceptable.
- .7 Roof Sheathing (DFP):
 - .1 Lay panels with face grain across the joist. Install with tongue and T&G panels pointing up.
 - .2 Space fasteners 150 mm (6") around the perimeter of the panel and 300 mm (12") on intermediate supports.
 - .3 Use only Code-approved fasteners: 51 mm spiral nails or 45 mm ring thread nails or screws, hot dip galvanized.

3.6 EXTERIOR CARPENTRY WORK

- .1 Construct exterior work using double hot dipped galvanized nails, screws or bolts. Bolts, nuts and washers shall be double hot dipped galvanized.
- .2 Plane all sides and backs; sand exposed faces and surfaces, round all edges to prevent checking of edges.
- .3 Countersink bolts and washers, fill holes with matching wood plugs.
- .4 Apply two liberal coats of clear surface applied wood preservative, allowing the first coat to soak in completely prior to applying second coat in accordance with manufacturers instructions.

3.7 PRESSURE PRESERVATIVE TREATED WOOD INSTALLATION

- .1 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation. Allow first coating to fully soak into grain before applying second coating in accordance with manufacturer's instructions.
- .2 Remove with fine sandpaper chemical deposits on treated wood to receive applied finish.
- .3 Use only hot dipped galvanized, corrosion resistant nail or screw fasteners. Staples are not acceptable for installation of preservative treated materials.
- .4 Use water borne preservative treated wood for:
 - .1 Wood in contact with masonry or concrete,
 - .2 Wood within 450 mm of grade,
 - .3 Wood decking and fence boards,
 - .4 Wood in contact with flashings
 - .5 Wood in contact with waterproofing membranes, confirm compatibility with membrane manufacturer prior to application.
- .5 Use oil borne preservative treated wood for:
 - .1 Wood in contact with the ground,
 - .2 Wood in contact with freshwater,
 - .3 Landscaping timbers,
 - .4 Retaining walls,
 - .5 Piers or docks,
 - .6 Pilings,
 - .7 Bases of utility poles,
 - .8 Bases of fence posts.

3.8 POWER, TELECOMMUNICATIONS AND DATA PANEL BOARDS

- .1 Install 19 mm (3/4-inch) thick Fire Rated Plywood Panels on walls in electrical, telephone and data rooms receiving wiring and equipment; minimum 1220 mm x 2440 mm panels on periphery walls over 300 mm wide, mounted 150 mm off of finished floor.

3.9 MECHANICAL ROOM LINING

- .1 Install 6.35 mm thick (1/4-inch) Douglas Fir (DFP) Exterior Grade plywood to all walls and ceiling of the Mechanical Room. Apply fire retardant coating to all exposed surfaces to Section 09 91 00, Fire Retardant Paint; colour: white.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.11 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 26 16 – Underslab Vapour Retarder.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D1621-10, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - .2 ASTM D2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- .2 Canadian Gas Association
 - .1 CAN/CGA B149.1-10, Natural Gas and Propane Installation Code.
 - .2 CAN/CGA B149.2-10, Propane Storage and Handling Code.
- .3 Underwriters Laboratories of Canada
 - .1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC S604-M91, Standard for Factory Built Type A Chimneys.
 - .3 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .4 CAN/ULC S716.2-12, Standard for Exterior Insulation and Finish Systems (EIFS) – Installation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .3 Submit warranties.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Storage and Handling Requirements:
 - .1 Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

- .2 Protect insulation as follows:
 - .1 Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - .2 Protect against ignition at all times. Do not deliver insulating materials to Project site before installation time.
 - .3 Complete installation and concealment of materials as rapidly as possible in each area of construction.
 - .4 Care for insulation in accordance with PIMA technical bulletin 109.

1.6 WARRANTY

- .1 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 32.1 of General Conditions "C" is extended to 24 months.

Part 2 Products

2.1 UNDERSLAB INSULATION

- .1 Underslab insulation over compacted fill:
 - .1 Extruded polystyrene (XPS) to CAN/ULC S701 and as follows:
 - .2 Thermal Resistance: RSI 0.87/1" minimum.
 - .3 Edges: ship-lapped.
 - .4 Size: 2' x 8' x thickness as indicated on Drawings.
 - .5 Compressive Strength: minimum 170 kPa at 10% deformation in accordance with ASTM D1621.
 - .6 Water Absorption: maximum 0.7% (% by volume) in conformance with ASTM D2842.
 - .7 Acceptable Materials:
 - .1 Dow Styrofoam SM.
 - .2 Owens-Corning Foamular 250.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's printed installation instructions, data sheets, standard details, and specifications.

3.2 EXAMINATION

- .1 Examine substrates and immediately inform Departmental Representative in writing of defects.
- .2 Prior to commencement of work, ensure that substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.3 UNDERSLAB INSULATION

- .1 Ensure fill is level, flat and smooth, and has been fully compacted and reviewed by Consultant prior to placing insulation boards.
- .2 Install rigid board insulation under all slab locations on compacted, level fill prior to installation of underslab vapour retarder and placement of concrete floor slab.

- .3 Install under the whole of slab to provide 100% thermal control layer.
- .4 Install boards in accordance with manufacturer's published preparation and installation instructions, technical datasheets and specifications.

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.2 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 31 13 – Asphalt Shingles.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C411-17, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .2 ASTM C518-17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - .3 ASTM C755-10(2015)e1, Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation.
 - .4 ASTM C1338-14, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
 - .5 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - .6 ASTM D1622/D1622M-14, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - .7 ASTM D1623-17, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics (Type C sample).
 - .8 ASTM D2126-15, Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 - .9 ASTM D2369-10(2015)e1, Standard Test Method for Volatile Content of Coatings.
 - .10 ASTM D2842-12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
 - .11 ASTM D4541-17, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - .12 ASTM D6226-15, Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
 - .13 ASTM D7234-12, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
 - .14 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
 - .15 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.
- .2 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC S102-18, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC S127-14, Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Building Materials.
 - .4 CAN/ULC S705.1-15, Amendment 3 to Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification, Includes Amendments 1, 2.
 - .5 CAN/ULC S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

- .6 CAN/ULC S741-08, Standard for Air Barrier Materials – Specification.
- .7 CAN/ULC S742-11, Standard for Air Barrier Assemblies – Specification.
- .8 CAN/ULC S770-15, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.
- .9 CAN/ULC S774-14, Standard Laboratory Guide for the Determination of Volatile Organic Compound Emissions from Polyurethane Foam.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data including manufacturer's literature for medium density closed cell spray polyurethane foam insulation components and accessories, indicating compliance with specified requirements and material characteristics.
 - .2 Submit list on spray polyurethane foam insulation manufacturer's letterhead of materials, components and accessories to be incorporated into Work
 - .3 Include details of insulation joints with sealants.
 - .4 Include product names, types and series numbers.
 - .5 Include contact information for spray polyurethane foam insulation manufacturer and their representative for this Project.
 - .6 Provide two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.
- .3 Quality assurance submittals: submit following in accordance with Section 01 11 00 – General Requirements: Quality Control.
 - .1 Test reports: submit certified test reports for spray insulation and thermal barrier from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Submit test reports in accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.
 - .3 Provide the CCMC Evaluation Report and the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the CAN/ULC S705.1 Material Standard.
 - .4 Applicator qualifications: submit letter on spray polyurethane foam insulation manufacturer's letterhead verifying applicator's certification for the work specified.
 - .5 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, trouble shooting guide and cleaning procedures for spray applied insulation and cementitious thermal barrier.
 - .6 Provide schedule indicating thermal barrier material to be used, surfaces to be protected, material thickness to be provided and appropriate references.

1.4 QUALITY ASSURANCE

- .1 Applicators to conform to CUFCA Quality Assurance Program or to a Quality Assurance Program managed by the insulation manufacturer that follows the requirements of CAN/ULC S705.1 and CAN/ULC S705.2.
- .2 Health and Safety Requirements: Worker protection:
 - .1 Protect workers as recommended by CAN/ULC S705.2 and manufacturer's recommendations:

- .2 Workers must wear gloves, respirators, dust masks, long sleeved clothing, eye protection, and protective clothing when applying foam insulation.
- .3 Workers must not eat, drink or smoke while applying foam insulation.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 11 00 – General Requirements: Common Product Requirements.
- .2 Deliver, store and handle materials in original containers and packaged with appropriate MSDS and labels in accordance with manufacturer's written instructions.
- .3 Store materials in a safe manner as recommended by the manufacturer and as required by the CAN/ULC S705.2 Installation Standard. Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- .4 Containers shall be marked as required by the CAN/ULC S705.1 Material Standard. The "use before" date shall be included on the drum label.

1.6 SITE CONDITIONS

- .1 Ventilate work areas in accordance with Section 01 11 00 – General Requirements: Temporary Utilities.
- .2 Ventilate areas to receive insulation by introducing fresh air and exhausting air continuously during and 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.
- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .5 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

1.7 WARRANTY

- .1 Submit manufacturer's standard 20-year warranty.
- .2 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 32.1 of General Conditions "C" is extended to 36 months.

Part 2 Products

2.1 SPRAY-APPLIED POLYURETHANE FOAM SYSTEM

- .1 Standard of Acceptance:
 - .1 WALLTITE ECO® v.2, by BASF, or similar to same effect and warranty, and meeting or exceeding the physical properties of the basis-of-design material. System must meet the requirements of this specification Section, and the following minimum additional requirements, with unequivocal compliance:
 - .1 CCMC Evaluation Listing.
 - .2 Conforms to CAN/ULC S 705.1.
 - .3 Zero ODP (utilizes zero ozone depleting blowing agents).
 - .4 EcoLogo™ Certified.
 - .5 GreenGuard Certified: meeting the requirements of GREENGUARD Children & SchoolsSM.
 - .6 Eco-efficiency: life-cycle analysis approved by NSF.

- .2 Closed cell, medium density, spray applied polyurethane foam insulation and air barrier; available in three reactivity grades, which include regular grade, fast grade, and cold temperature grade.
 - .1 The grade Contractor selects for use at the site is at Contractor's discretion and shall be selected based on which product grade best suites job conditions at time of application.
- .3 When tested, material shall meet the requirements of CAN/ULC S705.1 Standard for Thermal Insulation Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification, and having the following minimum cured properties:
 - .1 CCMC Classification as Thermal Insulation and Air Barrier.
 - .2 CCMC Classification as Air Barrier System.
 - .3 Core Density, to ASTM D1622: $\geq 29 \text{ kg/m}^3$.
 - .4 Long Term Thermal Resistance at 50 mm, to CAN/ULC S770: $\geq 1.95 \text{ (m}^2\cdot\text{K)/W}$ (R11.07 at 1.97-inches); full thickness required as indicated on Drawings.
 - .5 Air Permeance at 25.4 mm at 75 Pa pressure differential, to ASTM E2178: $\leq 0.000120 \text{ L/s.m}^2$.
 - .6 Water Vapour Permeance at 50 mm, to ASTM E96: 40 ng/Pa.s.m^2 (0.70 Perms).
 - .1 Qualifies as a Class II Vapour Retarder in accordance with ASTM C755.
 - .7 Open Cell Content (by Volume), to ASTM D6226: $\leq 8\%$.
 - .8 Compressive Strength, to ASTM D1621: $\geq 186 \text{ kPa}$.
 - .9 Tensile Strength, to ASTM D1623: $\geq 241 \text{ kPa}$.
 - .10 Dimensional Stability at 28 days (Volume Change), to ASTM D2126:
 - .1 $\leq 0.0\%$ at -20°C .
 - .2 $\leq 1.5\%$ at 70°C . @ $97\pm 3\% \text{ RH}$.
 - .3 $\leq 0.4\%$ at 80°C .
 - .11 Water Absorption (by Volume), to ASTM D2842: $\leq 1.2\%$.
 - .12 Surface Flame Spread Rating, to CAN/ULC S127: ≤ 500 .
 - .13 Smoke Developed Classification, to CAN/ULC S102: ≤ 500 .
 - .14 Time to Occupancy, to CAN/ULC S774: 24 hours.
 - .15 Fungus Testing, to ASTM C1338, VOC emissions evaluated in accordance with CAN/ULC S705.1: No Growth.
- .4 Provide primers and/or adhesives as required: in accordance with the spray polyurethane, and/or air/vapour barrier, and/or waterproofing membrane manufacturers' recommendations for surface conditions. The type of primers and/or adhesives selected and their installation shall comply with the published requirements of the manufacturer for the surface conditions involved.
- .5 Provide system accessories as required: typical accessories include transition membranes, penetration seals, and other components as required. Refer to the manufacturer's air barrier system technical guide specification for more information.
- .6 Thermal Barrier:
 - .1 Factory blended cementitious thermal barrier, spray applied, for use on urethane foam plastics to meet the requirements of CAN/ULC S124B.
 - .2 Acceptable Material: Monokote Z-3306 as manufactured by W.R. Grace and Co. or similar acceptable to spray-applied urethane foam manufacturer.
 - .3 Accessories: bonding agent, approved by both the thermal barrier manufacturer and the urethane foam manufacturer.

2.2 EQUIPMENT

- .1 The equipment used to spray the polyurethane foam material shall be in accordance with ULC S705.2 and the equipment manufacturer's recommendations for each specific type of application and condition required for this project.
- .2 Equipment settings are to be recorded on the Daily Work Record as required by the CAN/ULC S705.2 Installation Standard.
- .3 Each proportioner unit to supply only one spray gun.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for closed cell polyurethane foam insulation application in accordance with manufacturer's written recommendations, as outlined in this section and as indicated on the drawings.
- .2 Prior to commencement of work report in writing to the Contractor and Consultant any defects in surfaces or conditions that may adversely affect the performance of products installed under this section.
- .3 Commencement of spray applied insulation work outlined in this section shall be deemed as acceptance of existing work and conditions

3.3 PREPARATION

- .1 Protection:
 - .1 Mask and cover adjacent areas to protect from over spray.
 - .2 Ensure any required foam stop or back-up materials are in place to prevent over spray and achieve complete seal.
 - .3 Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.
 - .4 Erect barriers, isolate area and post warning signs to advise non protected personnel to avoid the spray area.
- .2 Surface Preparation:
 - .1 Surfaces to receive spray applied foam insulation shall be clean, dry and properly fastened to ensure adhesion of the polyurethane foam to the membrane.
 - .2 Ensure that all work by other trades that may penetrates through the foam insulation is in place and complete.
 - .3 Ensure that surface preparation and any primer and/or adhesive required conform to the manufacturer's instructions. If adhesion is in doubt, perform a mock-up and perform pull-off tests
 - .4 Following application of the spray applied foam insulation and prior to the application of the thermal barrier material, apply a bonding agent to all areas to receive the thermal barrier application.

3.4 APPLICATION

- .1 Select the product grade (regular, fast, cold weather) based on site conditions at time of application.
- .2 Do not apply spray foam insulation material in excess of 50 mm (two inches) per pass due to the product's exothermic effect. Allow appropriate cooling times between passes.
 - .1 After spraying a pass, cooling time must be allowed for the dissipation of heat before spraying another pass. Not allowing adequate cooling time raises the risk of scorching and/or fire and affects product mileage.
- .3 Meet or exceed requirements of Ontario Building Code and amendments.
- .4 Spray application of medium density, closed-cell polyurethane foam shall be performed in accordance with CAN/ULC S705.2 and the manufacturer's product-specific and grade-specific printed instructions and details.
- .5 Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and the CAN/ULC S705.2 Installation Standard.
- .6 Apply primers or adhesives as recommended by manufacturer, or as otherwise required to achieve adequate bond of materials.
- .7 Site-mix liquid components in accordance with manufacturer's written recommendations.
- .8 Apply in consecutive passes as recommended by manufacturer to thicknesses indicated on drawings. Passes shall be not less than 16 mm (5/8") and not greater than 50 mm (2"). Over all air/vapour barrier membranes apply 13 mm (1/2") maximum first pass. Allow to cool before applying subsequent passes. Under all circumstances, adjust application thicknesses as required by environmental conditions to ensure that the heat generated by the application process dissipates at the required rate to ensure the adhesion of the self-adhered membrane and the rigidity of the substrate are not affected or compromised.
- .9 Do not install spray polyurethane foam within 75 mm (3") of heat emitting devices such as light fixtures and chimneys.
- .10 Finished surface of foam insulation to be free of voids and imbedded foreign objects.
- .11 Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
- .12 Trim, as required, any excess thickness that would interfere with the application of work of other trades. Where insulation must be cut back the cut surface must be patched to the requirements of the manufacturer to provide a water shedding surface.
- .13 When installed inside a building, protect foam in accordance with Ontario Building Code requirements using a layer of gypsum board or a suitable thermal barrier.
 - .1 Thermal Barrier Application: apply bonding agent over exterior surface of spray applied foam insulation in accordance with manufacturer's written instructions. Apply thermal barrier over bonding agent where required by Ontario Building Code in accordance with the material manufacturer's application instructions to meet the requirements of CAN/ULC S124, Classification B (17 mm minimum).

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Coordinate manufacturer's services. Have manufacturer's technical representative review work involved in handling, application and protection of closed cell spray polyurethane foam insulation, and submit written reports in acceptable format to verify compliance of Work with Contract conditions.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for product application review in accordance with manufacturer's written recommendations. Report any inconsistencies from manufacturer's recommendations immediately to Consultant and Contractor.
- .3 Schedule site visits to review work at stages listed:
 - .1 After delivery and storage of closed cell spray polyurethane foam insulation, and when preparatory work on which Work of this Section depends is complete, but before application begins.
 - .2 Upon completion of Work, after cleaning is carried out.

3.6 TOLERANCES

- .1 Maximum variation from indicated thickness: minus (-) 3 mm (1/8"); plus (+) 13 mm (1/2").

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 10 – Rough Carpentry.
- .2 Section 07 31 13 – Asphalt Shingles.
- .3 Section 07 46 23 – Wood Siding.
- .4 Section 09 21 16 – Gypsum Board Assemblies.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C167-09, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
 - .2 ASTM C553-13, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .3 ASTM C665-12, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - .4 ASTM C1320-10(2016), Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
 - .5 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 Canadian Gas Association (CGA)
 - .1 CAN/CSA B149.1-10, Natural Gas and Propane Installation Code, Includes Update No. 1 (2010).
 - .2 CAN/CGA B149.2-10, Propane Storage and Handling Code.
- .3 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 S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
 - .3 CAN/ULC S604-M91, Standard for Factory Built Type A Chimneys.
 - .4 CAN/ULC S702-09-AM1, Standard for Thermal Insulation Mineral Fibre for Buildings, Includes Amendment 1 (January 2012).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 11 00 – General Requirements: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications, and data sheet.
- .2 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver insulation and accessories in original unopened packaging or cartons bearing manufacturer's seals and labels.
- .2 Store materials under cover on raised platforms, away from moisture. Keep dry at all times.

Part 2 Products

2.1 BLANKET INSULATION

- .1 Type INS-A: Fibrous Rock Wool Glass Acoustical Insulation for Fire and Smoke Rated Assemblies: Un-faced preformed mineral slag fibrous insulation meeting the requirements of ULC S702; having maximum flame spread and smoke developed of 20/20 in accordance with CAN/ULC S102 and being non-combustible in accordance with CAN/ULC S114 and as follows:
 - .1 Type: 1.
 - .2 Width: to friction fit in stud spaces.
 - .3 Thickness: minimum 89 mm to fill a minimum of 90% of the cavity thickness.
 - .4 Nominal density: 40 kg/m³.
 - .5 Standard of Acceptance:
 - .1 Roxul Inc., Roxul AFB Acoustical Fire Batt.
- .2 Type INS-B: Fibrous Rock Wool Insulation: Un-faced, preformed mineral slag fibrous insulation in accordance with CAN/ULC S702 and as follows:
 - .1 CAN/ULC S702 Type 1.
 - .2 Thermal Resistance: R22 (RSI 3.87) at 5.5" thick.
 - .3 Combustion Characteristics: non-combustible in accordance with CAN/ULC S114.
 - .4 Flame spread index = 0; Smoke developed index = 0 in accordance with CAN/ULC S102.
 - .5 Density: > 2 lbs/ft³ (>32 kg/m³).
 - .6 Thickness: 5.5" thick (140 mm).
 - .7 Standard of Acceptance:
 - .1 Rockwool Comfortbatt R22.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's printed installation instructions, data sheets, and standard details.

3.2 PREPARATION

- .1 Verify all in-wall construction is complete before beginning installation.
- .2 Install insulation after building substrate materials are dry.
- .3 Ensure substrate materials are properly installed and complete before beginning installation.

3.3 INSTALLATION

- .1 Install batts snug between framing members, structural components and other items snug and tight.
- .2 Cut and trim batts neatly to fit spaces. Use batts free from ripped or damaged back and edges.
- .3 Do not compress insulation to fit into spaces.
- .4 Install batt insulation where indicated with continuous vapour retarder on the warm side of the insulation in accordance with ASTM C1320.
- .5 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .6 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC S604 Type A chimneys and CAN/CGA B149.1 and CAN/CGA B149.2 Type B and L vents.
- .7 Fill stud space of exterior framed walls with insulation full depth of studs.
- .8 Hold insulation in position with clips, wires or as recommended by manufacturer when insulation is installed in horizontal locations.
- .9 Do not enclose insulation until it has been reviewed by Departmental Representative.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 Work of this Section.

3.6 SCHEDULE

- .1 Use insulation Type INS-A at interior partitions.
- .2 Use insulation Type INS-B at exterior walls between the studs.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Division 03 Cast-in-Place Concrete (refer to Drawings).
- .2 Section 07 21 13 - Board Insulation.
- .3 Section 31 05 99 - Common Work Results for Earthworks.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM E96/E96M-16, Standard Test Methods for Water Vapor Transmission of Materials.
 - .2 ASTM E154/E154M-08a(2013)e1 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - .3 ASTM F1249-13, Standard Test Method for Water Vapour Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
 - .4 ASTM E1643-18a, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - .5 ASTM E1745-17, Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - .6 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit the following in accordance with Section 01 11 00 – General Requirements: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.
 - .2 Submit manufacturer's installation instructions including joint treatment recommendations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- .2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- .3 Store materials in clean, dry area in accordance with manufacturer's instructions.
- .4 Protect materials during handling and application to prevent damage.

Part 2 Products

2.1 VAPOUR RETARDER MATERIAL

- .1 Vapour Retarder for installation under concrete slabs shall meet or exceed the requirements of ASTM E1745, Class A, minimum 15 mils thick.
 - .1 Acceptable materials:
 - .1 Moistop Ultra 15 Underslab Vapour Retarder (Premium), by Fortifiber Building Systems Group.

- .2 Florprufe 120, by Grace Construction Products.
 - .3 VaporFlex 15, by Layfield Construction Materials.
 - .4 VaporBlock VB15, by Raven Industries.
 - .5 Stego Wrap 15 mil, by Stego Industries LLC.
 - .6 VaporBlock G, by Global Plastics.
 - .7 Perminator 15 mil, by W.R. Meadows.
- .2 Accessories:
- .1 Provide manufacturer's required seam tape (4" wide at seams and 2" wide elsewhere), pipe boots and vapour proofing mastic as required to ensure continuity of vapour retarder performance and forming a complete system in accordance with CAN/CSA A23.1 and ASTM E1643

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written installation instructions, standard details and data sheets.

3.2 EXAMINATION

- .1 Examine surfaces to receive the membrane. Notify Consultant if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected. Commencement of Work means acceptance of existing conditions.

3.3 COORDINATION

- .1 Coordinate with other trades (example: floor socket installations) as required to ensure continuity of vapour retarder seal, and to deter construction damage. Repair all damage or defects prior to covering.

3.4 INSTALLATION: UNDER-SLAB SHEET VAPOUR BARRIER

- .1 Prepare surfaces in accordance with the manufacturer's printed instructions.
- .2 Install Vapour Retarder over rigid insulation per Drawing details.
- .3 Continuous Vapour Retarder shall be installed around underground ducts in accordance with the Sheet Metal and Air Conditioning Contractors' National Association's (SMACNA) construction standards. Coordinate Work with other trades.
- .4 Installation shall be in accordance with the manufacturer's printed instructions, and the requirements of ASTM E1643.
- .5 Unroll the Vapour Retarder with the longest dimension parallel with the direction of the pour.
- .6 Lap the Vapour Retarder over footings and seal to foundation walls.
- .7 Overlap joints 6" and seal with the manufacturer's seam tape.
- .8 Seal all penetrations (including pipes) with the manufacturer's pipe boot.
- .9 No penetration of the Vapour Retarder will be allowed, except for permanent utilities, unless approved in writing by Consultant. Seal all penetrations as recommended by the manufacturer.
- .10 Repair damaged areas by cutting patches of Vapour Retarder, overlapping the damaged area 6", and taping all four sides with tape.

3.5 FIELD QUALITY CONTROL

- .1 Field Inspection: to ASTM E1643; coordinate field inspection in accordance with Section 01 11 00 – General Requirements: Quality Control.
- .2 Manufacturer's Services:
 - .1 Have manufacturer review work involved in handling, installation, protection, and cleaning of vapour retarder and components, and submit written reports in acceptable format to verify compliance of Work with Contract conditions.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for product installation review in accordance with manufacturer's instructions.
 - .3 Report any inconsistencies from manufacturer's recommendations immediately to Consultant.
 - .4 Concrete shall not be poured until Consultant manufacturer and Consultant review and accept installation, and all deficiencies repaired at Contractor's expense.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 10 – Rough Carpentry.
- .2 Section 07 21 14 – Spray Applied Polyurethane Foam.
- .3 Section 07 31 13 – Asphalt Shingles.
- .4 Section 07 46 23 – Wood Siding.
- .5 Section 07 92 00 – Joint Sealants.
- .6 Section 08 11 13 – Metal Doors and Frames.
- .7 Section 08 50 13 – Aluminum Windows.
- .8 Other sections as required.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM D93-12, Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester.
 - .2 ASTM E96/E96M-10, Standard Test Methods for Water Vapor Transmission of Materials.
 - .3 ASTM D146/D146M-04 (2012) e1, Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing.
 - .4 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
 - .5 ASTM D882-12, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - .6 ASTM D903-98(2010), Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - .7 ASTM D1709-09, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
 - .8 ASTM D1970/D1970M-11, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - .9 ASTM D2103-10, Standard Specification for Polyethylene Film and Sheeting.
 - .10 ASTM D2261-13, Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine).
 - .11 ASTM D2582-09, Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
 - .12 ASTM D4533-11, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - .13 ASTM D4541-09e1, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - .14 ASTM D7234-12, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
 - .15 ASTM E96/E96M-13, Standard Test Methods for Water Vapor Transmission of Materials.

- .16 ASTM E283-04 (2012), Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .17 ASTM E1643-11, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- .18 ASTM E2112 - 07(2016), Standard Practice for Installation of Exterior Windows, Doors and Skylights.
- .19 ASTM E2178-11, Standard Test Method for Air Permeance of Building Materials.
- .20 ASTM E2357-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 37-GP-56M AMEND., Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
 - .2 CAN/CGSB-51.34-M86 AMEND., Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Select products to be compatible with adjoining membranes previously installed under related Sections
 - .2 Select products from a single manufacturer, or products that are compatible from different manufacturers.
 - .3 Coordination between all installers of each component of vapour and air retarder system is essential to ensure continuity of system and that junctions between the various components are effectively sealed.
 - .4 Verify with manufacturers and all tradesmen involved with installation procedures of building products incorporated into air barrier elements including, but not limited to, various membranes, coating and sealants as well as continuity with roofing membrane.
- .2 Pre-installation Meeting:
 - .1 Convene one week before commencing Work of this Section. Have trades affected by the Work of this Section in attendance. Review coordination and sequencing requirements required to maintain continuity of membrane performance.
- .3 Sequencing:
 - .1 Sequence work in accordance with Construction Progress Schedule.
 - .2 Sequence work to permit installation of materials in conjunction with related materials and seals.
 - .3 Overlap (shingle) materials to direct water down and away from the structure.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures:
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and datasheets, and include product characteristics, performance criteria, physical size, finish, and limitations.
 - .2 Submit statement from manufacturer(s), indicating products supplied under this Section are compatible with one another and with products previously installed under the work of related Sections.
- .3 Quality Assurance Submittals: submit following in accordance with Section 01 11 00 – General Requirements: Quality Control.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Manufacturers' Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.5 QUALITY ASSURANCE

- .1 Applicator: employ a company with documented experience with installation of air/vapour barrier systems.
 - .1 Completed installation must be approved by the material manufacturer.
- .2 Applicator: company:
 - .1 Currently licensed by National Air Barrier Association certifying organization.
 - .2 Must maintain their license throughout the duration of the project.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 11 00 – General Requirements: Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.7 AMBIENT CONDITIONS

- .1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.
- .2 Ventilate enclosed spaces in accordance with Section 01 11 00 – General Requirements: Temporary Utilities.
- .3 Maintain temperature and humidity recommended by materials manufacturer before, during and after installation.

1.8 WARRANTY

- .1 Contractor agrees to correct any deficiencies of labour or material found in the work performed for a period of 2-years from date of Substantial Performance.

Part 2 Products

2.1 AIR BARRIER: EXTERIOR APPLICATION

- .1 Air Barrier: vapour-permeable (breathable), water-resistive air barrier, with the following minimum physical properties and performance characteristics:
 - .1 Application temperature: to -7 degrees C.
 - .2 Service temperature: +80 degrees C to -40 degrees C.
 - .3 Air permeance, to ASTM E2178, maximum 0.02 l/m² @ 75 Pa: pass.
 - .4 Water vapour transmission, to ASTM E96 Method A: ≤ 235 g/m² – 24 hrs
 - .5 Water vapour permeance, to ASTM E96 Method A: ≤ 1915 ng/Pa•m²•s.
 - .6 Acceptance criteria for water-resistive barriers, to ICC-ES AC38: pass.
 - .7 Average Dry Breaking Force, to ASTM D5034:
 - .1 MD: ≥ 245 N
 - .2 CD: ≥ 214 N.
 - .8 Accelerated aging, to ICC-ES AC48, 25 cycles: pass.
 - .9 Cycling and elongation, to ICC-ES AC48, 100 cycles at -29°C: pass
 - .10 Thickness, to TAPPI T-410: 19 mils (.5 mm).
 - .11 Class A for flame spread and smoke developed.
 - .12 Low temperature flexibility, to ICC-ES AC38/3.3.4: pass.
 - .13 Nail sealability, to ASTM D1970, modified: pass.
 - .14 Acceptable Materials:
 - .1 Soprema (Sopraseal Stick VP with primer).
 - .2 W.R. Meadows (Air-Shield with primer).
 - .3 Henry Company (Blueskin VP160 with primer).
 - .4 Grace Construction and Packaging (Perm-A-Barrier® VPS with primer).
 - .5 VaproShield (WrapShield SA® with primer).
- .2 Primer: provide primer as supplied by membrane manufacturer.

2.2 VAPOUR RETARDER: INTERIOR APPLICATION

- .1 Vapour Retarder: instead of conventional polyurethane sheet, supply and install low-VOC variable vapour-permeable vapour retarder film; polyimide (nylon) or polyethylene copolymer membrane with polypropylene fleece and polypropylene non-woven fabric reinforcement; meeting or exceeding the following minimum requirements:
 - .1 Thickness: 0.05 mm.
 - .2 High moisture-variable diffusion resistance in any climate spanning range of more than 100 times:
 - .1 Sd-value: 0.25 m to above 25 m.
 - .2 G-value: 1.25 to above 125 MN•s/g.
 - .3 Vapour permeance: <0.13 to above 13.
 - .3 Fire Resistance: Class A, to ASTM E84.

- .1 Flame spread = 0; smoke developed ≤ 35 .
- .2 Vapour Permeance, to ASTM E96, Method A: similar to $10 \text{ ng/s}\cdot\text{m}^2\cdot\text{Pa} \pm .5 \text{ ng/s}\cdot\text{m}^2\cdot\text{Pa}$.
- .3 Air Permeance, to ASTM E2178: similar to $0.025 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$.
- .4 Performance: marketed as “smart” or “intelligent” vapour retarders in that vapour permeance of material responds to ambient humidity conditions, permitting greater vapour diffusion under higher humidity levels (summer) and lower vapour diffusion under lower humidity levels(winter)
 - .1 Standard of Acceptance:
 - .1 Certaineed MemBrain, The SMART Vapor Retarder.
 - .2 Intello Plus, by Pro Clima.

2.3 UNDER-SLAB VAPOUR RETARDER

- .1 Under-slab vapour retarder: refer to Section 07 26 16 – Underslab Vapour Retarder.

2.4 ROOF UNDERLAYMENT

- .1 Roof underlayment and vapour retarder membrane: refer to Section 07 61 00 - Sheet Metal Roofing.

2.5 WINDOW AND DOOR FLASHINGS

- .1 Supply premanufactured window and door flashing: self-adhering membrane consisting of an SBS rubberized asphalt compound, which is integrally laminated to a blue-engineered film. The membrane shall be specifically designed to be self-adhered to a prepared substrate at window and door openings.
- .2 Ensure compatibility with air barrier and vapour retarder systems to preserve continuity of both systems.
- .3 Supply compatible sealants and tape as recommended and supplied by membrane manufacturer.
- .4 Acceptable materials:
 - .1 Blueskin WB Window and Door Flashing, by Henry, or similar with same or better physical properties and performance characteristics.

2.6 ACCESSORIES

- .1 Accessories: supply manufacturer's recommended primers, seam tape, sealants, adhesives, prefabricated sill pan flashings, termination mastics, transition membranes, penetration sealants, and other accessories as required for a complete installation.
- .2 Moulded box vapour retarder: factory-moulded polyethylene box, purpose-made for use with recessed electric switch and outlet device boxes.
- .3 Fasteners: supply stainless steel screws, plastic clips and other fasteners as recommended by manufacturer required for complete installation of work.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturers' printed installation instructions, typical details, and data sheets.

3.2 COORDINATION

- .1 Coordinate with other trades as required to ensure continuity of air barrier and vapour retarder performance at entire enclosure perimeter. Tie-in to adjacent systems as required, and seal transitions.

3.3 EXAMINATION

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

3.4 PREPARATION

- .1 Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the air barrier assembly.
- .2 Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws in accordance with exterior sheathing manufacturers written instructions.
- .3 Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- .4 Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- .5 Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- .6 At changes in substrate plane, apply sealant at sharp corners and edges to form a smooth transition from one plane to another.
- .7 Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.5 WINDOW AND DOOR OPENING TREATMENT

- .1 Install flexible membrane window flashings in accordance manufacturer's printed installation instructions and illustrations.
- .2 Work at windows and doors shall generally conform to window flashing details recommended by air barrier manufacturer suitable to site conditions.

3.6 FOUNDATION SILL PLATE TREATMENT

- .1 Work at foundation sill plate shall generally conform to sill flashing detail recommended by air barrier manufacturer suitable to site conditions.

3.7 EXTERIOR AIR BARRIER

- .1 Refer to manufacturer's literature for recommendations on installation
- .2 Apply air barrier membrane to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- .3 Application of Self-Adhered Air Barrier Membrane:
 - .1 Install air barrier to dry surfaces at air and surface temperatures of 4°C (40°F) and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.
 - .2 Prime substrate to receive air barrier membrane as required per manufacturers written instructions.
 - .3 Precut pieces of air barrier into easily handled lengths.
 - .4 Remove release linear and position membrane carefully before placing against the surface.
 - .5 Begin installation at the base of the wall placing top edge of membrane immediately below any masonry reinforcement or ties protruding from substrate.
 - .6 When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
 - .7 Overlap adjacent pieces 50 mm (2 in.) and roll seams.
 - .8 Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap the membrane sheet below by 50 mm (2 in.). Roll firmly into place.
 - .9 Seal around masonry reinforcing or ties and all penetrations with penetration & termination sealant.
 - .10 Coordinate the installation of air barrier with roof installer to ensure continuity of membrane with roof air barrier.
 - .11 At end of each working day seal top edge of air barrier to substrate with termination sealant.
 - .12 Do not expose air barrier membrane to sunlight for more than 150 days prior to enclosure.
 - .13 Inspect installation prior to enclosing and repair punctures, damaged areas and inadequately lapped seams with a patch of the membrane sized to extend 150 mm (6 in.) in all directions from the perimeter of the affected area.
- .4 Transition Membrane Installation:
 - .1 Install strips, transition membrane, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier. Install all transition membrane only after application of air barrier.
 - .2 Apply primer to substrates to receive transition membrane at required rate and allow to dry. Limit priming to areas that will be covered by transition tape in same day. Re-prime areas exposed for more than 24 hours.

- .1 Prime glass-fiber-surfaced gypsum sheathing not covered with air membrane material with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- .3 Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- .4 At end of each working day, seal top edge transition membrane to substrate with termination sealant.
- .5 Apply joint sealants forming part of air barrier assembly within sealant manufacturer's recommended application temperature ranges. Consult sealant manufacturer when sealant cannot be applied within these temperature ranges.
- .6 Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition membrane so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
 - .1 Transition Membrane: Roll firmly to enhance adhesion.
- .7 Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- .8 Repair punctures, voids, and deficient lapped seams in transition membrane. Slit and flatten fish-mouths and blisters. Patch with transition membrane extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.8 INTERIOR VAPOUR RETARDER

- .1 Verify that services are installed and have been accepted by the Departmental Representative and Authorities Having Jurisdiction prior to installation of vapour barrier.
- .2 Install sheet vapour barrier on warm side of exterior wall and ceiling assemblies prior to installation of gypsum board to form continuous retarder in accordance with manufacturer's written instructions.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Install materials in a manner that maintains continuity; repair punctures and tears with sealing tape before work is concealed.
- .5 Openings:
 - .1 Cut sheet vapour barrier to form openings and lap and seal to window and door frames in accordance with good building envelope practice.
- .6 Seal perimeter of sheet vapour retarder as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.
 - .3 Adhere sheets using sealant bead at each steel framing member and at top and bottom tracks.
 - .4 Install sealant bead with no gaps; smooth out folds and ripples occurring in sheet over sealant.
- .7 Seal lap joints of sheet vapour retarder as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.

- .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
- .4 Adhere sheets using sealant bead at each steel framing member and at top and bottom tracks.
- .5 Install sealant bead with no gaps; smooth out folds and ripples occurring in sheet over sealant.
- .8 Seal electrical switch and outlet device boxes that penetrate vapour retarder as follows:
 - .1 Install moulded box vapour retarder:
 - .2 Apply sealant to seal edges of flange to main vapour retarder and seal wiring penetrations through box cover.

3.9 FIELD QUALITY CONTROL

- .1 The Departmental Representative shall inspect installed membrane for continuity of air barrier prior to placement of insulation or covering by other materials that prevent inspection.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.11 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry.
- .2 Section 07 21 14 - Spray Applied Polyurethane Foam.
- .3 Section 07 27 14 – Air and Vapour Barriers.
- .4 Section 07 46 23 – Wood Siding.
- .5 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .6 Section 07 92 00 – Joint Sealants.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B749-03(2009) Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
 - .2 ASTM D1922-09 Standard Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method.
 - .3 ASTM D1970/D1970M-13a Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - .4 ASTM D3018/D3018M-11 Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.
 - .5 ASTM D3161/D3161M-13 Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method).
 - .6 ASTM D3176-09 Standard Practice for Ultimate Analysis of Coal and Coke.
 - .7 ASTM D3462/D3462M-10a Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
 - .8 ASTM D4586/D4586M-07(2012)e1 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
 - .9 ASTM D4977/D4977M-03(2013)e1 Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion.
 - .10 ASTM D7158/D7158M-11 Standard Test Method for Wind Resistance of Asphalt Shingles (Uplift Force/Uplift Resistance Method).
 - .11 ASTM E108-11 Standard Test Methods for Fire Tests of Roof Coverings.
 - .12 ASTM F1667-11ae1, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 Canadian Roofing Contractors' Association (CRCA)
 - .1 CRCA Roofing Specification Manual, 2012.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A123.1-05/A123.5-05 (R2010), Asphalt Shingles Made From Organic Felt and Surfaced With Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules.
 - .2 CSA A123.2-03 (R2013), Asphalt-Coated Roofing Sheets.
 - .3 CSA A123.51-14, Asphalt shingle application on roof slopes 1:6 and steeper.
 - .4 CAN3 A123.52-M85 (R2011), Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3.

- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC S107-10, Methods of Fire Tests of Roof Coverings
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA Architectural Sheet Metal Manual, 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and technical datasheets. Indicate the following:
 - .1 Physical properties.
 - .2 Performance characteristics.
 - .3 Installation instructions.
 - .4 Limitations.
 - .5 Colour and finish.
- .3 Samples.
 - .1 Submit shingle samples for initial selection of colour.
 - .2 Do not order materials until samples approved.
- .4 Manufacturer's Instructions: Provide to indicate special handling criteria and installation sequence.
- .5 Submit Warranties.
- .6 Submit closeout data in accordance with Section 01 11 00 – General Requirements: Closeout Submittals.
 - .1 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions.

1.4 QUALITY ASSURANCE

- .1 Installer shall be a member in good standing of CRCA.
- .2 Asphalt shingles shall be applied to wood sheathing over a ventilated air space.
- .3 Work shall meet or exceed CRCA Roofing Specification Manual guidelines and recommendations, which shall be treated as minimum requirements for this Project.
- .4 Sheet metal work shall be to SMACNA Architectural Sheet Metal Manual.

1.5 MOCK-UPS

- .1 Construct mock-ups in accordance with Section 01 11 12 – Project General Requirements: Quality Control.
 - .1 Provide 3000 x 3000 mm mock-up including components as follows.
 - .2 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
 - .3 Locate where directed.
 - .4 Allow 24 hours for inspection of mock-up before proceeding with work.

- .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished Work.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store, and protect materials in accordance with Section 01 11 00 – General Requirements: Common Product Requirements.
- .2 Deliver asphalt shingle materials and components in manufacturer's original, unopened, undamaged packages with identification labels intact.
- .3 Provide and maintain dry, off-ground weatherproof storage.
- .4 Remove only in quantities required for same day use.

1.7 EXTRA MATERIALS

- .1 Provide maintenance materials in ac
 - .1 Provide 3 bundles or as otherwise sufficient to fully shingle 1 square (9.3 square metres) of roof area in accordance with the requirements of this Section.
- .2 All unused, undamaged shingles remain property of Departmental Representative.

1.8 WARRANTY

- .1 Manufacturer's Shingle Lifetime Limited Warranty Program:
 - .1 Provide manufacturer's lifetime limited warranty for product incorporated into the Work, with manufacturer's 180-month special protection period (during which time the manufacturer shall supply replacement shingles similar to those already on the roof at own cost, plus a reasonable allowance for the cost of applying the new shingles), 120-month algae resistance warranty, and 180-month high-wind application warranty, to 210 km/h (110 miles per hours).
 - .2 Warranty period commences from date of Certificate of Substantial Performance.
- .2 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 32.1 of General Conditions "C" is extended to 24 months.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 CertainTeed Corporation.
- .2 IKO Industries Ltd..
- .3 Malarkey Roof Products.
- .4 Similar, meeting or exceeding the physical properties and performance characteristics.

2.2 ASPHALT SHINGLES

- .1 Asphalt shingles: lifetime shingles, to CSA A123.5 and ASTM D3462, glass-fibre reinforced, mineral-granule surfaced, self-sealing with Class A fire rating. Shingle conforms to requirements of CSA A123.5, ASTM D3018, ASTM E108 Class A, ASTM 3462, ASTM D3161 Class F, and ASTM D7158 Class H, and as follows:
 - .1 Colour: charcoal grey, in accordance with approved samples.
 - .2 Match new shingles installed at adjacent buildings within the last 12 months.
- .2 Hip and Ridge Shingles: Manufacturer's standard to match asphalt shingles.

2.3 SHEET MATERIALS

- .1 Waterproofing Underlayment: to ASTM D1970, sheet barrier of self-adhering rubberized asphalt membrane having glass mat fibre reinforcement, mineral granule surfaced, back paper release film, cold-applied, minimum thickness of 1.8 mm (71 mils).
 - .1 Basis-of-Design:
 - .1 Armourgard Ice and Water Protector Commercial 44, by IKO, or similar with same or better performance characteristics and material properties, by:
 - .1 Johns Manville International, Inc.
 - .2 CertainTeed Corporation.
 - .3 GAF Materials Corporation.
 - .2 Felt paper: not used; use Waterproofing Underlayment specified above instead.

2.4 ACCESSORIES

- .1 Facia: shall be Eastern White Cedar to match siding in colour, to Section 06 20 00 - Finish Carpentry and Section 07 46 23 - Wood Siding.
- .2 Rigid Ridge Vent: Manufacturer's standard rigid section high-density polypropylene or other UV stabilized plastic ridge vent with non-woven geotextile filter strips and with external deflector baffles; for use under ridge shingles. Roof Vents/Louvers shall be equipped with insect/ critter/rodent protective screen critter/rodent proof.
 - .1 Acceptable Materials:
 - .1 Cobra Rigid Vent II, GAF Materials Corporation.
 - .2 RidgeMaster Plus, Mid America Building Products.
 - .3 ShingleVent II, Air Vent Inc., a CertainTeed Company.
 - .4 SmartAir Ridge Vent, Globe Building Materials, Inc.
- .3 Asphalt Plastic Cement: to ASTM D4586, asbestos-free.
- .4 Nails and Fasteners: to ASTM F1667, purpose-made, sufficient length to penetrate through the asphalt shingles and roof sheathing.
 - .1 Aluminum-zinc alloy cast or capped head, used with neoprene-coated aluminum or Type 303 stainless steel washer.
 - .2 Where nails are in contact with metal flashing, use nails made from same metal as flashing.
 - .3 Roofing nails shall have a head diameter of not less than 10 mm and a shank thickness of not less than 3 mm.

2.5 SHEET METAL FLASHING AND TRIM

- .1 Provide materials as required: to Section 07 62 00 – Sheet Metal Flashing and Trim.
- .2 Fabricate sheet metal flashing and trim in accordance with recommendations in SMACNA Architectural Sheet Metal Manual that apply to design, dimensions, metal, and other characteristics of item, and as follows:
 - .1 Apron Flashings: Fabricate with lower flange a minimum of 100 mm over and 100 mm beyond each side of down slope asphalt shingles and 150 mm up the vertical surface.
 - .2 Step Flashings: Fabricate with a head lap of 50 mm and a minimum extension of 100 mm over the underlying asphalt shingle and up the vertical surface.

- .3 Cricket, Backer, and Saddle Flashings: Fabricate with concealed flange extending a minimum of 610 mm beneath upslope asphalt shingles and 150 mm beyond each side of chimney and 15] mm above the roof plane.
- .4 Open Valley Flashings: Fabricate in lengths not exceeding 3050 mm with 25 mm high inverted V profile at centre of valley and equal flange widths of 305 mm, 610 mm total.
- .5 Drip and Rake Edges: Fabricate in lengths not exceeding 3050 mm with 50 mm roof deck flange and 38 mm fascia flange with 10 mm drip at lower edge.
- .3 Vent Pipe Flashings: Oatey ASTM B749, Type L51121, at least 1.5 mm thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 100 mm from pipe onto roof.

Part 3 Execution

3.1 COMPLIANCE

- .1 Comply with manufacturer's printed installation instructions, standard details, and data sheets.
- .2 Comply with the National Building Code of Canada as amended (Code) and requirements of *authorities having jurisdiction*. Where the requirements of this Section exceed the requirements of the Code, this Section governs.
- .3 Install asphalt shingles in accordance with CSA A123.51 or CAN3 A123.52, as applicable to roof slope conditions.

3.2 EXAMINATION

- .1 Verify substrate and surface conditions are in accordance with asphalt shingle manufacturer's recommended tolerances prior to installation of asphalt shingles and accessories.
 - .1 Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within acceptable flatness tolerances.
 - .2 Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
- .2 Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the work means acceptance of conditions.

3.3 INSTALLATION: WATERPROOFING UNDERLAYMENT

- .1 Cover entire roof surface (100%), from peaks to lower edge of roof, with Waterproofing Underlayment, lapped as specified, and shingled per normal shingle exposures.
- .2 Cut the membrane into 3 m to 4.5 m (10 ft. to 15 ft.) lengths.
- .3 Unroll and align with the lower edge of roof. Tack top edge with four equally-spaced temporary fasteners.
- .4 Lift the lower half and remove the lower release film, exposing the adhesive surface.
- .5 Carefully reposition the membrane down onto the deck and press firmly in place. Avoid wrinkles. Remove temporary fasteners.
- .6 Fold top half down and remove release film.

- .7 Carefully reposition the membrane up onto the deck and press firmly in place. Avoid wrinkles.
- .8 Upper courses shall overlap the selvage tape on lower courses.
- .9 End laps shall be at least 15 cm (6"), rolled to ensure adhesion, and shall be located at least 61 cm (24") from those in the previous course.
- .10 At valleys and ridges, cut the membrane into 1.2 m to 1.8 m (4 ft. to 6 ft.) lengths. In the valley, start at the low point and work upwards, overlapping each sheet at least 15 cm (6"). Peel off the release film and centre the sheet over the valley or ridge. Drape and press in place working from the centre outward toward the edges. Membranes shall not be left exposed in an open valley.

3.4 INSTALLATION: SHEET METAL FLASHING

- .1 General:
 - .1 Install metal flashings and other sheet metal as required.
 - .2 Install base flashings before shingles are applied.
 - .3 Install cap flashings and base flashings of sheet metal at chimneys, skylights, vents, walls and other vertical surfaces, and seal with asphalt plastic cement.
- .2 Apron Flashings: Extend lower flange over and beyond each side of down slope asphalt shingles and up the vertical surface.
- .3 Step Flashings: Install with a head lap of 50 mm and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- .4 Cricket, Backer, and Saddle Flashings: Install against the roof penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
- .5 Open Valley Flashings:
 - .1 Install 610 mm wide flashing centred in valley, lapping ends at least 203 mm in direction to shed water.
 - .2 Fasten upper end of each length to roof deck beneath overlap.
 - .3 Secure hemmed flange edges into metal cleats spaced 305 mm apart and fastened to roof deck.
 - .4 Adhere 225 mm wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
- .6 Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.
- .7 Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing; maintain a minimum of 6 mm spacing between vertical flashing flange and fascia.
- .8 Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.5 **INSTALLATION: ASPHALT SHINGLES**

- .1 Nailing requirements:
 - .1 Use 6 nails per shingle, placed in the nail line 7-3/8" below the top edge:
 - .1 Outside nails shall be 1" from each end. Inside nails shall be placed at equal spacing between outer nails in pairs, 1-inch apart, for a total of six nails. Three manual applications of asphalt plastic cement are required. Nails shall penetrate both the overlay and underlay portions of the shingle.
 - .2 Ensure that no nail is within 2" of a joint/cutout of the underlying shingle.
 - .3 Seal down each shingle at time of application with three 1" diameter (approx. size and thickness of a quarter) spots of asphalt plastic cement placed under the shingle 2" above the bottom edge and equally spaced along the shingle. Apply plastic cement in moderation since excessive amounts may cause blistering.
- .2 Starter Course: Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed. Install the starter course with the factory-applied sealant adjacent to the eaves overhanging the rake edge and eaves by a nominal 1/4" minimum. Begin starter course with a shingle cut 4" short so that joints will not coincide with joints between first course shingles.
 - .1 Starter strip shingles must be used at all eaves and rakes.
- .3 First Course: Start with a complete shingle applied flush with starter course at rake and eave. Nail as specified and continue across roof with full shingles.
- .4 Second, Third and Fourth Courses: Trim off 10", 20", and 30" respectively, from the left end of the starting shingle and apply to overhang rake edge by 1/4" to 3/8". Continue each course across the roof with full shingles butting ends loosely. Align the bottom edge of the shingles with the tops of the saw teeth of the shingles in the underlying course.
- .5 Fifth and Succeeding Courses: Repeat the sequence of the first four courses up the roof. Cement shingles at rake edges.
- .6 Open Valleys:
 - .1 Complete sheet metal valley flashing before shingles are applied.
 - .2 Center a 36" width strip of Waterproofing Underlayment in the valley. Ensure flashing is tight to the deck, then fasten with only enough nails to hold in place, nailing at the edges only.
 - .3 Center a minimum 24" wide, pre-finished/galvanized metal valley liner in the valley, and fasten with only enough nails to hold in place, nailing at the edges only.
 - .4 Snap two chalk lines the full length of the valley, 6" apart at the top and increasing in width 1/8" per foot towards the bottom.
 - .5 When the shingles are being applied, lay them over the valley flashing, trim the ends to the chalk line, and cut a 2" triangle off the corner to direct water into the valley.
 - .6 Embed the valley end of each shingle into a 3" band of asphalt plastic cement, and nail the shingles 2" back from the chalk line, 7-3/8" down from the top edge of the shingle.
 - .7 Closed cut or woven valleys are not permissible, and will be rejected at Contractor's expense.

- .7 Ridge Vents:
 - .1 Install continuous ridge vents in accordance with manufacturer's written instructions.
 - .2 Fasten with roofing nails or screws of sufficient length to penetrate sheathing.
 - .3 Fasten ridge cap shingles to cover ridge vent without obstructing airflow.

- .8 Ridge and Hip Cap Shingles:
 - .1 Maintain same exposure of cap shingles as roofing shingle exposure.
 - .2 Lap cap shingles at ridges to shed water away from direction of prevailing winds.
 - .3 Fasten with roofing nails of sufficient length to penetrate sheathing.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry.
- .2 Section 07 31 13 – Asphalt Shingles.
- .3 Section 07 27 14 – Air and Vapour Barriers.
- .4 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .5 Section 07 92 00 – Joint Sealants.
- .6 Section 08 11 13 – Metal Doors and Frames.
- .7 Section 08 50 13 – Aluminum Windows.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM D5116-10, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
 - .2 ASTM F1667-15, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA O118.2-08 (R2013), Eastern White Cedar Shingles.
 - .2 CAN/CSA O141-05 (R2009), Softwood Lumber.
- .3 Environmental Choice Program (ECP)
 - .1 CCD-045-95, Sealants and Caulking Compounds.
- .4 Maritime Lumber Bureau (MLB)
- .5 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber 2003.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, installer, and affected trades in accordance with Section 01 11 00 – General Requirements: Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review structural load limitations.
 - .3 Coordination with other building trades.
 - .4 Review manufacturer's installation instructions.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
- .3 Samples:
 - .1 Unfinished samples: Submit duplicate of each type of siding and trim in specified width, 600 mm long, in dry condition.
 - .2 Finished samples for initial selection of colours and finishing processes: Submit duplicate of each type of siding and trim, finished, in specified width, 600 mm long, in dry condition.
 - .3 Submit duplicate samples of caulking for initial selection of colours.
- .4 Manufacturer's Instructions: Provide to indicate special handling criteria and installation sequence.
- .5 Submit closeout data in accordance with Section 01 11 00 – General Requirements: Closeout Submittals.
 - .1 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions.
 - .2 Submit manufacturer's warranties as specified.

1.5 QUALITY ASSURANCE

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

1.6 MOCK-UPS

- .1 Construct mock-ups in accordance with Section 01 11 00 – General Requirements: Quality Control.
- .2 Construct typical exterior wall panel, 3 m long by 4 m wide, incorporating window openings with frame and sill installed, cladding, insulation, building corner condition, junction with roof system; illustrating materials interface and seals.
- .3 Locate where directed.
- .4 Mock-up may remain as part of Work.
- .5 Allow 48 hours for review of mock-up by Departmental Representative before proceeding with work.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with manufacturer's instructions.
- .2 Store materials in safe area, away from construction traffic; store under cover and off ground, protected from moisture with a waterproof covering. Store flat and level.

1.8 WARRANTY

- .1 Field-applied finish: 25-years against cracking, flaking and peeling.
- .2 Kiln-dried cedar: 30-years against wood decay.

Part 2 Products

2.1 EASTERN WHITE CEDAR SIDING, TRIM AND SOFFIT

- .1 Eastern White Cedar: kiln-dried, solid wood siding, to CSA O118.2-08 (R2013), Eastern White Cedar Shingles.
 - .1 Pattern: tongue and groove vertical board siding.
 - .2 Grade: #1 Grade, to Maritime Lumber Bureau standards.
 - .3 Tongue & Groove edges, jointed as indicated, S4S.
 - .4 Texture: rough sawn, circular blade pattern.
 - .5 Moisture Content: kiln dried (seasoned) to 10-12% moisture content; confirm moisture content, and provide testing results to Departmental Representative prior to installation.
 - .6 Board size (nominal): 1-inch x 6"-inches
 - .7 Standard board length: 8-feet.
- .2 Trim boards and other lumber, as required for a complete installation:
 - .1 Eastern White Cedar, to CSA 0141, East White Cedar (N), kiln dried (seasoned) to 10-12% moisture content, #1 Grade, to Maritime Lumber Bureau standards. Confirm moisture content and provide testing results to Departmental Representative prior to application.
 - .2 Surface: surfaced one side and two edges (S1S2E).
 - .3 Texture: smooth.

2.2 WESTERN RED CEDAR SIDING FOR VERTICAL INSTALLATION

- .1 Western Red Cedar: kiln dried, solid wood siding, to CSA 0118.1, graded to meet NLGA Grading Standards, paragraph 200 and WRCLA, and as follows:
 - .1 Pattern: tongue and groove vertical board siding.
 - .2 Grade: Clear Vertical Grain Heart, to NLGA 200a.
 - .3 Square edges, S4S.
 - .4 Texture: smooth face.
 - .5 Moisture Content: kiln dried (seasoned) to 10-12% moisture content; test moisture content, and provide testing results to Departmental Representative prior to installation.
 - .6 Board size (nominal): refer to Drawings, varies.
 - .7 Standard board length: 8' (2.44 m).
 - .8 Moisture Content: kiln dried (seasoned) to 10-12% moisture content, confirm moisture content and provide testing results to Departmental Representative prior to application.

2.3 FINISHES

- .1 Acceptable Coating Manufacturers (Low-VOC, Water or Oil Base to Contractor's Choice):
 - .1 Armstrong-Clark.
 - .2 BEHR Process Corporation.
 - .3 Benjamin Moore.
 - .4 Cabot™ Wood Stains, Valspar.
 - .5 Duckback Products.
 - .6 Flood®, PPG Architectural Finishes, Inc.
 - .7 Olympic Machinecoat™, PPG Architectural Finishes, Inc.

- .8 DeckScapes, Sherwin-Williams.
- .9 Sansin Corporation.
- .10 Sikkens (Akzo Nobel N.V.).
- .11 Wolman™ Wood Care Products, Rust-Oleum.
- .2 Sole Source: use only one manufacturer's products for project.
- .3 Eastern White Cedar (siding, trim and soffit) Basis-of-Design:
 - .1 Colour (basecoat and topcoat): semi-transparent (translucent), similar to Sansin Pickled White 20 (half-dilution, as approved by Departmental Representative). Submit colour samples as required for initial selection prior to ordering materials.
 - .2 Basecoat: penetrating coating, low-VOC (≤ 32 g/l), UV-stable, non-flammable, repels water but allows evaporation, similar to Dansin SDF-0 tintable clear base. Apply two coats to manufacturer's printed application instructions.
 - .3 Topcoat: high-solids, UV-stable, water-repellent, low-VOC (≤ 74 g/l), non-flammable coating, similar to Sansin SDF Top Coat, satin gloss (low luster). Coating shall not crack, peel or blister after application.
- .4 Western Red Cedar (siding) Basis-of-Design:
 - .1 Colour (basecoat and topcoat): transparent / natural.
 - .2 Basecoat: penetrating coating, low-VOC (≤ 32 g/l), UV-stable, non-flammable, repels water but allows evaporation, similar to Dansin SDF-0 clear base. Apply two coats to manufacturer's printed application instructions.
 - .3 Topcoat: high-solids, UV-stable, water-repellent, low-VOC (≤ 74 g/l), non-flammable coating, similar to Sansin SDF Top Coat, satin gloss (low luster). Coating shall not crack, peel or blister after application.

2.4 ACCESSORIES - GENERAL

- .1 Air and Vapour Barrier (Weather Barrier): to Section 07 27 13 – Air and Vapour Barriers.
- .2 UV-Resistant Black Air Barrier: to Section 07 27 14 – Air and Vapour Barriers.
- .3 Ventilation and Drainage Mat and Trim (black): draining air-gap mat with 6.4 mm stand-off dimples, manufactured from 100% post consumer recycled plastic, 380 kPa bearing capacity, approximately 3.6 kg in weight per 1.22 m x 2.44 m panel.
 - .1 Acceptable Materials, similar to the following system:
 - .1 Ventilation and Drainage Mat: Ventgrid12™, by Ventgrid™ Inc..
 - .2 J-Trim (at horizontal terminations top and bottom, and at joints to close off the void behind the cladding preventing pest intrusion while still providing drainage and ventilation): Ventrim20™, by Ventgrid™ Inc..
- .4 Strapping: kiln dried, pressure-treated Douglas Fir lumber: to Section 06 10 00 – Rough Carpentry. Sizes as required.
- .5 Fasteners: to ASTM F1667, SAE No. 316 stainless steel, sized as required.
 - .1 Stainless steel fasteners, suitable for fastening strapping to solid wood backing.
 - .2 Siding installation: stainless steel splitless ring-shanked nails with flat head. Splitless nails shall be minimum 7/32" (0.6 cm) head.
- .6 Sealants: to Section 07 92 00 – Joint Sealants.
- .7 Sheet Metal Flashing and Trim: to Section 07 62 00 – Sheet Metal Flashing and Trim.

Part 3 Execution

3.1 COMPLIANCE

- .1 General: comply with Part 9 - Housing and Small Buildings of the 2015 National Building Code of Canada.
- .2 Comply with manufacturers' printed installation instructions, data sheets, and standard and job-specific details for each product and assembly specified.

3.2 COORDINATION

- .1 Coordinate with other trades and sequence work as required to meet project schedule.

3.3 CEDAR TYPES

- .1 Install Eastern White and Western Red cedar as indicated. Trim and exposed boards shall match adjacent material in accordance with design intent.

3.4 PREPARATION

- .1 Sheet Metal Flashing and Trim: to Section 07 62 00.
- .2 Before installing siding, make sure that flashing are installed to prevent moisture from entering wall and roof spaces. Flashing shall be installed in a manner that intercepts and directs the flow of water away from the building to designed drainage paths. Install horizontal flashing extending from the top of all wall penetrations (e.g., all windows and doors) and at any material or material directional change (e.g., skirtboards, water tables or the introduction of any alternative material). The flashing shall be installed to tilt downward to allow water to drain away from the wall. Siding or trim shall terminate evenly ¼ inch (6 mm) above the flashing ledge. Do not caulk where the flashing and trim or other materials meet. Note that caulking in lieu of flashing is not acceptable.
- .3 Install sill flashing, starter and trim strips, skirtboards, inside corner flashing, edging, and flashing over openings.
- .4 Install UV-Resistant Black Air Barrier at reveals in cladding where it will be exposed and visible behind the cladding. Install J-trim (black) at perimeter of gaps to manage insect access; mitre corners to maintain continuity of insect protection.
- .5 Install black Ventilation and Drainage Mat and J-Trim system over air and vapour barrier membrane, including manufacturer's matching black J-trim at terminations and reveals.

3.5 VERTICAL SIDING INSTALLATION

- .1 Coordinate with work of Section 06 20 00 - Finish Carpentry as required.
- .2 Discard materials that are warped, twisted, bowed, crooked or otherwise defective.
- .3 Field joints: when butt jointing siding, cut ends at 45-degree angles to form an overlapping joint. This is particularly important for vertical installation. Ensure joints meet on studs, blocking or furring strips, with the nails penetrating solid wood at least 1-1/4 inches.
- .4 Fasten wood tongue and groove boards in straight, aligned lengths to strapping.
- .5 Start at one corner, and use a level or plumb line to ensure that the first board is installed plumb. Trim grooved edge of first board for flush fit as required. Nail siding to horizontal blocking lines installed between studs or to furring strips.
- .6 Blind-nail to solid wood backing; toe-nailed through base of each tongue, one siding nail per bearing; fasteners shall penetrate 1-1/4" (32 mm) into solid wood.

- .7 Fasteners shall not be counter sunk into material; set air pressure accordingly if using air tools.
- .8 Corner treatment:
 - .1 Inside corners: butt siding against 2" x 2" (50 mm x 50 mm) trim strip, fitted tight.
 - .2 Outside corners: mitred.
- .9 Siding, trim and skirtboards shall be installed to leave clearance above grade as indicated.

3.6 MOULDING, FASCIA, AND TRIM INSTALLATION

- .1 Installation standard / quality level: to Architectural Woodwork Standards (AWS), Premium Grade.
- .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.
- .4 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 Blind-nail to solid wood backing; fasteners shall penetrate 1-1/4" (32 mm) into backing.
 - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

3.7 FINISHING

- .1 Comply with coating manufacturer's printed directions and data sheets.
- .2 Clean all surfaces to be treated.
- .3 Sand surface well using 60 – 80 grit paper and variable speed orbital sander.
- .4 Vacuum surface to remove dusts. Surface shall be clean, free of dust, dirt, grease, or wax.
- .5 For each basecoat application, flood surface to point of saturation. Apply two coats. Notify Departmental Representative for review of application for each coat.
 - .1 Stir well before and during the application process.
 - .2 Test formula on an inconspicuous wood surface to ensure proper color and penetration.
 - .3 Apply in proper conditions with an ideal temperature of 21°C (70°F) and relative humidity of approximately 50%.
 - .4 Do not apply if rain or near freezing temperatures are expected.
 - .5 Saturate the wood surface.
 - .6 Brush out any puddles and runs and level the finish.
 - .7 Do not apply on wood that is warm to touch or in direct sunlight.
 - .8 Apply a second coat.

- .6 Topcoat application: flood surface to the point of saturation. Notify Departmental Representative for review of application.
 - .1 Test formula on an inconspicuous wood surface to ensure proper color and penetration.
 - .2 Apply in proper conditions, ideal temperature of 21°C (70° F) and relative humidity of approximately 50%.
 - .3 For best results, apply a flood coat of topcoat, to a point of maximum absorption. Always back-brush the surface a few minutes after application.
 - .4 Continually check the surface; wipe up all puddles and brush out any runs.
 - .5 Do not apply in the heat of day or in direct sunlight as this will cause surface filming and limit penetration which may result in peeling at a later date.
 - .6 Do not apply if rain or near-freezing temperatures are likely to occur within 24 hours after application.
 - .7 When using a tinted product be sure to stir well before and during application.
 - .8 Always read published directions for use prior to beginning a project.

3.8 CAULKING

- .1 Seal gaps at all windows, doors, corners, and other exterior joints that are exposed to potential water intrusion, to Section 07 92 00 – Joint Sealants, Type S-5: premium quality multi-component polyurethane sealant, colour to match expected weathered appearance of siding as closely as possible (submit samples to Departmental Representative for initial colour selections before ordering materials). Different colours will be required at white cedar and red cedar locations.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 - General Requirements: Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 - General Requirements: Cleaning.
- .4 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 11 00 - General Requirements: Waste Management and Disposal.
 - .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 wood siding installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry.
- .2 Section 07 31 13 – Asphalt Shingles.
- .3 Section 07 46 23 – Wood Siding.
- .4 Section 08 11 13 – Metal Doors and Frames.
- .5 Section 08 50 13 – Aluminum Windows.

1.2 REFERENCES

- .1 The Aluminum Association Inc. (AA)
 - .1 Specifications for Aluminum Sheet Metal Work in Building Construction.
 - .2 AA DAF-45-2003(R2009), Designation System for Aluminum Finishes.
- .2 ASTM International (ASTM)
 - .1 ASTM A606/A606M-15, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .2 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A792/A792M-10(2015), Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .4 ASTM B32-08(2014), Standard Specification for Solder Metal.
 - .5 ASTM B907-16 Standard Specification for Zinc, Tin and Cadmium Base Alloys Used as Solders.
 - .6 ASTM D523-14, Standard Test Method for Specular Gloss.
 - .7 ASTM D822/D822M-13 Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 - .8 ASTM D4586/D4586M-07(2012)e1 Standard Specification for Asphalt Roof Cement, Asbestos-Free.
 - .9 ASTM F1667-15, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual, 2012.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A440-11 (R2016), NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights, Includes Update No. 1 (2014).
 - .2 CSA A440.2-14/A440.3-14, Fenestration energy performance/User guide to CSA A440.2-14, Includes Update No. 1 (2015).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings showing proposed method of shaping, forming, jointing, fastening, and application of flashing and sheet metal work.
- .4 Verification Samples:
 - .1 Submit duplicate 300 x 300 mm samples of each type of sheet metal material, colour and finish proposed to be used for the project, and obtain written acceptance from Departmental Representative before ordering materials.
 - .2 Submit representative sample section of pre-painted metal flashing illustrating S-locking jointing method, minimum 600 mm long.
- .5 Quality assurance submittals: submit following in accordance with Section 01 11 00 – General Requirements: Quality Control.
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Coordination:
 - .1 Coordinate work of this Section with interfacing and adjoining Work for proper sequencing of each installation and to provide positive weather resistance, durability of the work, and protection of materials and finishes.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor's representative and Departmental Representative in accordance with Section 01 11 00 – General Requirements: Construction Progress Schedule - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building trades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .3 General: Fabricate and install sheet metal flashing and trim in accordance with SMACNA's Architectural Sheet Metal Manual, and to the CRCA Roofing Specifications Manual.
- .4 Sheet Metal Flashing: Comply with the applicable recommendations and guidelines of the CRCA Canadian Roofing Reference Manual, CRCA Specification Manual, and applicable CRCA technical bulletins.
- .5 Aluminum Flashing: Comply with the applicable recommendations and guidelines of the CRCA Canadian Roofing Reference Manual, CRCA Specification Manual, and applicable CRCA technical bulletins.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Stack pre-formed and pre-finished material in manner to prevent twisting bending and rubbing.
- .2 Provide protection for galvanized surfaces.

- .3 Prevent contact of dissimilar metals during storage and protect from acids, flux, and other corrosive materials and elements
- .4 Protect prefinished surfaces from scratches and from rust staining.

1.6 WARRANTY

- .1 Manufacturer's Standard Finish Warranty: minimum 20-years.
- .2 For the work of this Section, the 12-month warranty period prescribed in Subsection GC 32.1 of General Conditions "C" is extended to 36 months.

Part 2 Products

2.1 METAL FLASHING

- .1 Alloy time in construction schedule to custom order the products specified herein, which may be non-standard.
- .2 (Use at Aluminum-Framed Fabrications) Aluminum-zinc alloy (55% Al / 45% Zn) hot dipped coated steel sheet: to ASTM A792/A792M, Structural Steel Grade 33, AZ50/AZM150, Aluminum-Zinc alloy coated (Galvalume), and as follows:
 - .1 Minimum Galvalume™ Metal Thickness: 0.5512 mm thick (26 gauge).
 - .2 Galvalume™ Coating System: shall include aluminum-zinc alloy to specifications, factory-applied to both sides of substrate using reverse roll coaters or similar.
 - .3 Factory-Applied Coating:
 - .1 Polyvinylidene fluoride (PVDF) factory-applied paint system over Galvalume™ hot dipped coated sheet metal.
 - .2 Class: F1S.
 - .3 Colours:
 - .1 Roof related work: match roof panel colour.
 - .2 Work related to wood siding, aluminum windows and metal doors: match wood siding colour.
 - .4 Specular gloss: 30 units +/- 5 to ASTM D523.
 - .5 Coating thickness: not less than 22 micrometres.
 - .6 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .7 Outdoor exposure period 2,500 hours.
 - .8 Humidity resistance exposure period 5,000 hours.
- .3 (General Use) Hot dip galvanized steel sheet (pre-finished): Type A commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.
 - .1 Class: F1S-Finished one side (manufacturer's standard prime finish on unexposed face).
 - .2 Thickness: minimum 0.7010 mm base metal thickness.
 - .3 Manufacturer's Coil Coating System: silicone modified polyester (SMP) system, applied over a zinc phosphate pre-treatment, and high-performance, flexible primer.
 - .1 Acceptable Systems:
 - .1 Perspectra Series, by ArcelorMittal, or WeatherX, by Valspar.
 - .4 Colours: as selected by Departmental Representative from manufacturer's full range.
- .4 Form flashing, coping and fascia to profiles indicated.

2.2 EAVES TROUGHS AND DOWNSPOUTS

- .1 Form downspouts from 0.6426 mm thick (22 gauge) prefinished aluminum. Sizes and profiles as indicated.
- .2 Form eaves troughs from 0.8128 mm thick (20 gauge) prefinished aluminum. Sizes and profiles as indicated.
- .3 Provide goosenecks, outlets, strainer baskets and necessary fastenings as required.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Roofing Cement: to ASTM D4586, asphalt based, asbestos free.
- .3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.
- .4 Sealants: as indicated in Section 07 92 00 – Sealants.
 - .1 Mastic Sealant: CAN/CGSB 37.29 polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.
 - .2 Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00.
- .5 Fasteners: of same material as sheet metal, to ASTM F1667, as recommended by sheet metal manufacturer; non-corrosive. Finish of exposed parts to match material being fastened.
- .6 Washers: same material as sheet metal, 1 mm thick with rubber packing.
- .7 Solder and Flux:
 - .1 Soldering Aluminum and Galvalume™, to ASTM B907:
 - .1 Acceptable material:
 - .1 Superior Roof-Rod™ Aluminum Flux Core Solder, by Superior Flux and Mfg. Co.
 - .2 Flux: suitable to substrate being soldered:
 - .1 Acceptable material:
 - .1 Superior APF-1265, by Superior Flux and Mfg. Co.
- .8 Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather resistant seaming and adhesive application of flashing sheet metal.
- .9 Metal Accessories: Provide non-corrosive sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work. Accessories shall match or be compatible with material being installed; size and thickness as required.
- .10 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

- .1 Roofing: Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and as indicated.
- .2 Zinc or aluminum-zinc galvanized sheet steel, as specified: Fabricate in accordance with SMACNA Architectural Sheet Metal Manual.

- .3 Aluminum flashing (mill finished, pre-finished or anodized as specified) and other sheet aluminum work: Fabricate in accordance with AAI-Aluminum Sheet Metal Work in Building Construction. Back-paint aluminum flashing in contact with concrete or masonry, or dissimilar metal, with bituminous paint prior to installation.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- .6 Make flashing of prefinished metal for all cap flashing, for all flashing adjacent to roofing at roof edges and area dividers and where exposed to view from ground. Make flashing for other locations, of plain galvanized metal as follows:
- .7 Make metal flashings for other locations of hot dip galvanized metal, Type A commercial quality to ASTM A653/A653M, with Z275 designation zinc coating, as follows:
 - .1 Use 0.7010 mm metal core thickness except where otherwise specified.
 - .2 Use 0.84 mm metal core thickness for concealed fastening strips.
 - .3 Use material of thickness specified for other applications, and as indicated.
- .8 All straight run joints shall be S-Lock in roof flashing.
- .9 Make joints to allow for thermal movement, space S-Lock joints at 1500 mm maximum centers.
- .10 Make flashing for building into masonry and concrete so that joints can be lapped 100 mm or more.
- .11 Strengthen free edges of metal flashing by folding to form a 13-mm hem.
- .12 Make flashing to curbs, walls and parapets a minimum of 200 mm high, where possible.
- .13 Where curb-mounted roof penetrations are not required, provide flashing sleeves and collars for all pipes and conduit extending through the roof. Sleeves shall be soldered to a piece of sheet metal extending at least 150 mm onto the surrounding roof.
- .14 Make joints for corners and intersections with standing seams except where exposed of pre-finished metal when seams shall be flat locked.
- .15 All bends machine made; form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .16 All metal flashing shall be back painted with bituminous paint prior to installation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Check mounting and counter-flashing of mechanical items and report any defect to the Departmental Representative.
- .2 Verify that solid wood blocking or sheathing provided to back-up all flashing and that all nails, screws set and wood provides a smooth flat plane.
- .3 Verify that all Work by other trades is in place, and properly and securely located, true and level in line.

3.3 INSTALLATION: METAL FLASHING

- .1 Install sheet metal flashing and trim in accordance with applicable CRCA 'FL' series details, SMACNA's Architectural Sheet Metal Manual, and as indicated.
- .2 Verify shapes and dimensions of surfaces being covered before fabricating sheet metal.
- .3 Do not install metal flashings over flexible roof flashing until the flexible roof flashing has been inspected and approved by the Departmental Representative. This includes curbs for roof mounted items.
- .4 Do not use exposed fastening unless indicated, or concealed fastening is not possible. Locations and methods shall be approved by Departmental Representative.
- .5 Anchor units of work securely in place, providing for thermal expansion of metal units. Conceal fasteners where possible and set units true to line and level.
- .6 Install work with laps, joints, and seams that are watertight and weatherproof.
- .7 Install exposed sheet metal work that is without oil canning, buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weatherproof performance.
- .8 Install surface mounted reglets true and level, and caulk top of reglet with sealant. Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .9 Install pans where shown around items projecting through roof membrane.
- .10 Insert metal flashing into reglets or under cap flashing as indicated to form weather tight junction.
- .11 Fasten metal base flashing to walls or upstands along top of flashing. Do not secure to cant strip. Form lapped corner joints. Extend rolled edge of base flashing approximately 25 mm on to roof from toe of cant, and rest on top of roof surface.
- .12 Roof Edge Flashing: Secure metal flashing at roof edges at a maximum of 610 mm o.c.
- .13 Expansion Provisions:
 - .1 Provide for the thermal expansion of exposed sheet metal Work.
 - .2 Space movement joints at maximum of 3050 mm, with no joints allowed within 610 mm of a corner or intersection.
 - .3 Form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with mastic sealant (concealed within joints) where lapped or bayonet type expansion provisions in the work cannot be used or are not sufficiently weatherproof and waterproof.
- .14 Sealed Joints:
 - .1 Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant.
 - .2 Fill joint with sealant and form metal to conceal sealant completely.
 - .3 Use joint adhesive for non-moving joints specified.
- .15 Lock Seams:
 - .1 Fabricate non-moving seams in sheet metal with flat lock seams.
- .16 Separations:
 - .1 Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with bituminous paint or other permanent separation as recommended by the manufacturer.
 - .2 Underlayment: Install a slip-sheet of No. 15 perforated asphalt saturated felt and a course of polyethylene underlayment where installing sheet metal directly on cementitious or wood substrates. Secure in place and lap joints minimum 100 mm.

- .3 Bed flanges of work in a thick coat of roofing cement where required for waterproof performance.
- .17 Counter Flashing:
 - .1 Coordinate installation of counter flashing with installation of assemblies being protected by counter flashing.
 - .2 Secure in a waterproof manner.
 - .3 Lap counter flashing joints a minimum of 50 mm and bed with sealant.
- .18 Flashing and metal closures: where flashing and metal closures overlap at any point in a system, ensure that flashing and closures are shingled over top lower sheet(s) and not behind, so that water is directed, and drains, to the exterior.

3.4 INSTALLATION: EAVES TROUGHS AND DOWNSPOUTS

- .1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough spikes through spacer ferrules.
 - .1 Slope eaves troughs to downpipes as indicated.
 - .2 Solder joints watertight.
- .2 Install downpipes and provide goosenecks back to wall.
 - .1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.
- .3 Install splash pans as indicated.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 08 11 14 – Metal Doors and Frames.
- .2 Section 09 21 16 – Gypsum Board Assemblies.
- .3 Electrical and Mechanical Divisions.
- .4 Other sections as required.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM E119-12a, Standard Test Methods for Fire Tests of Building Construction and Materials.
 - .2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A1008/A1008M-12, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - .4 ASTM E1966-07(2011), Standard Test Method for Fire-Resistive Joint Systems.
 - .5 ASTM E2174-10ae1, Standard Practice for On-Site Inspection of Installed Fire Stops.
 - .6 ASTM E2307-10, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus.
 - .7 ASTM E2393-10a, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .2 Firestop Contractors International Association (FCIA)
 - .1 FCIA Firestop Manual of Practice (MOP).
 - .2 FM 4991, Standard for the Approval of Firestop Contractors.
- .3 International Firestop Council (IFC)
 - .1 Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs).
- .4 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC Guide No. 40 U19-1998, Firestop Systems.
 - .2 CAN/ULC S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - .3 CAN/ULC S102-10, Standard Method of Tests for Surface Burning Characteristics of Building Materials and Assemblies.
 - .4 CAN4 S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
 - .5 CAN/ULC S115-11, Standard Method of Fire Tests of Fire stop Systems.
 - .6 CAN/ULC S702-09, Standard for Thermal Insulation Mineral Fibre for Buildings.
 - .7 ULC S702.2-10, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.
 - .8 List of Equipment and Materials.
- .5 Underwriters Laboratories Inc. (UL)

- .1 ANSI/UL 1479, Standard for Fire Test of Through-Penetration Firestops.
- .6 National Fire Protection Agency (NFPA)
 - .1 NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 Edition.

1.3 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1(1) and 9.10.9.6(1)): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 11 10 – General Requirements: Construction Schedule to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building trades.
 - .4 Review manufacturer's installation instructions, and warranty requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 11 10 – General Requirements: Submittal Procedures.
 - .1 Not later than 30 working days following Award of Contract, submit a schedule and shop drawings, including room numbers from the Contract Drawings. Indicate ULC assembly number for each condition, required temperature rise and flame rating, hose stream rating, thickness, installation methods and materials of firestopping and smoke seals, damming materials, reinforcements, anchorages and fastenings, size of opening, adjacent materials and number of penetrations. Include manufacturer's printed instructions for each type of penetration.
 - .2 Where possible determine thickness to be applied from tests of assemblies identical to the assembly to be protected, conducted in accordance with CAN/ULC S101.
 - .3 Engineering Judgements: where a UL / ULC / c-UL Design (assembly number) has not been issued, obtain an engineering judgement from the system manufacturer for a solution relevant to the job conditions involved, and obtain approval of the Authorities Having Jurisdiction.

- .1 Determine system from available engineering studies, or correspondence with the labelling agency indicating the effect of the differences on the fire separation of the assembly. Confirm acceptance of system by Authorities Having Jurisdiction in writing.
 - .2 Obtain and submit fire stop system manufacturer's engineering judgement(s) meeting the requirements of Authorities Having Jurisdiction.
 - .3 Engineering judgements shall comply with "Recommended IFC Guidelines for Evaluating Firestop Systems in Engineering Judgments (EJs)."
- .2 Submit product data in accordance with Section 01 11 10 – General Requirements: Submittal Procedures:
- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Quality assurance submittals: submit following in accordance with Section 01 11 10 – Project General Requirements: Quality Control.
- .1 Contractor shall obtain a training letter from the firestop system manufacturer, and submit it to Departmental Representative prior to firestop installation.
 - .2 Submit copies of engineering judgments approved by local authorities having jurisdiction to Departmental Representative prior to installation.
 - .3 The firestopping system manufacturer shall submit a letter of certification to the Contractor, certifying that all firestopping has been installed in compliance with the approved ULC design specifications for each type of penetration. Forward one copy to Departmental Representative, and include one copy in each maintenance manual specified in Section 01 78 20.
 - .1 The 'Certificate of Substantial Performance' shall not be issued until Departmental Representative has received the manufacturer's letter of certification from the Contractor indicating that all fire-stopping applications comply with the tested assemblies of the manufacturer.
 - .4 Submit the manufacturer's engineering judgment identification number(s) and Shop Drawing details when no ULC or cUL system is available for an application. Engineering judgments must include the Contract name and number, and the Contractor's name.
 - .5 For those firestop applications that exist, for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests shall be submitted to local Authorities Having Jurisdiction, with a copy to Departmental Representative, for their review prior to installation. Engineering judgment Drawings must follow the requirements set forth by the IFC.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer:
 - .1 Company or person specializing in fire stopping installations, and approved by the manufacturer.
 - .2 Company or person shall be a member in good standing of the Firestop Contractors International Association (FCIA).

- .2 Work of this Section shall comply with the FCIA Firestop Manual of Practice (MOP), the National Building Code of Canada – 2010 (NBC), and the National Fire Code of Canada – 2010 (NFC), including errata and amendments.
- .3 Use materials and methods of determining required thickness of application that have the full acceptance of Authority Having Jurisdiction.
- .4 Use materials tested to CAN/ULC S115. Assemblies containing the materials shall be in accordance with assemblies tested and approved by agencies acceptable to Authority Having Jurisdiction.
- .5 Single Source Responsibility:
 - .1 Obtain through-penetration firestop and joint systems for each kind of penetration and construction condition indicated from a single source of manufacture and installation responsibility.
- .6 The manufacturer's direct technical representative (not distributor or agent) shall be on-site during the initial installation of the firestop systems to provide training to the installer's personnel in the proper product selection and installation procedures.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling, and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 11 10 – General Requirements: Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.
- .2 Storage and Protection:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
 - .3 Use stock before its expiration date.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 11 10 – General Requirements: Waste Management and Disposal.

1.9 PROJECT CONDITIONS

- .1 Install firestopping and smoke seals materials only when the areas in which they are scheduled are closed-in and protected from dampness.
- .2 Environmental Limitations: Install firestopping and smoke seals systems when ambient or substrate temperatures are within temperature and moisture limits permitted by firestopping and smoke seals system manufacturers or when substrates are not wet due to rain, frost, condensation, or other causes.
- .3 Ventilate firestopping and smoke seals systems in accordance with manufacturer's written instructions by natural means or forced air circulation where natural means are not adequate.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers: Subject to compliance with requirements specified in this Section and as established by the Basis-of-Design Materials, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

- .1 3M Canada Inc.
- .2 A/D Fire Protection Systems Inc.
- .3 Firestop Systems Inc.
- .4 Hilti Canada Ltd.
- .5 Nuco Self-Seal Firestopping Products.
- .6 Specified Technologies Inc.
- .7 Tremco Ltd.

2.2 PERFORMANCE/DESIGN CRITERIA

.1 Delegated Design Requirements: Design firestopping and smoke seals required by the Contract Documents to meet fire ratings indicated, and in accordance with requirements of the National Building Code of Canada.

.2 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the National Building Code, Underwriters Laboratories Canada, and authorities having jurisdiction, and as follows:

- .1 Provide through-penetration firestop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly penetrated:
 - .1 Fire resistance rated load bearing walls, including partitions, with fire protection rated openings.
 - .2 Fire resistance rated non-load bearing walls, including partitions, with fire protection rated openings.
 - .3 Fire resistance rated floor assemblies.
- .2 F-Rated Systems: Provide through penetration firestop systems with F-ratings indicated, as determined by ULC S115, but not less than that equalling or exceeding fire resistance rating of constructions penetrated.
- .3 T-Rated Systems: For the following conditions, provide through penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per by ULC S115, where systems protect penetrating items exposed to potential contact with adjacent materials:
 - .1 Penetrations located outside wall cavities.
 - .2 Penetrations located outside fire resistive shaft enclosures.
 - .3 Penetrations located in construction containing fire protection rated openings.
 - .4 Penetrating items larger than 100 mm diameter nominal pipe or 100 cm² in overall cross sectional area.
- .4 Firestopping and Smoke seals Systems Exposed To View: Systems exposed to view, traffic, moisture, and physical damage; provide products that after curing do not deteriorate when exposed to these conditions both during and after construction, and as follows:

- .1 Provide moisture resistant through penetration firestop systems for piping penetrations for plumbing and wet pipe sprinkler systems.
- .2 Provide firestopping and smoke seals systems capable of supporting floor loads involved either by installing floor plates or by other means for floor penetrations with annular spaces exceeding 100 mm in width and exposed to possible loading and traffic.
- .3 Provide firestopping and smoke seals systems not requiring removal of insulation for penetrations involving insulated piping.
- .4 Provide products with flame spread ratings of less than 25 and smoke developed ratings of less than 50 for firestopping and smoke seals and joint systems exposed to view.
- .5 Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equalling or exceeding fire resistance rating of constructions in which joints are located.

2.3

FIRESTOPPING AND SMOKESEALS: GENERAL

- .1 Compatibility: Provide firestopping and smoke seals systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestopping and smoke seals systems, under conditions of service and application, as demonstrated by firestopping and smoke seals system manufacturer based on testing and field experience, and as follows:
 - .1 Service penetration assemblies: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.
 - .2 Service penetration firestopping and smoke seals components: certified by ULC in accordance with ULC S115 and listed in ULC Guide No. 40 U19.13, under the Label Service of ULC.
 - .3 Fire resistance rating of installed firestopping and smoke seals assembly not less than the fire resistance rating of surrounding floor and wall assembly.
 - .4 Firestopping and Smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
 - .5 Firestopping and Smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations. Exemption to fire dampers.
- .2 Accessories: Provide components for each firestopping and smoke seals systems that are needed to install fill materials. Use only components specified by firestopping and smoke seals system manufacturer and approved by the qualified testing and inspecting agency for firestopping and smoke seals systems indicated. Accessories include, but are not limited to, the following items:
 - .1 Permanent forming, damming and backing materials, including the following:
 - .1 Slag or rock wool fibre insulation.
 - .2 Sealants used in combination with other forming, damming or backing materials to prevent leakage of fill materials in liquid state.
 - .3 Fire-rated form board.
 - .4 Fillers for sealants.
 - .2 Temporary forming materials.
 - .3 Substrate primers.
 - .4 Collars.
 - .5 Steel sleeves.

- .6 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .7 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .8 Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.912 mm.
- .9 Steel Deck Moulded Flute Inserts: One piece moulded mineral fibre flute inserts, sized for steel deck profiles, for placement at top of fire rated wall assemblies:
 - .1 Acceptable material: Hilti CP777 Speed Plugs.
- .10 Labels: Peel-and-stick labels printed with the following information:
 - .1 ATTENTION: FIRE RATED ASSEMBLY. DO NOT MODIFY
 - .2 Name of firestopping manufacturer
 - .3 Names of products used
 - .4 Hour Rating of Assembly
 - .5 Manufacturers standard detail number, or Engineered Judgement identifier; ULC or cUL_{US} Number
 - .6 Date of installation
 - .7 Name of installing Trade Contractor
 - .8 Contact telephone number for repair or replacement of firestopping materials.

2.4 **FILL MATERIALS**

- .1 General:
 - .1 Provide firestopping and smoke seals systems containing the types of fill materials indicated in the Firestopping and Smoke seals System Schedule below by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
 - .2 Firestopping and smoke seal systems shall be tested in accordance with ULC S115, and be comprised of asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases, and not to exceed opening sizes for which they are intended for the ratings as indicated on drawings.
- .2 Cast-in-Place Firestopping and Smoke seals Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- .3 Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- .4 Firestopping and Smoke seals Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- .5 Cable Penetration Devices: Premanufactured intumescent blocks, consisting of a system of inserts and adjustable cores; or premanufactured fire rated cable pathway systems, the following products are acceptable:
 - .1 EZ-Path Fire Rated Pathway, Specified Technologies Inc.
 - .2 CP 653 Speed Sleeve, Hilti

- .6 Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
- .7 Intumescent Putties: Non-hardening dielectric, water resistant putties containing no solvents, inorganic fibres, or silicone compounds.
- .8 Intumescent Spray Foam: Expanding spray-in-place intumescent foam sealant.
- .9 Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
- .10 Mortars: Pre-packaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- .11 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- .12 Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:
 - .1 Grade for Horizontal Surfaces: Pourable (self-levelling) formulation for openings in floors and other horizontal surfaces.
 - .2 Grade for Vertical Surfaces: non-sag formulation for openings in vertical and other surfaces.

2.5 ACCESSORIES

- .1 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .2 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .3 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .4 Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.95 mm (20 ga.).

2.6 MIXING

- .1 For those products requiring mixing before application, comply with firestopping and smoke seals system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's printed installation instructions, technical data sheets, details, and specifications.

3.2 EXAMINATION

- .1 Examine surfaces, components, materials to receive firestopping and smoke seals material; report any conditions that would detrimentally affect the application of the material or the proper firestopping and smoke seals of the system.
- .2 Commence Work when conditions of surfaces and the working conditions are suitable.

- .3 Where penetration sealants or caulking are required, ensure all service lines are in place, tested and approved.
- .4 Verify all proper blocking, framing (using non-combustible materials) are properly installed and prepared to receive firestopping and smoke seals. Notify Departmental Representative in writing of any deficiencies affecting the proper performance of the firestopping and smoke seals, do not proceed until deficiencies are corrected.

3.3 PREPARATION

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

3.4 INSTALLATION

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

3.5 SPECIAL REQUIREMENTS

- .1 Location of special requirements for fire stopping and smoke seal materials at openings and penetrations in fire resistant rated assemblies are as follows:
 - .1 Designed for re-entry, removable at: electrical and communications cable penetrations through partitions.
 - .1 Use Prefabricated Firestop Sleeves or prefabricated Cable Pathways, as approved by Departmental Representative.

3.6 SEQUENCE OF OPERATION

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

- .1 Ensure pipe insulation installation precedes fire stopping.

3.7 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
 - .1 Cut tests may be made at random by the Departmental Representative. Frequency of cut tests shall be determined by the Departmental Representative, but will not be more than 1% of total length of firestopping and smoke seals.
 - .2 Make all necessary repairs and correct all deficiencies noted after completion of cut tests.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, twice during progress of Work at 25% and 60% complete.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 - General Requirements: Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 - General Requirements: Cleaning.
- .4 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 11 00 - General Requirements: Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

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

3.10 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.

- .8 Around mechanical and electrical assemblies penetrating fire separations.
- .9 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.
- .10 Firestop at deflection caps at both rated and unrated fire separations.
- .11 Back coat electrical boxes at fire rated partitions, including application of firestop mouldable putty pads and firestop coatings meeting Code; outlet boxes and fittings at fire separations shall ULC, cUL or cULus classified fire-resistant for fire rating matching rating of assembly.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 07 31 13 – Asphalt shingles.
- .2 Section 07 46 23 – Wood Siding.
- .3 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .4 Section 08 11 13 – Metal Doors and Frames.
- .5 Section 08 50 13 – Aluminum Windows.
- .6 Section 09 21 16 – Gypsum Board Assemblies.
- .7 Other technical sections as required.

1.2 REFERENCES

- .1 ASTM International (ASTM)
 - .1 ASTM C834 -10, Standard Specification for Latex Sealants.
 - .2 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
 - .3 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants.
 - .4 ASTM C1193-13, Standard Guide for Use of Joint Sealants.
 - .5 ASTM D2240-05(2010), Standard Test Methods for Rubber Property, Durometer Hardness.

1.3 COORDINATION

- .1 Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation and to provide positive weather resistance, durability of the work, and protection of materials and finishes.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals shall comply with the requirements of Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Submit manufacturer's product data as follows:
 - .1 Printed product literature describing type, composition recommendations, and directions for surface preparation, material preparation, and material installation.
- .3 Submit manufacturer's installation instructions for each product used.
 - .1 Before performing work of this Section, submit the names of proposed materials.
 - .2 When required by Departmental Representative, submit test certificates from an approved Canadian material testing laboratory indicating that sealants meet the requirements specified, and that the tests have been conducted in accordance with ASTM D2240.
- .4 Submit samples as follows:
 - .1 Samples of back-up material, primer, joint fillers, and of each type and colour of sealant to be used. Cure samples under conditions anticipated at the site during application.
- .5 Reports: submit written pre-installation meeting recommendations, field inspection, and test report results after each inspection.
- .6 Submit Warranty.

1.5 QUALITY ASSURANCE

- .1 Comply with ASTM C1193 guidelines.
- .2 Pre-Installation Meeting:
 - .1 Arrange with manufacturer's representative to inspect substrates and to review installation procedures 48-hours in advance of installation.
 - .1 Review conditions under which work will be done.
 - .2 Joint condition and profile.
 - .3 Weather conditions.
 - .2 Submit written report of meeting to Departmental Representative.
- .3 Mock-up:
 - .1 Construct mock-up in accordance with Section 01 11 00 – General Requirements: Quality Control.
 - .2 Construct mock-up to show location, size, shape, colour, and depth of joints complete with bond breaker, joint backing, primer, and sealant.
 - .3 Arrange for the manufacturer's representative's review and acceptance. Allow 48 hours after acceptance before proceeding with the work.
 - .4 Inform Departmental Representative following construction of the mock-up. Allow 24 hours for review of mock-up by Departmental Representative before proceeding with sealant Work.
 - .5 Mock-up may remain as part of the Work if accepted by Departmental Representative. Remove and dispose of mock-ups not forming part of the Work.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store, and protect materials in accordance with manufacturer's recommendations and instructions.
- .2 Deliver containers labelled and sealed, complete with written application and maintenance instructions.
- .3 Store materials in a dry, heated enclosure.

1.7 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees 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.
 - .2 Substrate must be clean, dry, and frost free.

1.8 WARRANTY

- .1 Contractor warrants that sealant work will not leak, crack, crumble, melt, shrink, run, lose adhesion, or stain adjacent surfaces for not less than two years from the date of Substantial Performance.

Part 2 Products

2.1 MANUFACTURERS

- .1 Acceptable Materials: Use products meeting the requirements of this Section and suitable to the application to which the sealant is to be applied, selections restricted to the manufacturers listed below:
 - .1 BASF Master Builders
 - .2 Chemtron Manufacturing Ltd.
 - .3 Dow Corning Canada Inc.
 - .4 GE Silicones Limited.
 - .5 LymTal International.
 - .6 Pecora Corporation.
 - .7 PRC-DeSoto.
 - .8 Sika Chemical of Canada Ltd.
 - .9 Tremco Ltd.
- .2 Use materials as received from manufacturer without additives or adulteration. Use one manufacturer's product for each Type specified. Where sealant applications cross or contact each other, ensure compatibility, maintenance of physical properties and performance characteristics, and continuity of seal.

2.2 SEALANT MATERIALS

- .1 Do not use sealants that emit strong odours, contain toxic chemicals, or, if used within air handling units, are not certified as mould-resistant.
- .2 When low toxicity sealants are not possible, confine usage to areas that off-gas to exterior, are contained behind air barriers, or are applied several months prior to occupancy.

2.3 SEALANT MATERIAL TYPES

- .1 Type S-1: Silicone Sealant; mould and mildew resistant.
 - .1 To ASTM C920; type S; grade NS; class 100/50; use NT, M, G, and A.
 - .2 Acceptable materials:
 - .1 790 Silicone, Dow Corning.
 - .2 Spectrum 1 Silicone, Tremco Inc.
 - .3 890NST, Pecora.
- .2 Type S-2: Silicone Sealant; general construction and air-seal sealant.
 - .1 To ASTM C920: type S; grade NS; class 50; use NT, M, G, A, O.
 - .2 Acceptable materials:
 - .1 864NST or 895NST, Pecora Corporation.
 - .2 Dow Corning 795, Dow Corning
 - .3 Spectrum 2, Tremco Sealant & Waterproofing

- .3 Type S-3: Silicone Sealant; structural glazing.
 - .1 To ASTM C920: type S; grade NS; class 25; use NT, A, G, O.
 - .2 Acceptable materials:
 - .1 995 Silicone, Dow Corning.
 - .2 Proglaze SSG, Tremco Inc.
 - .3 SSG4000, General Electric.
 - .4 895NST, Pecora.
- .4 Type S-4: Acoustical Sealant; interior, non-hardening.
 - .1 To ASTM C834 Type P, Grade -18°C.
 - .2 Acceptable materials:
 - .1 Acoustical Sealant, Tremco.
 - .2 Metaseal, Chemtron.
 - .3 QuietZone acoustic sealant, Owens Corning.
 - .4 BA-98, Pecora.
- .5 Type S-5: Multi-component polyurethane sealant; chemical curing, exterior wall sealant.
 - .1 To ASTM C920: type M; grade NS; class 50; use T, NT, M, A, O.
 - .2 Acceptable materials:
 - .1 Dymeric, Tremco.
 - .2 Sikaflex 2c NS, Sika.
 - .3 Sonolastic NP 2, BASF Sonneborn.
 - .4 DynaTrol II, Pecora.
- .6 Type S-6: One-component polyurethane sealant; non-sag, for general constructions.
 - .1 To ASTM C920: type S; grade NS; class 25; use NT, M, A, O.
 - .2 Acceptable materials:
 - .1 Polyurethane Sealant 540, 3M Company
 - .2 Dymonic or Dymonic FC, Tremco Inc
 - .3 Multiflex, Chemtron.
 - .4 Sonolastic NP 1, BASF Sonneborn.
 - .5 Sikaflex 1a, Sika.
 - .6 DynaTrol I-XL, Pecora.
- .7 Type S-7: Horizontal joint sealant; two-component, self-levelling.
 - .1 To ASTM C920: type M; grade P; class 25; use T, M, O.
 - .2 Acceptable materials:
 - .1 Sikaflex 2c SL, Sika.
 - .2 Sonolastic SL 2, BASF Sonneborn.
 - .3 THC-901, Tremco Inc.
 - .4 Urexpan NR-200, Pecora.
- .8 Type S-8: One-part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to ASTM C920, type S, grade P, class 50, use T, M, A, O.
 - .1 Acceptable materials:
 - .1 Sonolastic SL 1, BASF Sonneborn.
 - .2 Vulkem 45 SSL, Tremco Inc.
 - .3 Urexpan NR-201b, Pecora.

- .9 Type S-9: Control joint sealant: two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.
 - .1 Acceptable materials:
 - .1 Loadflex, Sika.
 - .2 Dynapoxy EP-800, Pecora.
 - .3 MasterSeal CR 190, BASF Building Systems.
- .10 Type S-10: Exterior Door Thresholds, Window Perimeters, Concrete Counters (existing and new) and other wet areas: two-component, gun-grade, slump-resistant elastomeric polyurethane sealant, specially formulated for sealing joints in water-immersion conditions, and highly resistant to biodegradation by both aerobic and anaerobic bacteria; to ASTM C920, Type M, Grade NS, Class 25, use T, NT, M, G, A, O; certified to CAN/ULC S115; Canadian Food Inspection Agency accepted.
 - .1 Acceptable Materials:
 - .1 Sikaflex 2c NS EZ Mix, by Sika Canada.
 - .2 Sikaflex 2c NS EZ Mix TG, by Sika Canada (traffic grade option).

2.4 ACCESSORIES

- .1 Preformed compressible and non-compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing.
 - .1 Rod Type Sealant Backings:
 - .1 ASTM C1330, Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi-cellular material with a surface skin).
 - .2 Use any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.
 - .3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - .4 Non-adhering to sealant, to maintain two-sided adhesion across joint.
 - .2 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.
 - .3 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.
- .2 Primer: Non-staining type as recommended by sealant manufacturer.
- .3 Joint Cleaner: Non-corrosive solvent type recommended by sealant manufacturer for applicable substrate materials.

2.5 COLOURS

- .1 Colours: To match final colour of adjacent materials as selected by Departmental Representative from manufacturer's full colour range. Provide samples as required for initial selection prior to ordering materials.

2.6 SEALANT SELECTION

- .1 Where no specified type of sealant is shown or specified, choose one of the sealants specified in this Section appropriate for its location as recommended by the sealant manufacturer in accordance with its warranty provisions and datasheet.
- .2 Make sealant selections consistent with manufacturer's printed installation instructions and data sheets.
- .3 Use mould & mildew resistant silicone sealant Type S-1 for non-moving joints in washrooms and kitchens. Do not use on floors.
- .4 Use silicone general construction sealant Type S-2 or Type S-5 and S-6 for all joints, interior and exterior, where no other specific sealant type specified.
- .5 Use structural glazing silicone Type S-3 for sealing glass, interior and exterior.
- .6 Use acoustical sealant Type S-4 and air seal sealant Type S-2 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.
- .7 Use multi-component sealant type S-5 for wood and other porous substrates, such as concrete and masonry.
- .8 Use multi-component sealant Type S-7 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.
- .9 Use control joint sealant S-9 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.
- .10 Use Type S-10 at all floor-to-wall joints, exterior door thresholds, and other joints exposed to frequent wetting. Use traffic grade (TG) at applicable horizontal locations.

Part 3 Execution

3.1 PROTECTION

- .1 Protect installed work of other trades from staining, damage, or contamination.

3.2 EXAMINATION

- .1 Verify condition of previously installed work upon which this Section depends. Report defects to Departmental Representative. Commencement of work means acceptance of existing conditions.
- .2 Ensure joints are suitable to accept and receive the sealants.
- .3 Ensure surfaces are sound, dry, and free from dirt, water, frost, loose scale, corrosion, bitumen, paints, and other contaminants that may adversely affect the performance of the sealing materials.
- .4 Do not apply sealant to masonry until mortar has cured.
- .5 Before any sealing work is commenced, test the materials for indications of staining or poor adhesion.
- .6 Ensure joints and spaces which are to receive sealants are less than 10 mm deep; not less than 6 mm wide; and not more than 19 mm wide.

3.3 SURFACE PREPARATION

- .1 Perform cleaning to the extent required to achieve acceptable joint surfaces, and as approved by sealant manufacturer.
- .2 Protect adjacent finishes from damage.
- .3 Cleaning Procedures:
 - .1 Metal:
 - .1 Blast cleaning: Sandblast or iron shot blast surfaces requiring heavy cleaning down to bright metal. Remove loose matter by compressed air or commercial vacuum cleaner.
 - .2 Power tool cleaning: Clean surfaces by wire brush, impact tools, abrasive wheels or by buffing. Remove loose matter by compressed air or vacuum cleaner.
 - .3 Solvent cleaning: Clean with solvent applied by spray or brush. Wipe with clean, dry wiping cloths. Remove paints with paint remover and wipe with solvent. Remove residue.
 - .2 Concrete, Marble, Stone, Brick:
 - .1 Remove friable material with wire brush or by chipping, until surfaces are sound. Remove surface residue with a stiff brush, vacuum cleaner or compressed air.
 - .2 Concrete surfaces shall be cured for at least 28 days. Acid etch joint surfaces to remove alkaline salts and neutralize acid with a solution of tri sodium phosphate, followed by rinsing with clean, cold water.
 - .3 Allow joints to dry thoroughly.
 - .4 Completely remove resinous products used, such as curing compounds and form release agents.
 - .3 Glass, Ceramics, and Porcelain: Brush with solvent and wipe with clean, dry wiping cloths. Remove residue.
 - .4 Wood: Remove foreign matter such as soil, paint, grease, bitumen, resin with solvents, abrasives and paint removers; remove residue. Provide surfaces that are clean and dry.
- .4 Do not exceed shelf life and pot life of the materials, and installation times, as stated by the manufacturers.
- .5 Be familiar with the work life of the sealant to be used. Do not mix multiple component materials until required for use.
- .6 Thoroughly mix multiple component sealants, and bulk sealants when recommended by manufacturer, using a mechanical mixer capable of mixing at 80-100 rpm without mixing air into the material. Continue mixing until the material is a uniform colour and free from streaks of unmixed material.
- .7 Mask areas adjacent to joints to be sealed. Prevent contamination of adjacent surfaces. Remove masking promptly after the joint sealing has been completed.

3.4 INSTALLATION

- .1 Install materials in compliance with the recommendations of their manufacturer.
- .2 Fill joints with joint backing to produce joint profile with optimum sealant cross section. Provide joint depth of one half the joint width.
- .3 Prime all joints to receive sealants to prevent staining, to assist the bond, and to stabilize surfaces.

- .4 Apply primer with a brush that will permit joint surfaces to be primed. Perform priming immediately before installation of sealants, allowing minimal time between priming and sealing as recommended by the sealant manufacturer.
- .5 Sealants generally shall be of gun grade or knife grade non-sag consistency to suit the joint condition. Use gun nozzles of the proper sizes to suit the joints and the sealant material. Sealants for horizontal joints (other than overhead joints) shall be self-levelling type.
- .6 Install sealant with pressure operated guns.
- .7 Use sufficient pressure to fill all voids and joints solid. Sealant shall bond to the sides of the joint only and shall not adhere to the joint backing material. Provide bond breaker material where necessary.
- .8 Pour or gun self-levelling, low viscosity grades of sealant into horizontal joints. If applied by gun, hold the nozzle to the bottom of the joints to ensure complete filling of the joints.
- .9 Ensure that the correct sealant depth is maintained. Superficial coating with a skin bead will not be accepted.
- .10 Except as otherwise specified, sealant installations shall be a full bead free from air pockets and embedded impurities, providing smooth surfaces, free from ridges, wrinkles, sags, air pockets and imbedded impurities.
- .11 After joints have been completely filled, tool them neatly to a slightly concave surface.
- .12 Tool sealants to achieve airtight joints. Use wet tools as required.
- .13 Insert plastic vent tubes where required or shown, extending from the cavity to exterior face, sloped to the exterior. Seal around the tube and tool for positive adhesion. Insert joint backing for remainder of the joint. Do not plug vent tube during sealing operation.

3.5 REPAIR

- .1 Cut out damaged sealant, repeat preparation, prime joints and install new material as specified, and acceptable to the manufacturer.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 Work of this Section.

3.8 SCHEDULE

- .1 Exterior: provide sealant at the following exterior locations, unless sealant is specified to be included in the work of other sections:
 - .1 Control joints and expansion joints;
 - .2 Steel door frames and adjacent materials;
 - .3 Penetrations.

- .2 Interior: provide sealant at the following interior locations, unless joints are covered by trim or unless sealant is specified to be included in the work of other sections:
- .1 Control joints and expansion joints in non-fire-rated masonry and gypsum board walls;
 - .2 Steel door frames and adjacent materials;
 - .3 Penetrations in non-fire-rated walls;
 - .4 Top of non-fire-rated masonry and gypsum board walls;
 - .5 Interior side of exterior windows;
 - .6 Ceramic tile/quarry tile and adjacent materials;
 - .7 Vanities, counters, splashbacks, lavatories, water closets, and urinals to adjacent wall and floor surface.
 - .8 Interior sealing shall include both sides of walls and frames where finished installation will be visible.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry.
- .2 Section 07 27 14 – Air and Vapour Barriers.
- .3 Section 07 46 23 – Wood Siding.
- .4 Section 07 92 00 – Joint Sealants.
- .5 Section 08 71 05 – Door Hardware.
- .6 Section 08 80 50 – Glazing.
- .7 Section 09 91 00 – Painting.

1.2 REFERENCES

- .1 American National Standards Organization (ANSI) / Steel Door Institute (SDI)
 - .1 ANSI/SDI A250.3-2007 (R2011), Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames.
 - .2 ANSI/SDI A250.8-2003 (R2008), Recommended Specifications for Standard Steel Doors and Frames.
 - .3 ANSI/SDI A250.10-1998 (R2011), Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A780/A780M-09, Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.
 - .3 ASTM A879/A879M-12, Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
 - .4 ASTM A924 / A924M-13, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - .5 ASTM B29-03(2009), Standard Specification for Refined Lead.
 - .6 ASTM B749-03(2009), Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
 - .7 ASTM C553-11, Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications
 - .8 ASTM C578-12b, Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - .9 ASTM C591-12b, Specification for Un-Faced Pre-formed Rigid Cellular Polyisocyanurate Thermal Insulation
 - .10 ASTM C592-12, Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
 - .11 ASTM C1289-13e1, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
 - .12 ASTM D1622-08, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - .13 ASTM D4726-09, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors.

- .14 ASTM D6386-10, Standard Practice for Preparation of Zinc (Hot Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
- .15 ASTM D7396-08, Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN4-S106-M80, Standard Method for Fire Tests of Window and Glass Block Assemblies
 - .2 CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CSA W47.1-09, Certification of companies for fusion welding of steel, Includes Update No. 3 (2011), Update No. 5 (2012).
 - .4 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Guide Specification for Installation and Storage of Hollow Metal Doors and Frames, 2012.
 - .2 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.
 - .3 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2013 Edition.
 - .2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2012 Edition.
- .6 The Society for Protective Coatings (SSPC)
 - .1 SSPC-PS 12.01, One Coat Zinc-Rich Painting System.
 - .2 SSPC-PS Guide 12.00, Guide to Zinc-Rich Coating Systems.
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.
 - .2 CAN/ULC S105-09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104.
 - .3 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .4 CAN/ULC-S702-09-AM1, Standard for Thermal Insulation Mineral Fibre for Buildings, Includes Amendment 1 (January 2012).
 - .5 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets for each type of door and frame specified.
- .3 Shop Drawings:

- .1 Indicate general construction of each type of door and frame, configurations, material, material thickness, jointing methods, mortises, reinforcements, anchors, arrangement of hardware, fire ratings, finish and special features.
- .2 Reference door and frame types to Door Schedule. Indicate door numbers where applicable.

1.4 QUALITY ASSURANCE

- .1 Manufacturer/Fabricator: member in good standing of the Canadian Steel Door and Frame Manufacturer's Association.
- .2 Installer: Use installers who are experienced with the installation of hollow metal doors and frames of similar complexity and extent to that required for the Project.
- .3 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled:
 - .1 List by nationally recognized agency having factory inspection service and construct as detailed in Follow-up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
 - .2 Fabricate all rated doors and frames to labelling authority standard.
- .4 Manufacture door and frame assemblies to ANSI/SDI A250.8.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 11 00 – General Requirements: Common Product Requirements, and as follows:
 - .1 Receive and store materials as recommended by materials manufacturer.
 - .2 Adequately protect surfaces from damage during moving, handling and storage.

Part 2 Products

2.1 PERFORMANCE AND DESIGN CRITERIA

- .1 Perform work in accordance with CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, except as otherwise specified herein.
- .2 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .3 Maximum deflection for exterior steel entrance doors under wind load of 1.2 kPa not to exceed 1/175th of span.
- .4 Steel fire rated doors and frames: Label and list fire rated doors and frames by an organization accredited by the Standards Council of Canada in conformance with CAN/ULC S104 and CAN/ULC S105 for ratings specified or indicated. Fire labels must be factory applied by the manufacturer.
- .5 Be responsible for securing approval from Authorities Having Jurisdiction for materials, fabrication and installation of fire rated oversized door and frame assemblies

2.2 MATERIALS

- .1 Steel:
 - .1 Doors and frames: coated steel sheets to ASTM A924/M924; coating designation to ASTM A653/A653M: Commercial Steel (CS), Type B, ZF180 galvanized; stretcher levelled.

- .2 Nominal Base Metal Thickness Requirements:
- .1 Frames: refer to frame fabrication requirements specified in this section.
 - .2 Doors: refer to door fabrication requirements specified in this section.
 - .3 Hardware Reinforcement for Doors and Frames: Carbon steel, welded in place, prime painted, to the following minimum nominal thicknesses:

Hardware Reinforcement	Door (mm)	Frame (mm)
Pivot Hinge:	4.20	4.20
Mortise Hinge:	3.51	3.51
Mortise or Bored Lock or Deadbolt:	1.98	1.98
Flush or Surface Bolt Front:	1.98	1.98
Surface or Concealed Closer:	2.74	2.74
Strike Reinforcements:	1.98	1.98
Hold Open Arm:	1.98	1.98
Electronic Hardware Reinforcements:	1.98	1.98
Pull Plates and Bars:	1.30	1.30
Mortar Box:	--	0.84
Surface Exit Devices:	1.98	1.98
Door Surface Hardware Reinforcements:	1.30	1.30
Frame surface hardware reinforcements:	2.74	2.74

- .3 Door Core Materials
- .1 Honeycomb: Structural small cell 25 mm maximum. kraft paper honeycomb:
 - .1 Weight: 36.3 kg/ream minimum.
 - .2 Density: 16.5 kg/m³ minimum.
 - .3 Sanded to required thickness.
 - .2 Polystyrene: Rigid extruded, closed cell insulation, fire retardant treated meeting the requirements of ULC S701, Type 4, minimum thermal resistance RSI 0.8/25 mm thickness.
 - .3 Temperature Rise Rated (TRR): core composition shall provide the fire-protection rating and limit the temperature rise on the unexposed side of door at 250°C for 30 or 60 minutes as determined by National Building Code of Canada, 2010. Core shall be tested as part of a complete door assembly in accordance with CAN/ULC S104 covering the Standard Method of Tests of Door Assemblies and shall be listed by a nationally recognized testing agency having a factory inspection service.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Polystyrene cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Interlocking Edge Seam Adhesive: fire-resistant, resin-reinforced polychloroprene, high-viscosity, sealant/adhesive.

2.4 ACCESSORIES

- .1 Door silencers (bumpers): Black neoprene, to ANSI/BHMA A156.16 Type 6-180; three silencers on strike jambs of single door frames; two silencers on heads of double door frames; screw fastener applied. Stick on bumpers are not acceptable.

- .2 Exterior top and bottom caps: steel.
- .3 Interior top caps: rigid polyvinylchloride extrusion, to ASTM D4726.
- .4 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners, and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .5 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable glazing beads.
 - .2 Design exterior glazing stops to be tamperproof.
- .6 Metallic paste filler: to manufacturer's standard.
- .7 Fasteners: type 304 stainless steel screws with countersunk flat head.
- .8 Labels for fire doors and door frame: brass plate, riveted to door and door frame.
- .9 Sealant: Section 07 92 00 – Joint Sealants.
- .10 Glazing: Section 08 80 50 – Glazing.
- .11 Window and Door Flashing System: Blueskin WB™ Window & Door Flashing Membrane is a non-permeable, air and water barrier membrane with a proprietary all-weather adhesive compound, by Henry, or similar with same or better performance characteristics and physical properties.
- .12 Preformed Sill Flashing System: supply preformed window flashing system; Jamsill Guard® adjustable sill pan flashing designed to prevent water damage from window and door leaks, or similar with same or better performance characteristics and physical properties.

2.5 FABRICATION GENERAL

- .1 Welded construction: assemble units by welding in accordance with CSA W59 to produce a finished unit square, true, and free of distortion. Welding shall be continuous unless specified otherwise. Welding shall be undertaken only by a fabricator fully approved by the Canadian Welding Bureau to the requirements of CSA W47.1.
- .2 Permit access by an approved inspection and testing company for the purpose of inspecting at random, doors being fabricated for this project.
- .3 Make provisions in doors and frames to suit requirements of trade or section providing electrically operated hardware or security devices. Provide removable plates or knock outs for electrical contacts. Provide junction boxes on security door frames as required for door strikes, mag locks and door contacts. Ensure frames arrive on site prepared for wiring.
- .4 Fabricate galvanized steel channels to reinforce frames as required for size, and for fire protection rating requirements. Extend reinforcements from floor to structure above. Design top connection to accommodate structural deflection. Conceal reinforcements in frames.

2.6 FRAMES AND SCREENS FABRICATION: GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Accurately form frames to profiles indicated. Construct frames straight and free from twist or warp.
- .3 Exterior frames: 1.98 mm minimum welded construction. 50 mm face standard frame profile, throat and frame width to suit wall construction.

- .4 Interior frames: 1.6 mm minimum for single doors; 1.98 mm for frames with opening width in excess of 1220 mm; welded type construction; 50 mm face standard frame profile, throat and frame width to suit wall construction.
- .5 Blank, drill, reinforce and tap frames to receive mortised, templated hardware, security and electrical devices, using templates provided by finish hardware supplier. Reinforce frames for installation of closers. Install stiffener plates or two angle spreaders where required to prevent bending of frame and to maintain alignment when setting. Weld reinforcement in place.
- .6 Protect mortised cutouts with steel guard boxes where required (masonry/concrete construction).
- .7 Provide three resilient bumpers per single door at the strike jamb. Provide two resilient bumpers per door leaf at the head of double doors.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .10 Provide fire labelled frames for those openings requiring fire protection ratings, as indicated in as scheduled on Drawings.
- .11 Partition Screens:
 - .1 Fabricate metal screens to profiles indicated.
 - .2 Supply jamb and mullion extensions and anchors required to secure screens to structure or framing provided under other Sections. Fabricate anchorage to prevent transfer of load from support framing to the screens when deflection of structure occurs.
 - .3 Provide concealed reinforcement for screens to which handrails are shown to be installed.
 - .4 Provide closely fitted steel glass stops where required. Mitre corners. Drill and countersink fasteners symmetrically at 150 mm o.c. Screw stops in place.
- .12 Provide recessed sheet steel panels, bases, and covers, where indicated, minimum 2 mm thick. At fire rated screens, construct panels, bases, and covers in accordance with fire test requirements. Weld panels, bases, and covers to perimeter framing in concealed manner where possible; where welds are exposed, provide continuous welds. Reinforce or laminate panels, bases, and covers as required to provide a flat uniform surface.
- .13 Where frames occur in masonry provide and adjustable T-strap type or wire type anchor for every 610 mm of jamb length. Special anchors for frames to be set in concrete shall be as detailed.

2.7 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Where frames terminate at finished floor, supply floor plates for anchorage to slab. Check depth of extension of finished floor to structural slab and provide jamb extension anchorage as required. Provide 50 mm minimum adjustment
- .3 Locate wall anchors immediately above or below each hinge reinforcement on the hinge jamb, and directly opposite on the strike jamb. Provide three anchors per jamb for frames up to 2300 mm. Add one anchor per jamb for each additional 760 mm or fraction thereof in frame height.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.8 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Cut frame mitres accurately and weld on inside of frame profile. Fill frame corners, exposed surface depressions and butted joints with air drying paste filler. Sand to a smooth uniform finish. Touch up damaged galvanized finish with zinc rich primer.
- .3 Cope accurately and securely weld butt joints.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .7 Insulate exterior frame components with polyurethane insulation as indicated in Section 07 21 19.

2.9 DOOR FABRICATION: GENERAL

- .1 Doors: swing type, flush, with provision for openings as indicated.
- .2 Fabricate doors with longitudinal edges locked seamed with adhesive and spot-welded for larger doors. Seams: not visible, grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish. Bevel both stiles of single doors 1 in 16.
- .3 Provide side panels where indicated or scheduled of same materials, gauge, thickness, construction and finish as door. Reinforce panels to prevent oil canning. Install panels with concealed fastenings, and reinforce to accommodate hardware as required. Seal joint between panel airtight.
- .4 Mortise, reinforce, drill, and tap doors to receive templated hardware, security, and electrical devices.
- .5 Reinforce doors where required, for surface mounted hardware. Provide flush steel top and bottom caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .7 Cut-outs: Where openings are required, provide integrally formed cut-outs with steel framing, and closely fitted steel glass and grille stops, as required. Mitre corners of stops. Drill and countersink fasteners symmetrically at 150 mm o.c. Supply and install coated steel stops, with same coating type and thickness as doors. Screw stops in place.
- .8 Supply and install steel vent grilles in doors where indicated.
- .9 Fabricate doors with a clearance of 3 mm to the frame and 6 mm to completed floor finish or threshold, except at openings in non-fire rated separations where undercuts are indicated.
- .10 Provide flush top and bottom steel edge on exterior doors and doors to stair shafts.
- .11 Provide touch-up primer at areas where zinc coating has been removed or damaged during fabrication.
- .12 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

- .13 Manufacturer's nameplates on doors are not permitted.

2.10 FABRICATION: EXTERIOR DOORS

- .1 Face sheets: Minimum 1.6 mm base steel sheet thickness.
- .2 Stiffened, insulated and sound deadened with polystyrene core laminated under pressure to each face sheet.
- .3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams continuous welded, filled, and sanded flush with no visible seam.

2.11 FABRICATION: INTERIOR DOORS

- .1 Face sheets: Minimum 1.2 mm base steel sheet thickness.
- .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.
- .3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams continuous welded, sanded flush with no visible seam.
- .4 Make cut-outs as required for door vents and install vents (louvers) at indicated doors or as directed by Departmental Representative as washrooms and service rooms.

2.12 FABRICATION: FIRE RATED DOORS

- .1 Face sheets: Minimum 1.6 mm base steel sheet thickness.
- .2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.
- .3 Longitudinal edges mechanically interlocked, adhesive assisted with edge seams continuous welded, sanded flush with no visible seam.
- .4 Equip pairs of fire labelled doors with minimum 2.7 mm (0.105") steel surface mounted flat bar astragal, shipped loose for application on site.

2.13 LAMINATED CORE CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with polystyrene core laminated under pressure to face sheets.
- .2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

2.14 EXTERIOR FRAMES

- .1 Insulate exterior frame components with polyurethane foamed-in-place insulation, as indicated in Section 07 21 19.

2.15 PRIMER

- .1 Touch-up primer: Commercial rust inhibitive primer, shop prime coat doors and frames before delivery; grey or red coloured primer; in accordance with Section 09 91 00 – Painting. Clear primer not acceptable; provide primer for field touch-up.

2.16 PAINTING

- .1 All new doors and frames shall be factory-finished to required finish colour; only existing on-site doors to be field-painted.
 - .1 Doors: Refer to Schedules.

- .2 Field-paint existing steel doors and frames only, and in accordance with Section 09 91 00 - Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes. All primer and finish paint shall be formulated for Direct to Metal (DTM) application.
- .3 Exterior Door/Frame paint (field paint): Benjamin Moore, Colour 2133-20 Black Jack, Finish: Low Lustre
- .4 Interior Door/Frame Paint (field paint): Benjamin Moore, Colour 2133-20 Black Jack, Finish: Low Lustre.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

- .1 Verify condition and dimensions of previously installed work upon which this Section depends. Report defects to Departmental Representative. Commencement of work means acceptance of existing conditions

3.3 PREPARATION AT EXTERIOR LOCATIONS

- .1 Supply and install flexible, continuous gasket air/vapour barrier seals between work of this section and adjacent construction, and at deflection and expansion connections, where required. Prime substrates, apply gaskets to framing and to substrates with adhesive and retain with continuous aluminum or stainless-steel plates or bars and non-corrosive mechanical fasteners. Ensure a continuous permanent seal at joints.
- .2 Provide airtight seals at penetrations in air/vapour barriers.

3.4 INSTALLATION GENERAL

- .1 Install fire rated doors and frames in accordance with requirements of NFPA 80.
- .2 Install doors and frames to, CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.

3.5 FRAME AND SCREEN INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Install hollow metal window frames at interior locations as indicated.
- .6 Install door silencers.
- .7 Caulk perimeter of frames between frame and adjacent material.
- .8 Maintain continuity of air barrier and vapour retarder.

3.6 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 05 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, top of carpet, non-combustible sill, or thresholds: 6 mm.
- .3 Install louvres.
- .4 Adjust operable parts for correct function.

3.7 FINISH REPAIRS

- .1 Touch-up areas where galvanized coating has been removed or damaged with primer.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.8 GLAZING

- .1 Install glazing for doors and frames in accordance with Section 08 80 50 – Glazing.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 06 10 00 – Rough Carpentry.
- .2 Section 07 27 14 – Air and Vapour Barriers.
- .3 Section 07 46 23 – Wood Siding.
- .4 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .5 Section 07 92 00 – Joint Sealants.
- .6 Section 08 80 50 – Glazing.

1.2 REFERENCES

- .1 Aluminum Association (AA)
 - .1 Aluminum Design Manual, 2010 Edition.
 - .2 Welding Aluminum: Theory and Practice, 2002.
 - .3 Properties of Aluminum Alloys: Fatigue Data and the Effects of Temperature, Product Form, and Processing, 2008.
- .2 American Architectural Manufacturer's Association (AAMA)
 - .1 AAMA 501-05, Methods of Test for Exterior Walls.
 - .2 AAMA 611-12, Voluntary Standards for Architectural Anodized Aluminum.
 - .3 AAMA 1503-09, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - .4 AAMA AFPA-91, Anodic Finishes/Painted Aluminum.
 - .5 AAMA CW-RS-1-12, The Rain Screen Principle and Pressure Equalized Wall Design.
 - .6 AAMA RPC-00, Rain Penetration Control: Applying Current Knowledge.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.
 - .2 ASTM A480/A480M-14a, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - .3 ASTM B209/209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .4 ASTM B221/B221M-13, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - .5 ASTM B429/B429M-10e1, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
 - .6 ASTM C920-14, Standard Specification for Elastomeric Joint Sealants.
 - .7 ASTM E2112 - 07(2016), Standard Practice for Installation of Exterior Windows, Doors and Skylights.
- .4 Canadian Standards Association (CSA) International
 - .1 CSA A440-11, NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights, Includes Update No. 1 (2014).
 - .2 CAN/CSA A440.4-07 (R2012), Window, Door, and Skylight Installation.
 - .3 CAN/CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels, Includes Update No.1 (2014).

- .4 CAN/CSA Z91-02 (R2013), Health and Safety Code for Suspended Equipment Operations.
- .5 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International)
 - .1 Surface Preparation Guidelines:
 - .1 SSPC-SP COM Surface Preparation Commentary for Steel and Concrete Substrates
 - .2 SSPC-PS Guide 12.00, Guide to Zinc-Rich Coating Systems

1.3 DESIGN CRITERIA

- .1 Meet or exceed requirements of CSA A440, and the following performance requirements:
 - .1 Windows, Doors, Ventilators, Skylights:
 - .1 Performance class: AW.
 - .2 Performance grade: 40.
- .2 Provide data sheets and test results demonstrating compliance with these requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures:
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada, and Health and Welfare Canada. Indicate VOC's for sealant materials.
- .3 Shop Drawings:
 - .1 Submit shop drawings signed and sealed by the Manufacturer's Engineer clearly indicating:
 - .1 Components, materials, finishes, and locations of anchorage.
 - .2 Section details showing all window perimeter conditions.
 - .3 Mullion details and frame corner connections.
 - .4 Sill flashing terminations, in isometric view, including coordination with wall cladding materials.
 - .5 Frame anchorage details.
 - .6 Details showing sealing techniques within and around perimeter of framing and operable sash.
 - .7 Connection to building sheet membrane air and vapour retarder.
 - .8 Required sizes and tolerance of openings.
- .4 Samples:
 - .1 Submit one representative model of each type window.
 - .2 Include frame, sash, sill, glazing and weatherproofing method, insect screens, surface finish and hardware. Show location of manufacturer's nameplates.
 - .3 Include 150 mm long samples of head, jamb, and sill to indicate profile.
- .5 Provide operation and maintenance data for windows for incorporation into manual specified in Section 01 11 00 – General Requirements: Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Window fabricator shall be experienced in the fabrication and erection of metal windows of similar sizes, shapes and finishes to the units required for this project and shall have ample facilities to produce, furnish and supply the units as required for installation without delay to the Work.
- .2 Retain a professional engineer registered in the Province of the Work experienced in structural design in glass and aluminum window units, connections to building, to ensure the adequacy of the structural aspects of the design, manufacture, and installation of complete assembly. This Engineer is called the "Manufacturer's Engineer" elsewhere in this Section.
- .3 Only fabricators approved by Manufacturer shall fabricate and install products of this Section.

1.6 SINGLE SOURCE RESPONSIBILITY

- .1 Single-Source Responsibility: obtain all aluminum windows, to Section 098 50 13, and all passthrough windows, to Section 08 56 13 for all Project buildings from a single manufacturer regularly engaged in the manufacturing and supply of the specified products, meeting or exceeding the material properties and performance characteristics required.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle and store units in accordance with manufacturer's directions.
- .2 Store units at site on raised wood pallets protected from the elements and corrosive materials. Do not remove from crates or other protective covering until ready for installation.
- .3 Store all glass units vertically on end with solid bearing full thickness of insulating units.
- .4 Store pre-fabricated frame assemblies blocked off the ground to prevent warping, twisting, undo strain on assembly or physical abuse and damage.

1.8 JOB CONDITIONS

- .1 Protect aluminum finishes and glazing during erection against disfiguration, contamination or damage by abuse of harmful materials. Install protective cover where exposure to damage is critical.
- .2 After glass is installed, mark each light with large cross or other symbol to make glass obvious and noticeable to other trades. Use substance which will not stain, mark or "Shadow" glass either by itself or by reaction with sunlight, moisture or the environment. Do not use masking tape.
- .3 Coordinate installation of windows and skylights with Work specified in other Sections to ensure proper placement and installation of vapour barrier, insulation and flashing in order that air/vapour/thermal barrier of building is intact and moisture will be diverted to the exterior.

1.9 WARRANTY

- .1 Provide manufacturers written guarantee, signed and issued in the name of Departmental Representative, to replace the following items for defective material and workmanship for the time stated from date of Substantial Performance:
 - .1 Framing, panels and glazing: failure of performance requirements specified in Contract Documents; 2 years.
 - .2 Sealed glass units: misting, dusting and seal failure; 2 years.
 - .3 Sealants, caulking: failure to maintain seal; 2 years.

- .4 Aluminum brake shapes: oil-canning and delamination; 2 years.
- .2 Provide Warranty for aluminum windows to include in maintenance manuals as specified in Section 01 11 00 – General Requirements: Closeout Procedures.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Performance Requirements: Provide assemblies able to withstand positive and negative pressures normal to the plane of window in accordance with Building Code climatic requirements.
 - .1 Design wind loading for walls and windows is: 1.1 kPa.
 - .2 Provide aluminum framed window systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - .1 Thermal movements.
 - .2 Movements of supporting structure including, but not limited to, deflection from uniformly distributed and concentrated live loads.
 - .3 Dimensional tolerances of building frame and other adjacent construction.
 - .3 Provide drainage from all spaces around insulating glass units, including each horizontal space created by setting blocks.
 - .4 Provide baffles or other protection at drainage openings to prevent direct entrance of wind-driven rain.
 - .5 Ensure means of connection to structure and adjacent materials and connection of membranes for continuity of air and vapour barrier performance.

2.2 MATERIALS

- .1 Aluminum: Aluminum Association (AA) alloy 6063-T5 or 6063-T6 for aluminum extrusions and AA 1100, anodizing quality, for aluminum sheet, minimum 3 mm thickness.
- .2 Fasteners: To ASTM A480, stainless steel, type 304 selected to prevent galvanic action with the components fastened, of suitable size to sustain imposed loads.
- .3 Gaskets: Neoprene or EPDM with dimensional tolerances and durometer hardness and of suitable size and shape to meet the requirements of the specifications and their specific application. Gaskets shall be virgin material as manufactured by Tremco Ltd. Gaskets shall conform to Tremco Information Bulletins:
 - .1 For EPDM - TDB-460-1
 - .2 For Neoprene - TDB-270-1
- .4 Window and Door Flashing System: Blueskin WB™ Window & Door Flashing Membrane is a non-permeable, air and water barrier membrane with a proprietary all-weather adhesive compound, by Henry, or similar with same or better performance characteristics and physical properties.
- .5 Preformed Sill Flashing System: supply preformed window flashing system; Jamsill Guard® adjustable sill pan flashing designed to prevent water damage from window and door leaks, or similar with same or better performance characteristics and physical properties.
- .6 Supporting angles, plates, bars, rods, and other steel accessories: Mild steel CAN/CSA-G40.20/G40.21, shop painted with zinc chromate primer, thickness as required to sustain imposed loads and in no case less than 5 mm thick.
- .7 Sealant: Including primer, joint filler, as specified in Section 07 92 00.

- .8 Isolation coating: alkali resistant bituminous paint.
- .9 Thermal separator: Polyvinylchloride, 50 Shore A durometer hardness +5.
- .10 Glazing Tape: Refer to Section 08 80 50.
- .11 Metal air seal/vapour barrier (by window supplier) to be bonded to window frame and extend behind mounting frame. Seal all corners to maintain air seal vapour retarder. Install flexible flashing with continuous metal retaining strip to lap to interior wall assembly.
- .12 Provide all accessories, fastenings and parts recommended by manufacturer for a complete installation in accordance with printed installation instructions, data sheets, and specifications.

2.3 WINDOW TYPE AND CLASSIFICATION

- .1 Types:
 - .1 Casement: removable dual glazed insulating glass.
 - .1 Acceptable materials: similar to AA™900 Thermal Windows, by Kawneer, with insect screen removable from the inside.
 - .2 Fixed: removable dual glazed insulating glass.
 - .1 Acceptable materials: similar to AA™900 Thermal Windows, by Kawneer.
 - .3 Screens: on ventilating portion of windows; removable from the inside.
 - .2 Classification rating: to CSA A440; refer to item 1.3 DESIGN CRITERIA of this Section.

2.4 GLAZING AND ACCESSORIES

- .1 Glass and glazing: refer to Section 08 80 50 – Glazing.

2.5 FABRICATION

- .1 Fabricate in accordance with CSA A440, supplemented as follows:
- .2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.
- .3 Face dimensions detailed are maximum permissible sizes.
- .4 Brace frames to maintain squareness and rigidity during shipment and installation.
- .5 Finish steel clips and reinforcement with 380 g/m² zinc coating to CAN/CSA G164.

2.6 ALUMINUM FINISHES

- .1 Colour Anodized: Exposed aluminum surfaces shall be Aluminum Association (AA) Architectural Class I, AA-M10C21A44, black anodized finish, minimum .7 mils thick.
- .2 Unexposed aluminum: Mill finish.
- .3 Isolation Coating
 - .1 Isolate aluminum from following components, by means of isolation coating:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.7 **HARDWARE**

- .1 Hardware: stainless steel or white bronze sash locks and aluminum handles to provide security and permit easy operation of units.
- .2 Locks: provide operating sash with spring loading locking device, to provide automatic locking in closed position.
- .3 Provide special keyed opening device for windows normally locked.
- .4 Where windows latching devices are located in excess of 1900 mm above floor level:
 - .1 Equip casement units with roto operators with locking handle.
- .5 Equip operable windows with hardware as follows:
 - .1 Casement Hinges: low friction slide and pivot design, with Teflon filed slide shoe on roll formed stainless steel track and flat bottom.
 - .1 Acceptable Material: 14 Series Casement Hinge, Truth
- .6 Provide ADA handles for roto operators.
 - .1 Acceptable Materials: Truth 50 Series Maxim Awning Operator and Truth 50 Series Maxim Dual Arm Operator for casement.
- .7 Force to operate locking devices shall not exceed 20 N.

2.8 **FACTORY-APPLIED AIR BARRIER AND VAPOUR RETARDER**

- .1 Equip window frames with factory installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:
 - .1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.
 - .2 Material width: adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder from interior.

Part 3 **Execution**

3.1 **COMPLIANCE**

- .1 Comply with manufacturer's printed installation instructions, data sheets, standard and job-specific details, and specifications.

3.2 **INSPECTION**

- .1 Inspect Work and conditions affecting the Work of this Section. Proceed only after deficiencies have been corrected.
- .2 Ensure that all flashings built-in or provided by others integrate with system to divert moisture to exterior.
- .3 Ensure that all anchor blocks or inserts required to receive system are correctly located and installed.
- .4 Ensure that all anchors and setting or installing components provided by this Section for installation are properly located and installed.
- .5 Ensure that building air and vapour retarding membranes can be sealed to window units to maintain system integrity.
- .6 Coordinate with materials installation specified in Section 07 27 14 – Air and Vapour Barriers.

3.3 PREPARATION

- .1 Obtain all dimensions from the job site.
- .2 Provide data, dimensions and components, anchors and assemblies to be installed by others in proper time for installation.
- .3 Supply and install flexible, continuous gasket air/vapour barrier seals between work of this section and adjacent construction, and at deflection and expansion connections, where required. Prime substrates, apply gaskets to framing and to substrates with adhesive and retain with continuous aluminum or stainless-steel plates or bars and non-corrosive mechanical fasteners. Ensure a continuous permanent seal at joints.
- .4 Provide airtight seals at penetrations in air/vapour barriers.

3.4 INSTALLATION

- .1 Install to CAN/CSA A440.4-07 (R2012).
- .2 Erect Work in accordance with manufacturer's printed installation instructions.
- .3 Conceal all anchors and fitments. Exposed heads of fasteners not permitted. All joints in exposed work to be flush hairline butt joints.
- .4 Use anchors that will permit sufficient adjustment for accurate alignment. Make allowance for deflection of building structure.
- .5 Build in and provide any supplementary reinforcing and bracing required by assembly loads and deflections.
- .6 Secure Work adequately to structure in a manner not restricting thermal and wind movement.
- .7 Correctly locate and install flashings, deflectors and weep holes to ensure proper drainage of moisture to exterior.
- .8 Maintain alignment with adjacent Work.
- .9 Isolate aluminum surfaces from adjacent dissimilar materials and metals with coatings of bituminous paint.
- .10 Fill shim spaces at perimeter of assembly to maintain continuity of thermal barrier with foam-in-place insulation, and seal with materials specified in Section 07 92 00 – Joint Sealants.

3.5 GLAZING INSTALLATION

- .1 Glazing: refer to Section 08 80 50 – Glazing.

3.6 SEALANTS

- .1 Caulk and seal full perimeter of windows to building air/vapour retarder to provide and maintain the designed air/vapour/thermal barrier integrity and weather tightness.
- .2 Install sealants and back-up materials in strict accordance with manufacturer's written instruction.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.

- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1

General

1.1 RELATED SECTIONS

- .1 Section 08 11 13 – Metal Doors and Frames.

1.2 REFERENCES

- .1 Standard hardware location dimensions in accordance with the Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers Association.
- .2 ANSI/BHMA A156.2–2011, Bored & Preassembled Locks and Latches.
- .3 ANSI/BHMA A156.1–2013, Butts and Hinges.
- .4 ANSI/BHMA A156.3–2014, Exit Devices.
- .5 ANSI/BHMA A156.4–2013, Door Controls - Closers.
- .6 ANSI/BHMA A156.5-2014, Cylinders and Input Devices for Locks.
- .7 ANSI/BHMA A156.6-2010, Architectural Door Trim.
- .8 ANSI/BHMA A156.7-2014, Template Hinge Dimensions.
- .9 ANSI/BHMA A156.8-2010, Door Controls – Overhead Stops & Holders.
- .10 ANSI/BHMA A156.13-2012, Mortise Locks and Latches.
- .11 ANSI/BHMA A156.15-2011, Release Devices - Closer/Holders.
- .12 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
- .13 ANSI/BHMA A156.18-2012, Materials and Finishes.
- .14 ANSI/BHMA A156.19-2013, Power Assist & Low Energy Power Operated Doors.
- .15 ANSI/BHMA A156.21-2014, Thresholds.
- .16 ANSI/BHMA A156.22-2012, Door Gasketing and Edge Seal Systems.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- .1 Hardware for doors in fire separations and exit doors to be certified by ULI / ULC, a Canadian Certification Organization accredited by Standards Council of Canada.

1.4 SAMPLES

- .1 When requested, submit samples of hardware items in accordance with Section 01 11 11 – General Requirements: Submittal Procedures.
- .2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
- .3 After approval, samples will be returned for incorporation in the Work.

1.5 HARDWARE SCHEDULE

- .1 Submit finish hardware schedule using the standard DHI format for finish hardware schedules in accordance with Section 01 11 11 – General Requirements: Submittal Procedures.
- .2 Clearly indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

1.6 MAINTENANCE DATA

- .1 Provide operation and maintenance data for door closers, locksets, door holders and fire exit devices for incorporation into manual specified in Section 01 11 11 – General Requirements: Closeout Procedures.
- .2 Brief maintenance staff regarding proper care, cleaning and general maintenance of door hardware items.

1.7 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 11 11 – General Requirements: Closeout Procedures.
- .2 Supply two sets of wrenches for door closers, locksets and fire exit hardware.

1.8 DELIVERY AND STORAGE

- .1 Store finishing hardware in locked, clean and dry area.
- .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

Part 2 Products

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for all similar product groups.
- .2 Basis-of-Design – refer to Section 01 11 11 –General Requirements: Product Options and Substitutions: the product numbers listed in the finish hardware schedule are the Basis-of-Design and shall be used as the standard of acceptance for all items.
- .3 Other manufacturer's products will be considered provided they meet or exceed the performance, grade, quality, function, weight, design and finish of the specified product, and requests for approval are approved by the Departmental Representative in writing through issued addenda 7 days prior to tender closing.

2.2 DOOR HARDWARE

- .1 Butts and hinges:
 - .1 Butts and continuous hinges: designated by letter and numeral identifiers, followed by size and finish, as listed in Hardware Schedule.
 - .2 Butt hinges on exterior doors and locked doors opening out shall have non removable pins (NRP) and doors equipped with door closers or in high traffic areas shall have ball bearing (BB) hinges.
 - .3 Specified product – Butts/continuous hinges: Ives
- .2 Locks and latches:
 - .1 Locksets and latchsets are to be heavy duty cylindrical or mortise, lever type, and meet ANSI Grade 1, A156.2-2011, A117.1 Accessibility, and ULC requirements. Supply vandal proof lever handle trim on exterior doors, or where specified.
 - .2 Lever handle trim must have concealed through bolt mounting, and the levers are to be solid cast with a return to the door face. All locks are to have heavy duty cast mounting plates, threaded hub and locking nut, and stainless steel interlocking spindle. Lever handle design to be Schlage RHO/06.

- .3 Roses or Escutcheons: Round design 87mm O.D., as listed in schedule.
- .4 Normal strikes: box type, lip projection not to exceed 6mm beyond jam.
- .5 Cylinders: SFIC; cores supplied by owners, keyed to existing master key system.
- .6 Finish to be Satin Chrome Plated - 626.
- .7 Specified products: Locksets - Schlage Lock.
- .3 Exit Devices:
 - .1 To be heavy duty, grade 1, modern design push bar style, wide stile, to meet ANSI, ULC, NFPA and ADA certification, to have thru-bolted trim, heavy-duty steel I-beam bar, and heavy gauge latch head with reinforced bracket. All lever trims to be free-wheeling, vandal-resistant, and all devices are to have deadlocking latchbolts.
 - .2 Finish to be Satin Chrome Plated 626, for devices and trims. Functions and trims to be as listed in Hardware Schedule.
 - .3 Specified product: Von Duprin
- .4 Door Closers and Accessories:
 - .1 Door controls (closers): to meet or exceed ANSI A156.4 Grade 1 requirements; to be heavy duty cast aluminum bodies with adjustable spring power and have separate valves for latching, closing and backcheck control. All closer arms to be forged steel, with power adjustment arm bracket.
 - .2 All closers are to be non-sized to suit door and opening, and to have full covers with finish 689. Brackets, shoes, and plates are to be included for proper mounting of closers. All closers shall have minimum 25 - year warranty.
 - .3 Specified product: LCN
- .5 Overhead stops/holders:
 - .1 Door controls (overhead stops/holders): to meet or exceed ANSI A156.8 Grade 1 requirements; to be heavy duty slide track type with heavy duty shock absorber spring and non-metal slide block and shock block, non-handed.
 - .2 To be Type 304 stainless steel material in stainless steel 630 finish.
 - .3 Specified product: Glynn-Johnson
- .6 Auxiliary locks:
 - .1 To meet ANSI A156.16 requirements, to be heavy-duty and finished in 626.
 - .2 Cylinders: SFIC; rim or mortise type, finished to 626, cores supplied by owners, keyed to existing master key system.
 - .3 Specified product: Schlage
- .7 Architectural door trim:
 - .1 To meet ANSI A156.6 requirements, type 304 stainless steel, finished 630.
 - .2 Door protection plates: kick plate type 304 stainless steel, 1.27 mm thick stainless steel, finished to 630.
 - .3 Specified product: Ives Hardware
- .8 Auxiliary hardware; door stops:

- .1 to meet CAN/CGSB-69.32-(M90)/ANSI/BMHA A156.16-1989, designated by letter and numeral identifiers, as listed in Hardware Schedule, finished to 626.
 - .1 Floor stops, dome type, cast brass, finished 626.
 - .2 Specified products: Ives Hardware
- .9 Door sweeps:
 - .1 Heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene seal, surface mounted, adjustable, clear anodized finish.
 - .2 Specified product: DraftSeal
- .10 Thresholds:
 - .1 127 mm wide x full width of door opening, extruded aluminum, serrated surface, thermal break with stop strip, clear anodized finish.
 - .2 Specified product: DraftSeal
- .11 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.
 - .2 Adhesive backed santoprene material.
 - .2 Door bottom sweep:
 - .1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.
 - .3 Specified product: DraftSeal

2.3 FASTENINGS

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .4 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 All cylindrical locksets and deadlocks are to have SFIC cylinders with cores supplied by owners, keyed to existing master key system. Door locks and cylinders to be keyed differently, keyed alike, keyed alike in groups, master keyed or grandmaster keyed as directed. Prepare detailed keying schedule in conjunction with Agency's representative.
- .2 Provide three (3) change keys for every lock in this Contract.
- .3 Provide three (3) master keys for each MK or GMK group.

Part 3 Execution

3.1 INSTALLATION INSTRUCTIONS

- .1 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .2 Furnish manufacturer's instructions for proper installation of all hardware components.
- .3 Install hardware to standard hardware location dimensions in accordance with Canadian Imperial Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .4 Where door stop contacts door pulls, mount stop to strike bottom of pull.

3.2 SCHEDULE OF HARDWARE SETS

Hardware Set # H-1 – Pair Doors No. DO1; Each to have:

- 6 Hinges Ives 5BB1 114 x 114 NRP - 630
- 1 Set C/L Flush Bolts FB51P x UL x RHR dr. - 630
- 1 Lever Lockset Schlage ND96BDC-RHO x 14-042 ¾" L/B x CMK - 626
- 1 SFIC Permanent Cylinder Core – Supplied by owners
- 1 Door Closer LCN 4050 Hw/PA-T/J x 4050-18G Mtg. Plate x LHR dr. - 689
- 1 O/H Door Stop Glynn-Johnson 904S x LHR dr. - C32D
- 1 O/H Door Stop Glynn-Johnson 902S x RHR dr. - C32D
- 2 Stop Mounting Brackets Ives MB2 – SP28
- 1 Threshold DraftSeal DS177 x 5TBN x 1524mm - Alum
- 1 Set Door Seal DraftSeal DS132C x 5792mm - AL
- 2 Door Sweeps DraftSeal DS135C x 915mm/610mm - AL
- 1 Set Astragals DraftSeal DS163C x 2134mm (2 pcs.) - AL

Hardware Set # H-2 - Single Door No. DO2; Each to have:

- 3 Hinges Ives 5BB1 114 x 101 - 630
- 1 Lever Lockset Schlage ND80BDC-RHO x CMK - 626
- 1 SFIC Permanent Cylinder Core – Supplied by owners
- 1 Door Closer LCN 1450 Rw/PA FC - 689
- 1 Floor Door Stop Ives FS439 - 626
- 1 Set Door Seal DraftSeal DSS66D x 5183mm - AL
- 1 Door Sweep DraftSeal DS149CNB x 915mm - AL

END OF SECTION 08 71 00

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 08 11 13 – Metal Doors and Frames.
- .2 Section 08 50 13 – Aluminum Windows.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI Z97.1-2015, Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .2 ASTM International (ASTM)
 - .1 ASTM C542-05(2011), Specification for Lock Strip Gaskets.
 - .2 ASTM C716-06(2015), Standard Specification for Installing Lock-Strip Gaskets and Infill Glazing Materials.
 - .3 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.
 - .4 ASTM C964-07(2012), Standard Guide for Lock-Strip Gasket Glazing.
 - .5 ASTM C1048-12e1, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
 - .6 ASTM C1172-14, Standard Specification for Laminated Architectural Flat Glass.
 - .7 ASTM C1349-10, Standard Specification for Architectural Flat Glass Clad Polycarbonate.
 - .8 ASTM C1503-08(2013), Standard Specification for Silvered Flat Glass Mirror.
 - .9 ASTM D2240-16, Standard Test Method for Rubber Property Durometer Hardness.
 - .10 ASTM E330/E330M-14, Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 - .11 ASTM C1503-08, Standard Specification for Silvered Flat Glass Mirror.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 12.1-17, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.8-17, Insulating Glass Units.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA A440-00/A440.1-00 (R2005), A440-00, Windows / Special Publication A440.1-00, User Selection Guide to CSA Standard A440-00, Windows. Includes Update NO. 1 (2000), Update No. 2 (2006), Update No. 3 (2006).
 - .2 CAN/CSA A440.4-07 (R2016) - Window, Door, and Skylight Installation.
 - .3 CSA A500-16, Building Guards.
 - .4 CSA Certification Program for Windows and Doors.
- .5 Glazing Association of North America (GANA)
 - .1 GANA Glazing Manual (50th Anniversary Edition).
 - .2 GANA Guide to Architectural Glass (2010).
- .6 Underwriters Laboratories (UL)
 - .1 UL 2761, Sealants and Caulking Compounds, 10/03/2011.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Convene pre-installation meetings: one week prior to beginning work of this Section.
 - .1 Verify project requirements.
 - .2 Review installation conditions.

- .3 Coordinate with other building trades.
- .4 Review manufacturer's instructions and warranty requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
- .3 Samples:
 - .1 Submit 300 mm x 300 mm size of each glazing type. Departmental Representative reserves the right to change colour of glass after review of submitted samples.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Submit testing and analysis of glass under provisions of Section 01 11 00 – General Requirements: Quality Control.
 - .2 Submit shop inspection and testing for glass.
- .7 Closeout Submittals:
 - .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 11 00 – General Requirements: Closeout Submittals.

1.5 PERFORMANCE/DESIGN CRITERIA

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330.
- .3 Limit glass deflection to 1/200 with full recovery of glazing materials.

1.6 QUALITY ASSURANCE

- .1 Manufacturer's technical recommendations:
 - .1 Perform glazing work in accordance with written recommendations from the glass manufacturer or glass fabricator.
 - .2 Certify glass compatibility with glazing materials (i.e. insulating glass sealants, structural sealants and silicones, gaskets, setting blocks, etc.)
 - .3 Designs to be analyzed for thermal stress.
 - .4 Provide shop inspection for glass.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

- .1 Provide testing and analysis of glass under provisions of Section 01 11 00 – Project General Requirements: Quality Control.
- .2 Provide shop inspection and testing for glass.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 SITE CONDITIONS

- .1 Environmental Requirements:
 - .1 Install glazing when ambient temperature is 10 degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

- .1 Provide manufacturers guarantee for the following types of glass listed, against defects in materials and workmanship for the period indicated, commencing from the date of Substantial Performance of Work.
 - .1 Sealed Glass Units: Replace units that exhibit failure of hermetic seal under normal use evidenced by the obstruction of vision by dust, moisture, or film on interior surface of glass: 2 Years.
 - .2 Provide warranty for glazing to include in maintenance manuals as specified in Section 01 11 00 – General Requirements: Closeout Submittals.

Part 2 Products

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

- .1 Design Criteria:
 - .1 Size glass to withstand dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E330.
 - .2 Glass that is used or functions as a guard as defined by National Building Code of Canada shall meet or exceed the standards and recommendations of CSA A500.
 - .3 Safety Glass: shall meet or exceed criteria and standards established by CGSB 12.1 and ANSI Z97.1 Class A.
 - .4 Glazing installation shall meet or exceed requirements of National Building Code of Canada, with deflection less than 1/175.
- .2 Required Edge Treatments:
 - .1 Concealed edges: flat belt ground and seamed.
 - .2 Structural Silicone Glazed (SSG) edges: flat belt ground and seamed.
 - .3 Butt joined edges with silicone seal: flat ground with arris.
 - .4 Exposed edges: flat polish with arris.

2.2 MATERIALS: FLAT GLASS

- .1 Type GL2: Safety Glass: tempered glass to CAN/CGSB-12.1, transparent, glazing quality, thickness as required to meet ANSI Z97.1 Class A but not less than 6 mm thick. At locations where full-height glass panes are used (e.g., panes \geq 2200 mm in height), minimum thickness shall be 10 mm.

- .2 Type LE1: Low-emissivity (Low-e) coating on 3rd surface, as follows:
 - .1 Basis-of-Design:
 - .1 Low-e coating on 2nd surface, Solarban® 60, by PPG, or similar with same or better physical properties and performance characteristics.

2.3 MATERIALS: SEALED INSULATING GLASS

- .1 Double Pane Insulating Glass Units: meet or exceed requirements of CAN/CGSB-12.8. Units shall be certified by the Insulated Glass Manufacturers Alliance (IGMA). Overall unit thickness shall be 25 mm using 6 mm glass thickness for individual panes. Use two-stage seal method of manufacture, as follows:
 - .1 Primary Seal: polyisobutylene sealing compound between glass and metal spacer/separator, super spacer bar or TDSE Intercept.
 - .2 Secondary Seal: polyurethane, silicone or polysulphide base sealant, filling gap between the two panes of glass at the edge up to the spacer/separator and primary seal.
 - .3 Outboard pane: clear tempered glass, as follows:
 - .1 Type GL2: clear tempered glass.
 - .2 Type LE-1: Low-emissivity (Low-e) coating, 2nd surface.
 - .4 Inter-cavity space: 13 mm space with low conductivity spacers.
 - .5 Inert gas fill: ≥95% argon filled.
 - .6 Inboard glass: Type GL2: clear tempered glass with low-e coating, as follows:
 - .1 Type GL2: clear tempered glass.

2.4 ACCESSORIES

- .1 Sealant: in accordance with Section 07 92 00 – Joint Sealants.
- .2 Glazing sealant: Type as recommended by glazing manufacturer as required to meet or exceed performance requirements. Verify compatibility with insulating glass unit secondary sealant.
- .3 Sealant for glazing between edges of glass units: one component silicone base, non-acidic, non-corrosive qualifying to ASTM C920. DC 795 by Dow Corp, Silpruf SCS 2000 Series by G.E Silicones, or similar as required to meet performance requirements.
- .4 Heel bead: DC 795 by Dow Corp or Silpruf SCS 2000 Series by G.E Silicones, or similar as required to meet performance requirements.
- .5 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .6 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .7 Glazing tape:
 - .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.
 - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to create an air and vapour seal.
- .8 Glazing splines: resilient polyvinyl chloride, extruded shape to suit glazing channel retaining slot, black colour.
- .9 Glazing clips: manufacturer's standard type.

- .10 Lock-strip gaskets: to ASTM C542.
- .11 Other Glazing Accessories: to CAN/CSA A440.
- .12 Screws, bolts and fasteners: ASTM F738M; Type 304 stainless steel.
- .13 Glass presence markers: easily removable, non-residue depositing.

2.5 FABRICATION

- .1 Verify glazing dimensions on Site.
- .2 Clearly label each glass light with maker's name, weight, quality, type and certification number. Do not remove labels until after work has been reviewed by Departmental Representative.
- .3 Accurately size glass to fit openings allowing the clearances shown on the following tables:

.1 Minimum glass clearances:

Thickness	Edge Clearance	Face Clearance
6 mm	6 mm	3 mm
over 6 mm	6 mm or 3/4 times the glass thickness, whichever is greater	

* = where any dimension of glass exceeds 760 mm increase minimum edge clearance by 1.5 mm.

- .4 Bite of glass edge on stop: 12.5 mm minimum

Part 3 Execution

3.1 COMPLIANCE

- .1 Install work in accordance with the Quality Management provisions specified in this section and manufacturer's written instructions.
- .2 Size glass to meet or exceed National Building of Canada requirements and verify glass for openings are correctly sized and are within allowable tolerances. Install glass with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.
- .3 Perform work in accordance with GANA Glazing Manual, IGMA, and GANA Laminated Glazing Reference Manual for glazing installation methods.

3.2 EXAMINATION

- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- .3 Commencement of work means acceptance of existing conditions.

3.3 PREPARATION

- .1 Ensure all glazing rebates smooth and true, free of projections nails, screws, fastenings properly set to prevent contact with glass.
- .2 Ensure all stops, splines, glazing accessories provided by others accurately cut to length and proper size and type for specific glazing.
- .3 Clean contact surfaces with solvent and wipe dry.

- .4 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .5 Prime surfaces scheduled to receive sealant.

3.4 EXTERIOR GLAZING

- .1 Manufacturer's Instructions: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .3 Cut glazing tape to length and set against permanent stops, 6 mm below sight line. Seal corners by butting tape and dabbing with sealant.
- .4 Apply heel bead of sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapour seal.
- .5 Place setting blocks at ¼ points, with edge block maximum 150mm from corners.
- .6 Rest glazing on setting blocks and push against tape and heel head of sealant with sufficient pressure to attain full contact at perimeter of light or glass unit.
- .7 Install removable stops with spacer strips inserted between glazing and applied stops 6 mm below sight line.
- .8 Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, to maximum 9 mm below sight line.
- .9 Apply cap head of sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services: Upon Departmental Representative's written request provide periodic site visit by manufacturer's field service representative.

3.6 SCHEDULE

- .1 Exterior Doors and Sidelights: Type IGU-1, 25 mm overall with each pane 6 mm thick.
- .2 Exterior Windows: Type IGU-2, 25 mm overall with each pane 6 mm thick.
- .3 At any interior location where full-height glass panes are used (e.g., panes ≥ 2200 mm in height), use Safety Glass, minimum thickness shall be 10 mm.
- .4 Interior Sidelights: Type GL2, minimum 6 mm thick, or thickness as otherwise indicated or required by Code.
- .5 Interior Windows: Type GL2, minimum 6 mm thick, or thickness as otherwise indicated or required by Code.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 05 50 00 – Metal Fabrications.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 07 92 00 – Joint Sealants.
- .4 Section 09 91 00 – Painting.

1.2 REFERENCES

- .1 Aluminum Association (AA)
 - .1 AA DAF-45, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C475/C475M-15, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .2 ASTM C514-04(2014), Specification for Nails for the Application of Gypsum Board.
 - .3 ASTM C557-03(2017), Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .4 ASTM C840-17, Specification for Application and Finishing of Gypsum Board.
 - .5 ASTM C919-12(2017), Standard Practice for Use of Sealants in Acoustical Applications.
 - .6 ASTM C1002-16, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .7 ASTM C1047-14a, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .8 ASTM C1178/C1178M-13, Specification for Glass Mat Water-Resistant Gypsum Backing Board.
 - .9 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.
 - .10 ASTM C1658/C1658M-13, Standard Specification for Glass Mat Gypsum Panels.
- .3 Association of the Wall and Ceilings Industries International (AWCI)
- .4 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 11 10 – General Requirements: Submittal Procedures:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- .2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.

- .3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.5 SITE ENVIRONMENTAL REQUIREMENTS

- .1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours 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 GYPSUM MATERIALS

- .1 Moisture Resistant Board (walls and ceilings): as follows:
 - .1 Type: regular and Type X fire resistant as noted on Drawings.
 - .2 Size: 1200 mm x maximum practical length.
 - .3 Thickness: as indicated on Drawings - minimum 16 mm.
 - .4 Edges: square.
 - .5 Minimum Properties and Standard of Acceptance:
 - .1 Mould resistance to ASTM D3273: 10.
 - .2 Mould resistance to ASTM G21: 0.
 - .3 Less than 5% water absorption by weight after 2-hour immersion per ASTM C473.
 - .6 Acceptable materials:
 - .1 M2TECH Water Resistant Board, by CertainTeed.
 - .2 Gold Bond® BRAND XP® Water Resistant Board, by National Gypsum.
 - .3 DensArmor Plus® Interior Panels, by Georgia-Pacific.
 - .4 CGC Sheetrock® Brand Panels Mold Tough®, by CGC.

2.2 FRAMING MATERIALS

- .1 Wood studs, to Section 06 10 10 – Rough Carpentry: use only kiln dried lumber.
 - .1 Moisture Content: maximum 8% at time of installation.
- .2 Wood furring, to Section 06 10 10 – Rough Carpentry: use only kiln dried lumber.
 - .1 Moisture Content: maximum 8% at time of installation.

2.3 PARTITION WALL INSULATION MATERIALS

- .1 Insulation at partition walls: to Section 07 21 16 - Blanket Insulation.

2.4 ACCESSORIES

- .1 Nails: to ASTM C514.
- .2 Concrete screws: ¼-inch diameter x 2-¾-inch length, self-tapping concrete screws, corrosion resistant finish.
- .3 Wood screws designed for the fastening of gypsum board to wood stud, to ASTM C1002; hot dipped galvanized.

- .4 Stud adhesive: to ASTM C557.
- .5 Laminating compound: as recommended by manufacturer, asbestos-free.
- .6 Casing beads, corner beads, control joints, and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one-piece length per location.
 - .1 Gypsum board corner bead vertical corners shall be 3/4" round. Provide transition caps at the base and head, by Trim-Tex or similar.
- .7 Strippable Edge Trim: Extruded PVC with pre-masked L-shaped tape on trim with tear away protective serrated strip for removal after compound and paint is applied, for use at areas where gypsum butts aluminum frames and where gypsum butts concrete or concrete block.
- .8 Sealants: in accordance with Section 07 92 00 – Joint Sealants.
- .9 Acoustic sealant: non-hardening, non-skinning, permanently flexible and in accordance with Section 07 92 00 – Joint Sealants.
- .10 Insulating Strip / Acoustic Strip: rubberized, moisture-resistant, 3 mm thick closed cell neoprene strip, or 8 mm thick open cellular rubber reinforced with solid rubber particles bonded to cellulose, minimum 28 mm (1-1/2 inch) wide, with self-sticking permanent adhesive on one face, lengths as required.
- .11 Joint Treatment Materials: Provide joint compound and accessory materials in accordance with ASTM C475 and as follows:
 - .1 Joint Tape:
 - .1 Interior Gypsum Board: Paper.
 - .2 Sheathing board and Cement board: Fibreglass mesh tape.
 - .2 Joint Compound for Interior Gypsum Board: Vinyl based, non-asbestos, low dusting type compatible with other compounds applied on previous or for successive coats, and as follows:
 - .1 Pre-filling: Setting type taping compound.
 - .2 Embedding and First Coat: Drying type compound.
 - .3 Fill Coat: Drying type compound.
 - .4 Finish Coat: Drying type, sandable topping compound.
 - .5 Skim Coat: Drying type, sandable topping compound.
 - .6 Acceptable Materials:
 - .1 CertainTeed Dust Away.
 - .2 CGC Dust Control.

2.5 FINISHES

- .1 Paint: in accordance with Section 09 91 00 – Painting.
- .2 Other finishes as indicated.

Part 3 Execution

3.1 ERECTION

- .1 Do erection and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Install work level to tolerance of 1:1200.

- .3 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .4 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .5 Furr gypsum board faced vertical bulkheads within and at termination of ceilings.
- .6 Furr above ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .7 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .8 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .9 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .10 Erect drywall resilient furring transversely across studs and joists spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.
- .11 Install 150 mm continuous strip of 13 mm gypsum board along base of partitions where resilient furring installed.
- .12 Install trim, shadow mould and reveals as indicated.

3.2 APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply single or double layer gypsum board to wood 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 in accordance with ASTM C840.
 - .2 Apply gypsum board vertically or horizontally, providing 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.
- .3 Apply mould-resistant gypsum board adjacent to sinks, wet areas, and where indicated. Apply mould-resistant sealant to edges, ends, cut-outs that expose gypsum core and to fastener heads.
- .4 Apply non-cementitious backer board at wall tile locations. Apply mould-resistant sealant to edges, ends, cut-outs that expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.
- .5 Apply acoustical sealants, to ASTM C919, and as follows:

- .1 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.
- .6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .7 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.
- .8 Install gypsum board with face side out.
- .9 Do not install damaged or damp boards.
- .10 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.3 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 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 window and exterior door frames, to provide thermal break.
- .5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.
- .6 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .7 Provide continuous polyethylene dust barrier behind and across control joints.
- .8 Locate control joints where indicated, and at changes in substrate construction at approximate 10 m spacing on long corridor runs at approximate 15 m spacing on ceilings.
- .9 Install control joints straight and true.
- .10 Construct expansion joints at building expansion and construction joints. Provide continuous dust barrier.
- .11 Install expansion joint straight and true.
- .12 Install cornice cap where gypsum board partitions do not extend to ceiling.
- .13 Fit cornice cap over partition, secure to partition track with two rows of wood screws staggered at 300 mm on centre.
- .14 Splice corners and intersections together and secure to each member with 3 screws.
- .15 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or wood framing.
- .16 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.

- .17 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:
- .1 Levels of finish:
 - .1 Level 0: No taping, finishing or accessories required for areas of temporary construction.
 - .2 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable and for plenum areas above ceilings, in attics or in concealed spaces.
 - .3 Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable and when gypsum is used as a substrate for tile.
 - .4 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges and where areas are to receive a heavy coating of textured material.
 - .5 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges and where light textures or wall coverings are to be applied.
 - .18 All installations where board will be exposed to view shall have a Level 4 finish.
 - .19 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.
 - .20 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.
 - .21 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
 - .22 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
 - .23 Mix joint compound slightly thinner than for joint taping.
 - .24 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.
 - .25 Allow skim coat to dry completely.
 - .26 Remove ridges by light sanding or wiping with damp cloth.
 - .27 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

3.4 **CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 11 10 – General Requirements: Cleaning. 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 11 10 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 10 – General Requirements: Waste Management and Disposal. 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 Work of this Section.

3.6 BOARD SCHEDULE

- .1 Use Fire Rated Type 'X' or Type 'C' board at fire rated wall and ceiling assemblies as required to meet National Building Code of Canada 2015.
- .2 Install board as indicated, and as follows:
 - .1 Moisture Resistant Board: at interior face of exterior walls, at all partitions and all ceilings, fire-resistance-rated where indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 35 00 – Concrete Finishing.
- .2 Section 05 50 00 – Metal Fabrications.
- .3 Section 08 11 13 – Metal Doors and Frames.
- .4 Section 09 21 16 – Gypsum Board Assemblies.
- .5 Other technical sections as indicated; coordinate with Drawings.

1.2 REFERENCES

- .1 American Society of Testing and Materials (ASTM)
 - .1 ASTM D16-12, Standard Terminology for Paint, Related Coatings, Materials, and Applications.
 - .2 ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 Green Seal
 - .1 Green Seal Standards GS-11, Paint.
 - .2 Green Seal Standard GC-03, Anti-Corrosive Paints.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .4 Environmental Protection Agency (EPA)
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).
- .5 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual.
- .6 National Fire Code of Canada – 2010.
- .7 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.
- .8 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, 2011 Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Construction Progress Schedule.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building trades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

- .2 Scheduling
 - .1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.
 - .2 Obtain written authorization from Departmental Representative for changes in work schedule.
 - .3 Schedule painting operations to prevent disruption of and by other trades.
- .3 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Health and Safety Requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit product data in accordance with Section 01 11 00 – General Requirements: Submittal Procedures:
 - .1 Submit product data and instructions for each paint and coating product to be used.
 - .2 Submit product data for the use and application of paint thinner.
- .2 Submit samples in accordance with Section 01 11 00 – General Requirements: Submittal Procedures:
 - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
 - .2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating, and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm birch plywood for finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
 - .5 10 mm plywood for finishes over wood surfaces.
 - .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
- .3 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 11 00 – General Requirements: Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation and application instructions.
- .5 Submit quality assurance submittals in accordance with Section 01 11 00 – General Requirements: Quality Control.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

- .1 Contractor: experienced painting contractor.
- .2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
- .3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

1.6 MOCK-UPS

- .1 Construct mock-ups in accordance with Section 01 11 00 – General Requirements: Quality Control.
 - .1 Provide 3 m x 3 m mock-up. Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.
 - .2 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.
 - .3 Locate where directed.
 - .4 Allow 24 hours for review of mock-up before proceeding with work.
 - .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Pack, ship, handle and unload materials in accordance with Section 01 11 00 – General Requirements: Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
 - .1 Identify products and materials with labels indicating:
 - .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 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well-ventilated area with temperature range 7 degrees C to 30 degrees C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.

- .8 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

1.8 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 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 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless pre-approved written approval by Departmental Representative and product manufacturer, perform no painting when:
 - .1 Ambient air and substrate temperatures are below 10 degrees C.
 - .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is above 85% or when the dew point is more than 3 degrees C variance between the air/surface temperatures. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
 - .2 Perform painting work when maximum moisture content of the substrate is below:
 - .1 12% for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
 - .4 Allow new concrete and masonry to cure minimum of 28 days.

- .3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:
 - .1 Apply paint finishes 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.
- .5 Additional exterior application requirements:
 - .1 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
 - .2 Do not apply paint when:
 - .1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.
 - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
 - .3 Surface to be painted is wet, damp or frosted.
 - .3 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
 - .4 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
 - .5 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

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 Provide paint materials for paint systems from single manufacturer.
- .3 Use only MPI listed L-rated materials.
- .4 Conform to latest MPI requirements for all painting work, including preparation and priming.
- .5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI - Architectural Painting Specification Manual "Approved Product" listing.

- .6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

2.2 COLOURS

- .1 Refer to Drawings for colour requirements.
- .2 Colours to be selected by Departmental Representative from manufacturer's full range; the number of different colours required for the project is not expected to exceed 4 colours overall; some rooms may require a feature wall painted a different colour than the remaining walls, so assume one feature wall per room space; associated painted trim to match adjacent wall.
- .3 Minimum number of coats shall be three: primer and two topcoats, minimum, plus additional as required to achieve opaque, uniform colour.
- .4 Second coat in three-coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Unless otherwise specified or pre-approved, all paint shall be ready-mixed and pre-tinted. Re-mix all paint in contained prior to and during application to ensure break-up of lumps, completed dispersion of settled pigment, and colour and gloss uniformity.
- .2 Mix paste, powder, or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.

2.4 GLOSS/SHEEN RATINGS

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

Description / Gloss Level	Gloss @ 60 degrees	Sheen @ 85 degrees
G1 - Matte Finish (flat)	Max. 5	Max. 10
G2 - Velvet-Like Finish	Max.10	10 to 35
G3 - Eggshell Finish	10 to 25	10 to 35
G4 - Satin-Like Finish	20 to 35	min. 35
G5 - Traditional Semi-Gloss Finish	35 to 70	
G6 - Traditional Gloss	70 to 85	
G7 - High Gloss Finish	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated or otherwise specified.

2.5 SPECIALIZED COATINGS - BASIS OF DESIGN

- .1 PROJECTOR SCREEN PAINT - EXTERIOR S1 SCREEN PAINT SILVER-GALLON G005EX, by PAINT ON SCREEN™.
- .2 Reference Website: <https://www.projectorscreen.com/store/p/2405-Projector-Screen-Paint-Exterior-S1-Screen-Paint-Silver-Gallon-g005ex.html>
- .3 Manufacturer's Specifications:
- .1 Gain = .95 - 6.0 (depending on selection)
 - .2 110 - 160 Viewing Angle (Cone)

- .3 Very High Viscosity 440+ cSt
- .4 3DHD must be sprayed.
- .5 Maximum VOC: 50 g/l (0.42 lb/gal)
- .6 If permanently marked or scuffed, reapply fresh coat of PAINT ON SCREEN™.
- .4 Supply and apply manufacturer's recommended primer as required.
- .5 Apply several coats of projector screen paint as recommended by manufacturer.

2.6 EXTERIOR PAINTING

- .1 Unless otherwise specified, all exterior painting work shall be in accordance with MPI Premium Grade finish requirements; minimum 3 coats typically, and minimum of 4 coats where deep or bright colors are used.
- .2 Concrete foundations exposed above grade: colored water-based outdoor concrete paint and sealer; acrylic 30% solids, low VOC (less than 100 grams per Liter), strong binding, coloured, satin acrylic sealer for overlays or any cement based product; contains a hybrid, self-cross-linking, acrylic resin with built-in water repellents and exhibits tenacious penetration and adhesion. It shall contain no wax or silicone additives. Pigments shall be specifically formulated for UV stability, will not blush, and will retain long gloss retention. Product shall be non-flammable and environmentally safe.
 - .1 Basis-of-Design:
 - .1 Colored Water-Based Outdoor Concrete Paint and Sealer ColorTec AcrylicWB™, by SureCrete Design Products.
 - .2 Custom Colour: matte black.
 - .3 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal:
 - .1 EXT 5.1T / REX 5.1H Polyurethane, pigmented finish (over H.B. self-priming epoxy).
 - .4 Steel - High Heat: heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted:
 - .1 EXT 5.2A / REX 5.2A– Heat-resistant enamel finish, maximum 205 degrees C.
 - .5 Galvanized Metal: non-chromate passivated; high contact/high traffic areas (doors, frames, railings and handrails, etc.):
 - .1 EXT 5.3D - Polyurethane, pigmented finish (over vinyl wash and epoxy primer).

2.7 INTERIOR PAINTING

- .1 Unless otherwise specified, all interior painting work shall be in accordance with MPI Premium Grade finish requirements; minimum 3 coats typically, and minimum of 4 coats where deep or bright colors are used. Colour as indicated on Drawings.
- .2 Structural, electrical and mechanical elements at exposed areas shall be primed and finish painted to MPI Premium Grade requirements.
- .3 Metal doors, frames, balustrades and railings shall be primed and finish painted to MPI Premium Grade requirements.
- .4 Concrete Floors:
 - .1 Pigmented Acrylic Floor Sealer: commercial-quality pigmented and acrylic copolymer (methacrylate resin) based sealer formulated for concrete floors, having the following minimum physical properties:
 - .2 Solids Content: 50 % +/- 2 by weight, 40% +/- 2 by volume (dependent upon colours).

- .3 Gloss level: Level 1: Traditional Matte (Flat).
- .4 Colour: as selected by Consultant.
- .5 Viscosity: 1200 cps.
- .6 Standard of Acceptance:
 - .1 Sikagard® Color A-50 Lo-VOC.
- .5 Structural Steel and Metal Fabrications:
 - .1 INT 5.1R – High performance architectural latex, G5 finish.
- .6 Steel - high heat:
 - .1 INT 5.2B – Heat-resistant aluminum paint finish, maximum 427 degrees C.
- .7 Galvanized metal:
 - .1 INT 5.3M – High performance architectural latex, G5 finish.
- .8 Plaster and gypsum board: gypsum board at walls and ceilings:
 - .1 INT 9.2B – High-performance architectural latex; eggshell finish for walls and matte finish for ceilings.
- .9 Fire Retardant Paint:
 - .1 Standard of Acceptance:
 - .1 Fire Retardant Paint FR-110, by Incl-x, or similar from Great Northern Insulation, InnovProtect, or AD Fire Protection Systems.
 - .2 Colour: white.
 - .3 CSA Class A - flame spread rating 0 - 25.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturers' printed recommendations and specifications, including product technical bulletins, handling, storage, preparation and application instructions, and technical datasheets.

3.2 GENERAL

- .1 Perform preparation and operations for painting in accordance with MPI - Architectural Painting Specifications Manual, Premium Grade.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .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 properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Metal: 0%.
 - .2 Stucco, plaster and gypsum board: 12%.

- .3 Concrete: 12%.
- .4 Brickwork: 12%.
- .5 Wood: 15%.
- .4 Prior to commencement of repainting work, thoroughly examine (and test as required) all interior conditions and surfaces scheduled to be repainted and report in writing to the Departmental Representative any conditions or surfaces that adversely affect work of this section.
- .5 The degree of surface deterioration (DSD) shall be assessed as follows:

Condition	Description
DSD-0	Sound Surface (may include visual (aesthetic) defects that do not affect film's protective properties).
DSD-1	Slightly Deteriorated Surface (may show fading; gloss reduction, slight surface contamination, minor pin holes scratches, etc.) / Minor cosmetic defects (runs, sags, etc.).
DSD-2	Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, staining, etc.).
DSD-3	Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).
DSD-4	Substrate Damage (repair or replacement of surface required by others).

- .6 Correct defects DSD-0 through DSD-4 as required, ready to be painted. Coordinate with other trades as needed.

3.4 PREPARATION – REPAINTING

- .1 Prepare all interior surfaces for repainting in accordance with MPI Repainting Manual requirements.
- .2 Sand, clean, dry, etch, neutralize and/or test all surfaces under adequate illumination, ventilation and temperature requirements.
- .3 Remove and securely store all miscellaneous hardware and surface fittings and fastenings (e.g. electrical plates, mechanical louvers, door and window hardware (e.g. hinges, knobs, locks, trim, frame stops), removable labels, washroom accessories, light fixture trim, etc. from wall and ceiling surfaces, doors and frames, prior to repainting and replace upon completion. Carefully clean and replace all such items upon completion of repainting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes). Doors shall be removed before repainting to paint bottom and top edges and then re-hung.
- .4 Protect all adjacent interior surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, etc., from repainting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and make good any damage caused by failure to provide such protection.

3.5 PREPARATION – NEW WORK

- .1 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 surfaces as directed by Departmental Representative.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.
 - .4 Protect passing pedestrians, building occupants, and general public in and about the building.

- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.
- .3 Concrete floor preparation:
 - .1 Mechanically roughen surface to CSP 2-4 in accordance with Guideline 310.2R-2013, and then remove all dust and debris.
 - .2 Refer to Section 03 01 30.71 – Concrete Repair.
- .4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual requirements and coating manufacturer's recommendations. 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 clothes or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .5 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 pre-treatment as soon as possible after cleaning and before deterioration occurs.
- .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .8 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 or vacuum cleaning.
- .9 Prepare existing brick surfaces to be painted to firm substrate by removing dirt, dust, loose, un-adhered and flaking paint, oil, grease and other foreign substances in accordance with MPI requirements. Remove all products from surfaces, pockets, and corners to be painted by brushing with clean brushes or vacuum cleaning.
- .10 Touch up of shop primers with primer as specified.

- .11 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.6 APPLICATION

- .1 Method of application shall be as approved by Departmental Representative. Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
 - .2 Work paint into cracks, crevices, and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers, or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers, or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
 - .5 Remove runs, sags, brush marks from finished work, and repaint.
- .3 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes and rollers to work paint into cracks, crevices, and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum period as recommended by manufacturer.
- .7 Sand and dust between each coat to provide an anchor for next coat and to remove defects in previous coat (runs, sags, etc.) visible from a distance up to 1000 mm (39").
- .8 To avoid air entrapment in applied coats, apply materials in accordance with manufacturer's spread rates and application requirements.
- .9 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.
- .10 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .11 Finish closets and alcoves as specified for adjoining rooms.
- .12 Finish top, bottom, edges, and cut-outs of doors after fitting as specified for door surfaces.
- .13 Paint plywood to protect it from the moisture in Service Building Washrooms (applicable to sections of vanities, such as undersides, that are not visible).

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .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.

3.8 FIELD QUALITY CONTROL

- .1 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.
- .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 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.
- .4 Painted interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Departmental Representative:
 - .1 brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 - .2 evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
 - .3 damage due to touching before paint is sufficiently dry or any other contributory cause.
 - .4 damage due to application on moist surfaces or caused by inadequate protection from the weather.
 - .5 damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).

- .5 Painted interior surfaces shall be considered unacceptable if any of the following are evident under final lighting source conditions:
 - .1 visible defects are evident on vertical surfaces when viewed at 90 degrees to the surface from a distance of 1000 mm (39”).
 - .2 visible defects are evident on horizontal surfaces when viewed at 45 degrees to the surface from a distance of 1000 mm (39”).
 - .3 visible defects are evident on ceiling surfaces when viewed at 45 degrees to the surface.
 - .4 when the final coat on any surface exhibits a lack of uniformity of sheen across full surface area.
- .6 Painted surfaces rejected by the Departmental Representative shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 Work of this Section.

3.11 SCHEDULE AND GUIDELINES

- .1 Finish Schedule: refer to schedules on Drawings and the requirements of this Section.
 - .1 Assume full responsibility for painting or otherwise finish surfaces of all materials of the contract exposed in the finished work which do not already have finished surfaces and that normally require paint or varnish finish. Inspect surfaces over which the work of this section is dependent for unevenness, cracks, surface defects, moisture, cleanliness, roughness and other irregularities detrimental to the application and performance of the work. Confirm conditions satisfactory before proceeding. Failure in complying with above or failure to have unsatisfactory conditions corrected before proceeding, shall not relieve Contractor of responsibility for required results.
 - .2 Exposed means visible in complete work including interiors of cupboards and closets, tops of doors, trim, and the like, whether in sight line or not, including behind surface mounted fixtures and heating units.
 - .3 Unless otherwise indicated, all exposed wood that is not prefinished is to receive a transparent finish. Prefinished wood items include:
- .2 In instances where materials specified are not suitable for particular application or are contrary to manufacturer's recommendations for use on particular surface, immediately bring to attention of Consultant for clarification and instructions.
- .3 Where finishing formula for surfaces requiring paint is not specified, follow recommendations of MPI Painting Specifications Manual, Premium.

- .4 Consultant shall have right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to Owner.
- .5 Unless otherwise noted or scheduled, walls shall be painted the same colour within a given area.
- .6 Access doors, prime coated butts and other prime painted hardware, registers, radiators and covers, exposed piping and electrical panels shall be painted to match adjacent surfaces in terms of colour, texture and sheen, unless otherwise indicated.
- .7 In areas specifically designated as "unfinished" painting is not required except for bare, primed and zinc coated metal surfaces and insulated ductwork and pipes.
- .8 Where exposed to view paint bare metals, previously primed metals and zinc coated metals unless specified otherwise.
- .9 Paint electrical power and lighting panels, whether prefinished or not.
- .10 Unless specifically indicated on drawings to be painted, all finish carpentry work shall receive transparent finish.

END OF SECTION

PART 1 - GENERAL

- 1.1 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Shop Drawings:
 - .1 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.
-
- 1.2 CLOSEOUT SUBMITTALS
- .1 Operation and Maintenance Data:
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Parks Canada 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.
-

- 1.2 CLOSEOUT .1 (Cont'd)
- SUBMITTALS .4 (Cont'd)
- (Cont'd)
-
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
- .1 Submit 2 copies of draft Operation and Maintenance Manual to Parks Canada Representative for approval. Submission of individual data will not be accepted unless directed by Parks Canada Representative.
- .2 Make changes as required and re-submit as directed by Parks Canada 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 Parks Canada 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 Parks Canada 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.
-

- 1.2 CLOSEOUT
SUBMITTALS
(Cont'd)
- .1 (Cont'd)
 - .9 Submit copies of as-built drawings for inclusion in final TAB report.
- 1.3 MAINTENANCE
MATERIAL SUBMITTALS
- .1 Furnish spare parts as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
 - .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
 - .3 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 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 Storage and Handling Requirements:
 - .1 Store materials off ground and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- 2.1 NOT USED
- .1 Not used.
-

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 Parks Canada Representative.
 - .2 Inform Parks Canada 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 Parks Canada Representative.
- 3.2 PAINTING REPAIRS AND RESTORATION .1 Do painting in accordance with Section 09 91 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
 - .3 Restore to new condition, finishes which have been damaged.
- 3.3 SYSTEM CLEANING .1 Clean interior and exterior of all systems including strainers.
- 3.4 FIELD QUALITY CONTROL .1 Site Tests: conduct tests and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- 3.5 DEMONSTRATION .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
-

- 3.5 DEMONSTRATION
(Cont'd)
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
 - .3 Instruction duration time requirements as specified in appropriate sections.
 - .4 Parks Canada Representative will record these demonstrations on video tape for future reference.
- 3.6 CLEANING
- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .3 Waste Management:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.7 PROTECTION
- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

Kouchibouguac National Park	WELL WATER	Section 22 10 12
Phase 1 South Kouchibouguac	CHEMICAL TREATMENT	Page 1
Utility House Project #954	EQUIPMENT	2019-03-20

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 This section includes specifications for the well system chemical treatment equipment including chlorine dosing system; chlorine analyzer/pump controller; chlorine retention (contact) tanks and well pump pressure tanks that were previously tendered under Pre-Purchase Tender #1.
- 1.2 REFERENCES
- .1 American Water Works Association (AWWA).
.1 AWWA C651-05 Errata, Disinfecting Water Mains.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets.
- .3 NSF International.
.1 NSF 61-2017 Drinking Water System Components - Health Effects.
.2 NSF 372-2016 Drinking Water System Components - Lead Content
- 1.3 SUBMITTALS
- .1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
- .2 Shop drawings:
.1 Submit shop drawings to indicate:
.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
.2 Wiring and schematic diagrams.
.3 Dimensions and recommended installation.
.4 Pump performance and efficiency curves.
.5 Details on pump controllers, chlorine residual controllers and sensors.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
-

- 1.3 SUBMITTALS
(Cont'd)
- .4 Instructions: submit manufacturer's installation instructions.
 - .5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Division 01, include:
 - .1 Manufacturer's name, type, model year, capacity and serial number.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list with names and addresses.

PART 2 - PRODUCTS

- 2.1 PRESSURE TANKS
- .1 FRP vertical tanks with chlorine resistant heavy-gauge polymer aircell (replaceable) and a one piece molded inner shell of high density polyethylene.
 - .2 Sturdy, molded polymeric base.
 - .3 Maximum operating pressure: 862 kPa.
 - .4 Maximum operating temperature: 49 Deg. C.
 - .5 Capacity:
 - .1 Diameter - 610 mm.
 - .2 Height - 1,400 mm.
 - .3 Volume - 328 L.
 - .4 Drawdown volume - 101.5 L.
 - .5 Quantity - 2.
 - .6 Tested and certified to NSF 61, Section 8 and NSF 372 for potable water.
 - .7 See Pre-Purchase Tender #1 for final equipment selection.
- 2.2 CHLORINE
RETENTION (CONTACT)
TANK
- .1 FRP vertical tank with a one piece molded inner shell of high density polyethylene.
 - .2 Sturdy, molded polymeric base.
 - .3 Maximum operating pressure: 862 kPa.
-

2.2 CHLORINE
RETENTION (CONTACT)
TANK
(Cont'd)

- .4 Maximum operating temperature: 49 Deg. C.
- .5 Capacity:
 - .1 Diameter - 1,220 mm.
 - .2 Height - 2,310 mm.
 - .3 Volume - 1,741 L.
 - .4 Quantity - 1.
- .6 Tested and certified to NSF/ANSI 61, Section 8 and NSF/ANSI 372 for potable water.
- .7 SEE PRE-PURCHASE TENDER #1 FOR FINAL EQUIPMENT SELECTION.

2.3 CHLORINE
ANALYZER

- .1 The chlorine analyzer for monitoring of free or total residual chlorine shall be as follows:
 - .1 Measurement Range:
 - .1 0 to 5 mg/l (ppm) range and automatic colour/turbidity compensation
 - .2 Accuracy:
 - .1 $\pm 5\%$ of reading or ± 0.03 mg/l (ppm), which ever is greater.
 - .3 Precision:
 - .1 5% of reading or 0.01 mg/l (ppm), which ever is greater
 - .4 Minimum detection limit:
 - .1 0.03 mg/l (ppm).
 - .5 Resolution:
 - .1 0.01 mg/l (ppm).
 - .6 Repeatability:
 - .1 0.05 mg/l (ppm).
 - .7 Cycle time:
 - .1 2.5 minutes.
 - .8 Dual fully adjustable setpoint alarms.
 - .9 NEMA 12 enclosure that is IP62 rated with the gasketed door latched.
 - .10 Automatic self-testing diagnostics.
 - .11 Unattended operation up to 30 days.
 - .12 Manual and automatic feed pump control.
 - .13 The analyzer shall have two feed control (relay) operation modes to operate chemical feed pump. Available control options are:
 - .1 On/Off control where the concentration alarm outputs activate or deactivate the pump when chlorine levels fall below or exceed acceptable levels.

2.3 CHLORINE
ANALYZER
(Cont'd)

- .1 (Cont'd)
- .13 (Cont'd)
 - .2 Proportional control where the 4-20 mA output is scaled to pace the feed pump proportional to output.
 - .14 Two alarms selectable for sample concentration, system warning or system shut-down. Each alarm equipped with a SPDT relay rated at 5A.
 - .15 Power: 120/1/60.
- .2 SEE PRE-PURCHASE TENDER #1 FOR FINAL EQUIPMENT SELECTION.

2.4 METERING PUMPS

- .1 Pumps shall be positive displacement type.
- .2 Pumps shall be self-priming, and shall have a maximum suction lift capability of up to 90 kPa (30 feet vertical water column).
- .3 Discharge Pressure Rating: up to 690 kPa (100 psi).
- .4 Flow range: 0.0038 LPH-19.7 LPH in 0.0038 LPH increments (0.001-5.2 GPH in 0.001 GPH increments).
- .5 Pumps shall be capable of pumping both liquids and gases without vapor locking.
- .6 Pump shall be 24 hr continuous duty rated and have a three-year manufacturer's warranty from date of shipment.
- .7 Pumps shall be meet CE, NSF 61 and applicable electrical standards.
- .8 On/off switch.
- .9 Clear liquid crystal display.
- .10 Control shall be selectable between internal and external pulsing by means of a tactile keypad.
- .11 Pressure capacity shall be keypad adjustable.
- .12 Drive: totally enclosed with no exposed moving parts, solid state pulse fully encapsulated.
- .13 Electronics shall be housed in a chemical resistant enclosure.

2.4 METERING PUMPS
(Cont'd)

- .14 Automatic pressure relief by stopping pulsing when discharge pressure exceeds pump pressure rating by 35%.
- .15 Pump housing shall be chemical-resistant glass fiber reinforced plastic.
- .16 Metering pump valves shall be ball type with ceramic balls, seat and rings shall be renewable.
- .17 Pump head shall be transparent acrylic. Fittings and connections at pump shall be PVC.
- .18 Provide 5.0 m of polyethylene tubing, required valves and strainers.
- .19 SEE PRE-PURCHASE TENDER #1 FOR FINAL EQUIPMENT SELECTION.

2.5 CHLORINE TANK

- .1 HDPE closed top chemical storage tank.
- .2 The HDPE resin complies with FDA and is listed NSF 61 for potable water applications.
- .3 Capacity: 100 litres.
- .4 Dimensions:
 - .1 Diameter - 450mm.
 - .2 Height - 725mm.
- .5 Supplied with a 140mm dia. threaded lid.
- .6 SEE PRE-PURCHASE TENDER #1 FOR FINAL EQUIPMENT SELECTION.

2.6 CHEMICAL
CONTAINMENT BASIN

- .1 HDPE open top tank.
 - .2 Capacity: 180 litres.
 - .3 Basin dimensions shall be sufficient to place chlorine tank inside basin.
 - .4 SEE PRE-PURCHASE TENDER #1 FOR FINAL EQUIPMENT SELECTION.
-

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- 2.7 CHEMICAL DOSING PIPING, VALVES & ACCESSORIES
- .1 Provide piping valves and accessories as detailed on Detail 2- Drawing H-103.
 - .2 PVC Piping and Valves: to Section 22 11 16 - Domestic Water Piping.
 - .3 Polyethelyne tubing:
 - .1 Pressure rating: 827 kPa (120 PSIG) at 20.0 Deg.C.
 - .2 Tested and certified to NSF/ANSI 61, Section 8 and NSF/ANSI 372 for potable water.

PART 3 - EXECUTION

- 3.1 CHLORINE DOSING EQUIPMENT
- .1 Install chemical dosing pump, valves and accessories on 20 mm plywood backboard mounted in Mechanical Room.
 - .2 Refer to shop drawing and installation data for equipment provided under Pre-Purchase Tender #1.

- 3.2 START-UP
- .1 SEE PRE-PURCHASE TENDER #1 FOR MANUFACTURER REPRESENTATIVE'S START-UP SERVICES.

- 3.3 SERVICE AGREEMENT
- .1 SEE PRE-PURCHASE TENDER #1 FOR MANUFACTURER REPRESENTATIVE'S SERVICE AGREEMENT.

- 3.4 CHLORINE CONTACT TANKS AND PRESSURE TANKS
- .1 Install to manufacturer's instructions.
 - .2 Shim and anchor to concrete floor to manufacturer's instructions.

PART 1 - GENERAL

- 1.1 SCOPE .1 This specification section includes all materials, equipment, labour, and incidentals required for the supply and installation of polyvinyl chloride (PVC) for use in potable water systems.
- 1.2 RELATED REQUIREMENTS .1 Section 22 05 00 - Common Work Results for Plumbing.
.2 Section 22 42 01 - Plumbing Specialties and Accessories.
.3 Section 23 05 05 - Installation of Pipework.
.4 Section 23 05 53.01 - Mechanical Identification.
- 1.3 REFERENCE STANDARDS .1 Canadian Standards Association (CSA)
.1 CSA B137 Series - 17 Thermoplastic Pressure Piping Compendium.
.2 ASTM International
.1 ASTM D1784-11 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
.2 ASTM D1785-15e1 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
.3 ASTM F438-17 Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
.4 ASTM F442-13e1 Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
.5 ASTM F1970-12e1 Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems.
.3 National Sanitation Foundation (NSF) International
.1 NSF 61-2017 Drinking Water System Components - Health Effects.
.2 NSF 372-2016 Drinking Water System Components - Lead Content
-

- 1.3 REFERENCE STANDARDS (Cont'd)
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .6 National Research Council (NRC)
 - .1 National Plumbing Code of Canada 2015 (NPC).
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit product data for the following:
 - .1 Strainers.
 - .2 Valves.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Place materials defined as hazardous or toxic in designated containers.
 - .2 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- 1.6 SUSTAINABLE REQUIREMENTS
- .1 Construction:
 - .1 Construction requirements form integral part of this project including materials and products of this Section. Sustainable construction requirements include:
 - .1 Specific construction requirements for project.
 - .2 Administrative, temporary and procedural requirements for the use of materials and methods of construction.

PART 2 - PRODUCTS

- 2.1 PIPING
- .1 Raw well water and domestic cold water, within building.
 - .1 Above ground: Schedule 40 PVC: to NSF 61; CSA B137.6; and ASTM F442.
 - .2 Buried or embedded: to Section.
-

- 2.1 PIPING
(Cont'd)
- .2 Pipe shall be homogeneous throughout, free of voids, cracks, inclusions, and other defects.
- 2.2 FITTINGS
- .1 PVC fittings: to NSF 61; CSA B137.6; ASTM F438; ASTM F4339; and ASTM F1970.
- 2.3 VALVES
- .1 Ball Valves:
- .1 Body: PVC.
 - .2 Ball: PVC.
 - .3 Working Pressure: 1035 kPa (150 psig)
 - .4 PVC compound shall have an ASTM cell classification 12454-A with a minimum suffix for contact with drinking water.
 - .5 All valves will be CRN (Canadian Registration Number).
 - .6 Socket ends and threaded ends in PVC shall be Schedule 80.
 - .7 Standard of acceptance: Chemline Type 21
- .2 Ball Check Valve:
- .1 Body: PVC.
 - .2 Ball: PVC.
 - .3 Working Pressure: 690 kPa (100 psig)
 - .4 PVC compound shall have an ASTM cell classification 12454-A with a minimum suffix for contact with drinking water.
 - .5 All ball check valves shall have union ends.
 - .6 All valves will be CRN (Canadian Registration Number).
 - .7 Socket ends and threaded ends in PVC shall be Schedule 80.
 - .8 Standard of acceptance: Chemline Type BC

PART 3 - EXECUTION

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

- 3.2 INSTALLATION
- .1 Install in accordance with National Plumbing Code NPC, Province(s) Plumbing Code and local authority having jurisdiction.
 - .2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
 - .3 Assemble piping using fittings manufactured to ASTM standards.
 - .4 Identify water piping in accordance with Section 23 05 53.01 - Mechanical Identification.
- 3.3 VALVES
- .1 Isolate equipment, fixtures and branches with ball valves.
- 3.4 PRESSURE TESTS
- .1 Conform to requirements of Section 23 05 00 - Common Work Results for Mechanical.
 - .2 Test pressure: greater of 1 times maximum system operating pressure or 690 kPa.
- 3.5 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 air chambers, expansion compensators are installed properly.
- 3.6 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 supervision during start-up.
-

3.6 START-UP
(Cont'd)

- .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 Check control, limit, safety devices for normal and safe operation.

- .4 Rectify start-up deficiencies.

3.7 OPERATION
REQUIREMENTS

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

- .2 Operational requirements:
 - .1 Cleaning materials and schedules.
 - .2 Repair and maintenance materials and instructions.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 This section includes:
 - .1 Specifications for all piping and fittings for drainage systems.
- 1.2 RELATED REQUIREMENTS
- .1 Division 01 - General Requirements.
 - .2 Section 22 05 00 - Common Work Results for Plumbing.
 - .3 Section 22 42 01 - Plumbing Specialties and Accessories.
 - .4 Section 23 05 05 - Installation of Pipework.
- 1.3 REFERENCE STANDARDS
- .1 American Society for Testing and Materials (ASTM International).
 - .1 ASTM D2235-04(2016), Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564-12, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - .2 Canadian Standards Association (CSA International).
 - .1 CSA B1800-15, Thermoplastic Nonpressure Piping Compendium.
 - .1 CSA-B181.2-15, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
 - .2 CSA-B182.1-15, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .3 National Research Council Canada
 - .1 National Plumbing Code of Canada, 2015.
- 1.4 WASTE MANAGEMENT AND DISPOSAL
- .1 Waste management and disposal to be in accordance with Division 01.
-

PART 2 - PRODUCTS

- 2.1 PIPING AND FITTINGS
- .1 For buried and or above ground sanitary, storm and vent piping to:
 - .1 CSA-B181.1.
 - .2 CSA-B181.2.
 - .3 CSA-B182.1.
 - .4 Aboveground piping to meet the following:
 - .1 Flame spread rating: less than 25.
 - .2 Smoke development rating: less than 50.

- 2.2 JOINTS
- .1 Solvent weld for PVC: to ASTM D2564.
 - .2 Solvent weld for ABS: to ASTM D2235.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 In accordance with Section 23 05 05 - Installation of Pipework.
 - .2 Install in accordance with National Plumbing Code of Canada and local authority having jurisdiction.

- 3.2 TESTING
- .1 Pressure test buried systems before backfilling in accordance with the National Plumbing Code of Canada.
 - .2 Hydraulically test to verify grades and freedom from obstructions.

- 3.3 PERFORMANCE VERIFICATION
- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
 - .2 Test to ensure traps are fully and permanently primed.
-

- 3.3 PERFORMANCE .3 Storm water drainage:
VERIFICATION .1 Verify domes are secure.
 .2 Verify provisions for movement of roof system.
(Cont'd)
- .4 Ensure fixtures are properly anchored, connected to
 system and effectively vented.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 22 05 00 - Common Work Results for Plumbing.
- 1.2 REFERENCE STANDARDS .1 American Society for Testing and Materials (ASTM International)
- .2 National Research Council Canada (NRC)
.1 National Plumbing Code of Canada 2015 (NPC).
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 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. Indicate VOC's.
- .2 Shop Drawings:
.1 Indicate on drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details and accessories.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Manufacturers' Field Reports: manufacturers' field reports specified.
- 1.4 CLOSEOUT SUBMITTALS .1 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.
-

- 1.4 CLOSEOUT SUBMITTALS (Cont'd)
- .1 (Cont'd)
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 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.

PART 2 - PRODUCTS

- 2.1 FLOOR DRAINS
- .1 Floor Drains: to CSA B79.
 - .2 FFD-1: combination funnel floor drain, 200 mm; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral oval funnel, and trap primer.
 - .1 Acceptable material: Zurn 415-BFP, Jay R. Smith, Watts.
- 2.2 TRAP PRIMERS
- .1 Trap primer valve, with integral vacuum breaker.
 - .2 The valve requires a 70 kPa pressure drop across the valve to activate and will deliver a metered amount of water to the floor drain. The trap Primer is to be connected to a cold water supply only.
 - .3 Acceptable manufacturers: PPP Oregon, MIFAB, Prime Perfect.
-

- 2.3 CLEANOUTS
- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
 - .2 Access Covers:
 - .1 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: nickel bronze round, gasket, vandal-proof screws.
 - .2 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

- 2.4 NON-FREEZE WALL HYDRANTS
- .1 Recessed type with integral vacuum breaker, NPS 3/4 hose outlet, removable operating key. Polished bronze finish.
 - .1 Acceptable manufacturers: Zurn, Jay R. Smith, Watts.

- 2.5 VACUUM BREAKERS
- .1 Breakers: to CSA-B64 Series, vacuum breaker atmospheric.
 - .1 Acceptable manufacturers: Watts, Febco, CASH ACME.

- 2.6 HOSE BIBBS AND SEDIMENT FAUCETS
- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.
 - .1 Acceptable manufacturers: Crane, Emco, Waltec.

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 plumbing specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Parks Canada Representative.
-

- 3.1 EXAMINATION .1 (Cont'd)
- (Cont'd)
- .2 Inform Parks Canada 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 Parks Canada Representative.
-
- 3.2 MANUFACTURER'S .1 Compliance: comply with manufacturer's written
- INSTRUCTIONS
- 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 (NPC), 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 at locations required code, and as indicated.
- .2 Bring cleanouts to finished floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.
-
- 3.5 TRAP PRIMERS .1 Install for all floor drains and elsewhere, as indicated.
- .2 Install PPEX piping to floor drain traps.
- .3 Piping to be graded to each trap.
-
- 3.6 NON-FREEZE WALL .1 Install 600 mm above finished grade.
- HYDRANTS
-

3.7 HOSE BIBBS AND SEDIMENT FAUCETS .1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.8 START-UP .1 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.
.2 Provide continuous supervision during start-up.

3.9 TESTING AND ADJUSTING .1 Timing:
.1 After start-up deficiencies rectified.
.2 After certificate of completion has been issued by authority having jurisdiction.
.2 Cleanouts:
.1 Verify covers are gas-tight, secure, yet readily removable.
.3 Hose bibbs, sediment faucets:
.1 Verify that flow and pressure meet design criteria.
.2 Check for leaks, replace compression washer if required.
.4 Floor drains:
.1 Verify operation of trap seal primer.
.2 Prime, using trap primer. Adjust flow rate to suit site conditions.
.3 Check operations of flushing features.
.4 Check security, accessibility, removeability of strainer.
.5 Clean out baskets.

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.

PART 1 - GENERAL

1.1 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, 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.

1.2 CLOSEOUT
SUBMITTALS

- .1 Operation and Maintenance Data: submit operation and maintenance data for for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Parks Canada Representative before final inspection.
 - .2 Operation data to include:
 - .1 Description of systems and their controls.
 - .2 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .3 Operation instruction for systems and component.
 - .4 Description of actions to be taken in event of equipment failure.
 - .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.

- 1.2 CLOSEOUT .1 (Cont'd)
- SUBMITTALS .4 (Cont'd)
- (Cont'd)
-
- .3 Special performance data as specified.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
- .1 Submit 2 copies of draft Operation and Maintenance Manual to Parks Canada Representative for approval. Submission of individual data will not be accepted unless directed by Parks Canada Representative.
- .2 Make changes as required and re-submit as directed by Parks Canada 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 Parks Canada 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 Parks Canada 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.
-

1.2 CLOSEOUT SUBMITTALS (Cont'd) .1 (Cont'd)
.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.2 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 from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

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 Parks Canada Representative.
.2 Inform Parks Canada 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 Parks Canada Representative.

- 3.2 PAINTING REPAIRS AND RESTORATION
- .1 Do painting in accordance with Section 09 91 00 - Painting.
 - .2 Prime and touch up marred finished paintwork to match original.
 - .3 Restore to new condition, finishes which have been damaged.
- 3.3 CLEANING
- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .3 Waste Management:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- 3.4 PROTECTION
- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 23 07 15 - Thermal Insulation for Piping.
 - .2 Section 23 05 00 - Common Work Results for Mechanical.
 - .3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- 1.2 REFERENCE STANDARDS
- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 Canadian Standards Association (CSA International)
 - .1 CSA B139 Series 15, Installation Code for Oil Burning Equipment.
 - .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11-2015, Paints, Coatings, Stains, and Sealers.
 - .4 National Research Council Canada (NRC)
 - .1 National Fire Code of Canada 2015 (NFC).
- 1.3 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

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 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.
- .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 valves unless indicated otherwise, with hose end male thread, cap and chain.
-

3.5 PIPEWORK
INSTALLATION

- .1 Screwed fittings jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ASTM standards.
- .5 Install exposed piping, equipment and similar items parallel or perpendicular to building lines.
- .6 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .7 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .8 Group piping wherever possible and as indicated.
- .9 Ream pipes, remove scale and other foreign material before assembly.
- .10 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .11 Provide for thermal expansion as indicated.
- .12 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
- .13 Check Valves:
 - .1 Install check valves in horizontal lines on discharge of pumps and as indicated.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.

- 3.8 PRESSURE TESTING OF EQUIPMENTS AND PIPEWORK
- .1 Advise Parks Canada Representative 48 hours minimum prior to performance of pressure tests.
 - .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
 - .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
 - .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
 - .5 Conduct tests in presence of Parks Canada Representative.
 - .6 Pay costs for repairs or replacement, retesting, and making good. Parks Canada Representative to determine whether repair or replacement is appropriate.
 - .7 Insulate or conceal work only after approval and certification of tests by Parks Canada Representative.
- 3.9 EXISTING SYSTEMS
- .1 Connect into existing piping systems at times approved by Parks Canada Representative.
 - .2 Request written approval by Parks Canada Representative 10 days minimum, prior to commencement of work.
 - .3 Be responsible for damage to existing plant by this work.
- 3.10 CLEANING
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 SUMMARY
- .1 Section Includes:
 - .1 Electrical motors, drives and guards for mechanical equipment and systems.
 - .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
 - .3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.
- 1.2 REFERENCE STANDARDS
- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1-2016 SI, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IES Co-sponsored).
 - .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
 - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
 - .2 Quality Control:
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
-

1.3 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd) .3 Closeout Submittals:
.1 Provide maintenance data for motors, drives and guards for incorporation into manual.

1.4 QUALITY ASSURANCE .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.

1.5 DELIVERY, STORAGE, AND HANDLING .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GENERAL .1 Motors: high efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

2.2 MOTORS .1 Provide motors for mechanical equipment as specified.
.2 Motors under 373 W 1/2 HP: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
.3 Motors 373 W 1/2 HP and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, single phase, 240 V, unless otherwise indicated.

2.3 TEMPORARY MOTORS .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Parks Canada Representative for temporary use. Work will only be accepted when specified motor is installed.

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 Fasten securely in place.
.2 Make removable for servicing, easily returned into, and positively in position.

3.3 FIELD QUALITY CONTROL .1 Site Tests: conduct tests and submit report as described in PART 1 - 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 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 CLEANING .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 23 07 15 - Thermal Insulation for Piping.
 - .2 Section 22 11 16 - Domestic Water Piping.
- 1.2 REFERENCE STANDARDS
- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-2016, Power Piping.
 - .2 American Society for Testing and Materials (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, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
 - .3 ASTM A563-15, Standard Specification for Carbon and Alloy Steel Nuts.
 - .3 Factory Mutual (FM)
 - .4 Manufacturer's Standardization Society (MSS)
 - .1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.
 - .5 National Fire Protection Association (NFPA)
 - .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2016 Edition.
 - .6 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada 2015 (NPC).
 - .7 Underwriter's Laboratories of Canada (ULC)
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 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.
-

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
 - .2 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .3 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

1.4 DELIVERY,
STORAGE AND
HANDLING

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

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 ANSI 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 Ensure steel hangers in contact with copper piping are copper plated.
 - .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and retaining clip.
 - .1 Rod: 9 mm UL listed and 13 mm FM approved for sprinkler systems.
 - .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 to MSS-SP 58.
 - .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip to MSS SP 58.
 - .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 and FM approved.
 - .4 Upper attachment to concrete:
 - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
 - .2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP 58.
 - .5 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
 - .3 Sway braces for restraint systems: to Section 23 05 48.
-

2.3 PIPE HANGERS
(Cont'd)

- .6 Hanger rods: threaded rod material to MSS SP 58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.

- .7 Pipe attachments: material to MSS SP 58:
 - .1 Attachments for steel piping: carbon steel black.
 - .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 and FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

- .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: black.
 - .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated or 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: black 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 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.

2.6 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.

2.7 EQUIPMENT
ANCHOR BOLTS AND
TEMPLATES

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

PART 3 - EXECUTION

- 3.1 MANUFACTURER'S INSTRUCTIONS
- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- 3.2 INSTALLATION
- .1 Install in accordance with manufacturer's instructions and recommendations.
 - .2 Vibration Control Devices:
 - .1 Install on piping systems at pumps and boilers.
 - .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 of Canada (NPC), Provincial Code or authority having jurisdiction.
-

3.3 HANGER SPACING
(Cont'd)

- .2 Fire protection: to applicable fire code.
 - .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
 - .4 Copper piping: up to NPS 1/2: every 1.5 m.
 - .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
 - .6 Within 300 mm of each elbow.
- | Maximum Pipe
Size : NPS | Maximum
Spacing Steel | Maximum
Spacing Copper |
|----------------------------|--------------------------|---------------------------|
| up to 1-1/4 | 2.4 m | 1.8 m |
| 1-1/2 | 3.0 m | 2.4 m |
| 2 | 3.0 m | 2.4 m |
| 2-1/2 | 3.7 m | 3.0 m |
| 3 | 3.7 m | 3.0 m |
| 3-1/2 | 3.7 m | 3.3 m |
| 4 | 3.7 m | 3.6 m |
| 5 | 4.3 m | |
| 6 | 4.3 m | |

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 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 Remove surplus materials, excess materials, rubbish, tools and equipment.

Kouchibouguac National Park	VIBRATION AND SEISMIC	Section 23 05 48
Phase 1 South Kouchibouguac	CONTROLS FOR HVAC	Page 1
Utility House Project #954	PIPING AND EQUIPMENT	2019-03-20

PART 1 - GENERAL

- 1.1 SUMMARY .1 Section Includes:
.1 Vibration isolation materials and components and their installation.
- 1.2 REFERENCE STANDARDS .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).
.2 National Fire Protection Association (NFPA)
.1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2016 Edition.
.3 National Research Council Canada (NRC)
.1 National Building Code of Canada 2015 (NBC).
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
.2 Shop drawings: Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
.1 Provide separate shop drawings for each isolated system complete with performance and product data.
.3 Quality assurance submittals:
.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 Parks Canada Representative will make available 1 copy of systems supplier's installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GENERAL .1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 ELASTOMERIC PADS .1 Type EP1 - neoprene waffle or ribbed; 9 mm minimum thick; 50 durometer; maximum loading 350 kPa.
.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.
.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.
.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS .1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS .1 Design stable springs: ratio of lateral to axial stiffness is equal to or greater than 1.2 times ratio of static deflection to working height. Select for 50% travel beyond rated load. Units complete with levelling devices.
.2 Ratio of height when loaded to diameter of spring between 0.8 to 1.0.
.3 Cadmium plate for outdoor 100% relative humidity installations.

2.4 SPRINGS .4 Colour code springs.
(Cont'd)

- 2.5 SPRING MOUNT
- .1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.
 - .2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.
 - .3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.
 - .4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.
 - .5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.
 - .6 Performance: as indicated.

- 2.6 HANGERS
- .1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.
 - .2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.
 - .3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.
 - .4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.
 - .5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.
 - .6 Performance: as indicated.
-

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 vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS 4: first 3 points of support. NPS 5 to NPS 8: first 4 points of support. NPS 10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL .1 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

- 3.3 FIELD QUALITY CONTROL
(Cont'd)
- .1 (Cont'd)
 - .2 (Cont'd)
 - .1 After delivery and storage of Products.
 - .2 After preparatory work is complete but before installation commences.
 - .3 Twice during the installation, at 25% and 60% completion stages.
 - .4 Upon completion of installation.
 - .3 Submit manufacturer's reports to Parks Canada Representative within 3 days of manufacturer representative's review.
 - .4 Make adjustments and corrections in accordance with written report.
- .2 Inspection and Certification:
- .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .2 Provide Parks Canada Representative with notice 24 hours in advance of commencement of tests.
 - .3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
 - .4 Submit complete report of test results including sound curves.
- 3.4 CLEANING
- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 SUMMARY .1 Section Includes:
.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
- 1.2 REFERENCE STANDARDS .1 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.
.2 National Fire Protection Association (NFPA)
.1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2016 Edition.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Product data to include paint colour chips, other products specified in this section.
.2 Samples:
.1 Samples to include nameplates, labels, tags, lists of proposed legends.
- 1.4 DELIVERY, STORAGE, AND HANDLING .1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

- 2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
.2 Lettering and numbers raised or recessed.
.3 Information to include, as appropriate:
.1 Equipment: manufacturer's name, model, size, serial number, capacity.
-

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES (Cont'd) .3 (Cont'd)
 .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

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

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

.2 Use maximum of 25 letters/numbers per line.
 .4 Locations:
 .1 Terminal cabinets, control panels: use size # 5.
 .2 Equipment in Mechanical Rooms: use size # 9.

2.3 PIPING SYSTEMS GOVERNED BY CODES .1 Identification:
 .1 Sprinklers: to NFPA 13.

2.4 IDENTIFICATION OF PIPING SYSTEMS .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

2.4 IDENTIFICATION
OF PIPING SYSTEMS
(Cont'd)

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

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

2.4 IDENTIFICATION .7 (Cont'd)
OF PIPING SYSTEMS
 (Cont'd)

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic cold water supply	Green	DOM. CWS
Well Water	Green	WELL WTR
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Refrigeration Suction	Yellow	REF. SUCTION
Refrigeration Liquid	Yellow	REF. LIQUID

2.5 IDENTIFICATION .1
DUCTWORK SYSTEMS 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.

2.6 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.

2.7 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.

2.8 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 00 - Painting has been completed.
- 3.3 INSTALLATION .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and or CSA registration plates as required by respective agency.
- 3.4 NAMEPLATES .1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
.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.
-

PART 1 - GENERAL

1.1 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Parks Canada Representative within 90 days of award of contract.
 - .2 Provide documentation confirming qualifications, successful experience.
 - .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
 - .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
 - .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
 - .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
 - .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
 - .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
-

- 1.2 QUALIFICATIONS OF TAB PERSONNEL (Cont'd) .8 (Cont'd)
- .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
- .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.
- 1.3 PURPOSE OF TAB .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.
- 1.4 EXCEPTIONS .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.
- 1.5 CO-ORDINATION .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.
-

- 1.6 PRE-TAB REVIEW
- .1 Review Contract Documents before project construction is started and confirm in writing to Parks Canada 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 Parks Canada Representative in writing proposed procedures which vary from standard.
 - .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

- 1.7 START-UP
- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
 - .2 Follow special start-up procedures specified elsewhere in Division 23.

- 1.8 OPERATION OF SYSTEMS DURING TAB
- .1 Operate systems for length of time required for TAB and as required by Parks Canada Representative for verification of TAB reports.

- 1.9 START OF TAB
- .1 Notify Parks Canada 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, and caulking.
 - .5 Pressure, leakage, other tests specified elsewhere Division 23.
 - .6 Provisions for TAB installed and operational.
-

- 1.9 START OF TAB
(Cont'd)
- .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 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .2 Correct fan rotation.
 - .3 Fire, smoke, volume control dampers installed and open.
 - .4 Access doors, installed, closed.
 - .5 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Correct pump rotation.
 - .2 Strainers in place, baskets clean.
 - .3 Isolating and balancing valves installed, open.
- 1.10 APPLICATION
TOLERANCES
- .1 Do TAB to following tolerances of design values:
- .1 Hydronic systems: plus or minus 10%.
- 1.11 ACCURACY
TOLERANCES
- .1 Do TAB to following tolerances of design values:
- .1 HVAC systems: plus or minus 10%.
 - .2 Hydronic systems: plus or minus 5%.
- 1.12 INSTRUMENTS
- .1 Prior to TAB, submit to Parks Canada 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 Parks Canada Representative.
-

- 1.13 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit, prior to commencement of TAB:
 - .1 Proposed methodology and procedures for performing TAB if different from referenced standard.
- 1.14 PRELIMINARY TAB REPORT
- .1 Submit for checking and approval of Parks Canada Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.
- 1.15 TAB REPORT
- .1 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
 - .2 Submit 6 copies of TAB Report to Parks Canada Representative for verification and approval, in English in D-ring binders, complete with index tabs.
- 1.16 VERIFICATION
- .1 Reported results subject to verification by Parks Canada Representative.
 - .2 Provide personnel and instrumentation to verify up to 30 % of reported results.
 - .3 Number and location of verified results as directed by Parks Canada Representative.
 - .4 Pay costs to repeat TAB as required to satisfaction of Parks Canada Representative.
- 1.17 SETTINGS
- .1 After TAB is completed to satisfaction of Parks Canada Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
 - .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.
-

- 1.18 COMPLETION OF TAB .1 TAB considered complete when final TAB Report received and approved by Parks Canada Representative.
- 1.19 AIR SYSTEMS
- .1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, SMACNA, ASHRAE.
 - .2 Do TAB of systems, equipment, components, controls specified in Division 23.
 - .3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.
 - .4 Quality assurance: perform TAB under direction of supervisor qualified by standards of AABC or NEBB.
 - .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
 - .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
 - .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).
- 1.20 OTHER TAB REQUIREMENTS
- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.
 - .2 Building pressure conditions:
 - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during winter and summer design conditions at all times.
-

1.20 OTHER TAB
REQUIREMENTS
(Cont'd)

- .3 Zone pressure differences:
 - .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.

- .4 Smoke management systems:
 - .1 Test for proper operation of all smoke and fire dampers, sensors, detectors, installed as component parts of air systems specified Division 23.

- .5 Measurement of noise and vibration from equipment specified in Division 23.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

- 3.1 NOT USED .1 Not used.

PART 1 - GENERAL

1.1 REFERENCE
STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-2016, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

 - .2 American Society for Testing and Materials (ASTM International)
 - .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, 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 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

 - .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-2011, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
-

- 1.1 REFERENCE STANDARDS (Cont'd) .5 (Cont'd)
.2 CAN/ULC-S701-2011, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- 1.2 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.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 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.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

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.
-

2.2 INSULATION
(Cont'd)

- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with or without 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 or without 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.
- .3 Aluminum:
 - .1 To ASTM B209 with and without moisture barrier as scheduled in PART 3 of this section.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Stucco embossed.
 - .4 Jacket banding and mechanical seals: 19 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.
 - .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.
-

- 2.4 ACCESSORIES
(Cont'd)
- .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, plain reinforced, 75 mm wide minimum.
 - .7 Contact adhesive: quick-setting.
 - .8 Canvas adhesive: washable.
 - .9 Tie wire: 1.5 mm stainless steel.
 - .10 Banding: 19 mm wide, 0.5 mm thick stainless steel.
 - .11 Fasteners: 4 mm diameter pins with 35 mm square clips, length to suit thickness of insulation.

PART 3 - EXECUTION

- 3.1
PRE-INSTALLATION
REQUIREMENTS
- .1 Pressure test ductwork systems complete, witness and certify.
 - .2 Ensure surfaces are clean, dry, free from foreign material.
- 3.2
INSTALLATION
- .1 Install in accordance with TIAC National Standards.
 - .2 Apply materials in accordance with manufacturers 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 - Hangers and Supports for HVAC Piping and Equipment.
-

3.2 INSTALLATION
(Cont'd)

- .5 (Cont'd)
 - .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.

3.3 DUCTWORK
INSULATION SCHEDULE

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

	TIAC Code	Vapour Retarder	Thickness (mm)
Exhaust duct to 3000 mm from discharge location and louvre (Admin. Bldg only)	C-1	yes	50
- .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	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3

3.4 CLEANING

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

PART 1 - GENERAL

1.1 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 90.1-2007-SI Edition, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International Inc.
 - .1 ASTM C 335-05a, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C 921-03a, 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 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC)
 - .1 National Insulation Standards 2005.
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd) .2 (Cont'd)
.2 Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Division 01.

.3 Manufacturer's Instructions:
.1 Include procedures to be used and installation standards to be achieved.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Division 01.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 Fire and smoke ratings to CAN/ULC-S102:
.1 Maximum flame spread rating: 25.
.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 TIAC Code A.6: flexible unicellular tubular elastomer.
.1 Insulation: with vapour retarder jacket.
.2 Jacket: to CGSB 51-GP-52MA.
.3 Maximum "k" factor.
.4 Certified by manufacturer free of potential stress corrosion cracking corrodents.

2.3 INSULATION SECUREMENTS

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
.2 Contact adhesive: quick setting.
.1 Maximum VOC limit to SCAQMD Rule 1168 and in accordance with Division 01.
.3 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

- 2.4 VAPOUR RETARDER LAP ADHESIVE .1 Water based, fire retardant type, compatible with insulation.
.1 Maximum VOC limit to SCAQMD Rule 1168 and in accordance with Division 01.

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

- 3.3 INSTALLATION .1 Install in accordance with TIAC National Standards
.1 Hot equipment: To TIAC code 1503-H.
.2 Cold equipment: to TIAC code 1503-C.
.2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.
.3 Provide vapour retarder as recommended by manufacturer.
.4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.
.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Hangers, supports outside vapour retarder jacket.
-

- 3.3 INSTALLATION
(Cont'd)
- .7 Supports, Hangers:
.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- 3.4 EQUIPMENT
INSULATION
SCHEDULES
- .1 Includes chlorine contact tank and well pump pressure tanks, valves, valve bonnets, strainers, flanges, and fittings unless otherwise specified.
- .2 Cold equipment:
.1 TIAC A-6 with bands.
.2 Thickness: 50 mm.
- .3 Finishes:
.1 Equipment in mechanical rooms: TIAC code CEF/1 with jacket.
- 3.5 CLEANING
- .1 Clean in accordance with Division 01.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.
- .2 Related Requirements:
 - .1 Section 07 92 00 - Joint Sealants.
 - .2 Section 22 11 16 - Domestic Water Piping.

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1-2016 (SI), Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .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 C534/C534M-16, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - .4 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 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
 - .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-2011, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-2011, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
-

- 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 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for insulation to be used on pipe, valves, fittings and jointing recommendations. Include product characteristics, performance criteria, and limitations.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.

PART 2 - PRODUCTS

- 2.1 FIRE AND SMOKE RATING
- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.
- 2.2 INSULATION
- .1 TIAC Code A-6: flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket.
-

2.2 INSULATION .1 (Cont'd)
 (Cont'd)

 .2 Jacket: to CGSB 51-GP-52Ma.
 .3 Maximum "k" factor: to ASTM C534.
 .4 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

2.3 INSULATION .1 Tape: self-adhesive, aluminum, plain reinforced, SECUREMENT
 50 mm wide minimum.

 .2 Contact adhesive: quick setting.

 .3 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT .1 Thermal insulating and finishing cement:
 .1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER .1 Water based, fire retardant type, compatible with LAP ADHESIVE
insulation.

PART 3 - EXECUTION

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

3.2 PRE-INSTALL- .1 Pressure testing of piping systems and adjacent ATION REQUIREMENT
 equipment to be complete, witnessed and certified.

 .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION .1 Install in accordance with TIAC National Standards.

 .2 Apply materials in accordance with manufacturers instructions and this specification.

- 3.3 INSTALLATION (Cont'd)
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
 - .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Install hangers, supports outside vapour retarder jacket.
 - .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- 3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES
- .1 Application: at expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
 - .2 Design: to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
 - .3 Insulation:
 - .1 Insulation, fastenings and finishes: same as system.
 - .2 Jacket: PVC.
- 3.5 INSTALLATION OF ELASTOMERIC INSULATION
- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
 - .2 Provide vapour retarder as recommended by manufacturer.
- 3.6 PIPING INSULATION SCHEDULES
- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
 - .2 TIAC Code: A-6.
 - .1 Insulation securements: Tape at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: SS wire.
 - .3 Thickness of insulation as listed in following table.
-

3.6 PIPING INSULATION SCHEDULES (Cont'd) .3 (Cont'd)

.1 Run-outs to individual units and equipment not exceeding 4000 mm long.

.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Appli- cation	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic & Well CWS		A-6	25	25	25	25	25	25

3.7 CLEANING .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS .1 Section 22 05 00 - Common Work Results for Plumbing.
.2 Section 23 05 00 - Common Work Results for Mechanical.

1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

PART 2 - PRODUCTS

2.1 THERMOSTAT (LINE VOLTAGE) .1 Line voltage, wall-mounted thermostat, for cooling (reverse-acting) with:
.1 Full load rating: 16 A at 120 V.
.2 Temperature setting range: 5 degrees C to 30 degrees C.
.3 Thermometer range: 5 degrees C to 30 degrees C.
.4 Markings in 5 degree increments.
.5 Differential temperature fixed at 1.1 degrees C.

2.2 THERMOSTAT GUARDS .1 Thermostat guards: lockable, clear opaque plastic cast metal. Slots for air circulation to thermostat.

2.3 PRESSURE SWITCH (WELL PUMP) .1 General:
.1 Diaphragm actuated pressure switch.
.2 Adjustable cut-in and cut-out pressure settings.
.3 UL listed and CSA certified.

- 2.3 PRESSURE SWITCH .1 (Cont'd)
(WELL PUMP) .4 Removable cover.
(Cont'd)
-
- .2 Rating:
.1 Cut-in pressure - 275 kPa (40.0 PSig)
.2 Cut-out pressure - 413 kPa (60.0 PSig).
.3 Motor - 2.0 HP.
.4 Voltage - 230V/1ph/60Hz.
- .4 Acceptable material: Schneider Square D Pumptrol;
Eaton Cutler Hammer CHWPS, Everbilt.
- 2.4 WELL PUMP .1 Existing well is a 2.0 HP, 230V/1 Ph/60 Hz, 3 wire
CONTROL BOX submersible pump manufactured by Grundfos.
- .2 Provide a pump control box for pump electrical
wiring.
- .3 Pump control box shall be by pump manufacturer.
- .4 Wiring by Division 26.
- .5 Standard of acceptance: Grundfos Model SA-SPM6 (Part
No 98315257).

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Install control devices.
- .2 On outside wall, mount thermostats on bracket or
insulated pad 25 mm from exterior wall.
- .3 Install remote sensing device and capillary tube in
metallic conduit. Conduit enclosing capillary tube
must not touch heater or heating cable.
- 3.2 CLEANING .1 Progress Cleaning:
.1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus
materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 23 05 53.01 - Mechanical Identification.
 - .2 Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
 - .3 Section 23 33 00 - Air Duct Accessories.
 - .4 Section 23 37 20 - Louvres, Intakes and Vents.
- 1.2 REFERENCE STANDARDS
- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - .2 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A480/A480M-16b, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
 - .2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements 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 National Fire Protection Association (NFPA).
 - .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 edition.
 - .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air-Conditioning Systems, 2018 edition.
 - .3 ANSI/NFPA (Fire) 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, 2017 Edition.
 - .4 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.
-

- 1.3 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 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.

PART 2 - PRODUCTS

- 2.1 SEAL CLASSIFICATION
- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed
 - .2 Seal classification:
 - .1 Class C: transverse joints and connections made air tight with gaskets sealant tape or combination thereof. Longitudinal seams unsealed.
 - .2 Unsealed seams and joints.

- 2.2 SEALANT
- .1 Sustainability Characteristics:
 - .1 Adhesives and sealants: in accordance with Section 07 92 00 - Joint Sealants.
 - .2 Sealant: oil-resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.
 - .1 Acceptable manufacturers: Duro Dyne, Bakor, Foster.

- 2.3 TAPE
- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
 - .1 Acceptable manufacturers: Duro Dyne, Foster, Bakor.

2.4 DUCT LEAKAGE .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS .1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius or short radius with single thickness turning vanes centreline radius: 1.5 times width of duct.

.3 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.

.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.

.4 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.5 Offsets:

.1 Full short radiused elbows as required or as indicated.

.6 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Fire Stopping.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL .1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.

2.7 GALVANIZED STEEL
(Cont'd)

.3 Joints: to ASHRAE and SMACNA proprietary manufactured duct joint.

2.8 HANGERS AND SUPPORTS

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- .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 ASHRAE and SMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA 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 or steel plate washer.
- .3 For steel beams: manufactured beam clamps:
- .4 Acceptable manufacturers: Grinnell, Myatt, Erico.

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 metal duct installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Parks Canada Representative.
- .2 Inform Parks Canada Representative of unacceptable conditions immediately upon discovery.

3.1 EXAMINATION (Cont'd) .1 (Cont'd)
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Parks Canada Representative.

3.2 GENERAL .1 Do work in accordance with ASHRAE and SMACNA 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 ASHRAE SMACNA.
.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.

3.3 HANGERS .1 Strap hangers: install in accordance with SMACNA.
.2 Angle hangers: complete with locking nuts and washers.
.3 Hanger spacing: as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 WATERTIGHT DUCT .1 Provide watertight duct for: ct mounted humidifier in all directions.
.1 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.

- 3.4 WATERTIGHT DUCT (Cont'd)
- .3 Slope horizontal branch ductwork down towards equipment served.
 - .1 Slope header ducts down toward risers.
 - .4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve trap primer and discharging to open funnel drain as indicated.
- 3.5 SEALING AND TAPING
- .1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.
 - .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturer's recommendations.
- 3.6 LEAKAGE TESTS
- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
 - .2 Do leakage tests in sections.
 - .3 Make trial leakage tests as instructed to demonstrate workmanship.
 - .4 Do not install additional ductwork until trial test has been passed.
 - .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
 - .6 Complete test before performance insulation or concealment Work.
- 3.7 CLEANING
- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.
 - .2 Section 23 34 00 - HVAC Fans.
- 1.2 REFERENCE STANDARDS
- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Flexible connections.
 - .2 Duct access doors.
 - .3 Instrument test ports.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 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 air duct accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

PART 2 - PRODUCTS

- 2.1 GENERAL .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.
- 2.2 FLEXIBLE CONNECTIONS .1 Frame: galvanized sheet metal frame .66 mm thick with fabric clenched by means of double locked seams.
- .2 Material:
.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².

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 air duct accessories installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Parks Canada Representative.
.2 Inform Parks Canada 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 Parks Canada Representative.
- 3.2 INSTALLATION .1 Flexible Connections:
.1 Install in following locations:
.1 Inlets and outlets to supply air units and fans.
.2 Inlets and outlets of exhaust and return air fans.
.3 As indicated.
.2 Length of connection: 100 mm.
.3 Minimum distance between metal parts when system in operation: 75 mm.
-

- 3.2 INSTALLATION .1 (Cont'd)
- (Cont'd) .4 Install in accordance with recommendations of
 SMACNA.
- .5 When fan is running:
- .1 Ducting on sides of flexible connection to
 be in alignment.
- .2 Ensure slack material in flexible
 connection.

- 3.3 CLEANING .1 Progress Cleaning:
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus
 materials, rubbish, tools and equipment.
- .3 Waste Management:.
- .1 Remove recycling containers and bins from site
 and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 23 05 13 - Common Work Requirements for HVAC.
 - .2 Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
 - .3 Section 23 33 00 - Air Duct Accessories.
- 1.2 REFERENCE STANDARDS
- .1 Air Movement and Control Association (AMCA)
 - .1 AMCA 99-16, Standards Handbook.
 - .2 AMCA 210-16, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 AMCA 300-14, Reverberant Room Method for Sound Testing of Fans.
 - .4 AMCA 301-14, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
 - .2 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #18, Primer, Zinc Rich, Organic.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Shop Drawings:
 - .1 Provide:
 - .1 Fan performance curves showing point of operation, bhp, kW and efficiency.
 - .2 Sound rating data at point of operation.
 - .2 Indicate:
 - .1 Motors, sheaves, bearings, shaft details.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

- 1.4 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)
- .2 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 HVAC fans from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- 2.1 SYSTEM
DESCRIPTION
- .1 Performance Requirements:
.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
.2 Capacity: flow rate, total static pressure, bhp, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300. Supply unit with ANSI/AMCA certified sound rating seal.
.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210. Supply unit with ANSI/AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

- 2.2 FANS GENERAL
- .1 Motors:
.1 In accordance with Section 23 05 13 - Common Motors Requirements for HVAC Equipment supplemented as specified herein.
.2 Sizes as indicated.
- .2 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .3 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
-

2.2 FANS GENERAL .4 Flexible connections: to Section 23 33 00 - Air Duct
(Cont'd)

2.3 CENTRIFUGAL .1 Fan wheels:
FANS .1 Welded steel or aluminum construction.
 .2 Maximum operating speed of centrifugal fans not
 more than 50% of first critical speed.
 .3 Air foil, forward curved blades, as indicated.

.2 Bearings: heavy duty grease lubricated ball or
roller self aligning type with oil retaining, dust
excluding seals and a certified minimum rated life
of 100,000 hours.

.3 Acceptable manufacturers: Cook, Greenheck, Penn.

2.4 CABINET FANS - .1 Fan characteristics and construction: as centrifugal
GENERAL PURPOSE

.2 Cabinet hung single or multiple wheel with DWDI
centrifugal fans in factory fabricated casing
complete with vibration isolators, motor.

.3 Fabricate casing of zinc coated or phosphate treated
steel reinforced and braced for rigidity. Provide
removable panels for access to interior. Paint
uncoated, steel parts with corrosion resistant paint
to MPI #18. Finish inside and out, over prime coat,
with rust resistant enamel. Internally line cabinet
with 25 mm thick rigid acoustic insulation, pinned
and cemented.

.4 Acceptable manufacturers: Cook, Greenheck, Penn.

PART 3 - EXECUTION

3.1 EXAMINATION .1 Verification of Conditions: verify that conditions
of substrate previously installed under other
Sections or Contracts are acceptable for HVAC fans
installation in accordance with manufacturer's
written instructions.
 .1 Visually inspect substrate in presence of Parks
Canada Representative.

- 3.1 EXAMINATION
(Cont'd)
- .1 (Cont'd)
 - .2 Inform Parks Canada 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 Parks Canada Representative.
- 3.2 FAN
INSTALLATION
- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.
 - .2 Provide sheaves and belts required for final air balance.
 - .3 Bearings and extension tubes to be easily accessible.
 - .4 Access doors and access panels to be easily accessible.
- 3.3 ANCHOR BOLTS
AND TEMPLATES
- .1 Size anchor bolts to withstand acceleration and velocity forces as specified.
- 3.4 CLEANING
- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 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.
- 1.3 MAINTENANCE MATERIAL SUBMITTALS .1 Extra Materials:
.1 Include:
.1 Keys for volume control adjustment.
.2 Keys for air flow pattern adjustment.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.2 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 diffuser, registers and grilles from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.
-

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 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
 - .3 Concealed manual volume control damper operators.
 - .4 Colour: white.
- 2.3 MANUFACTURED UNITS
- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.
- 2.4 SUPPLY GRILLES AND REGISTERS
- .1 General: with opposed blade dampers.
 - .2 Steel, 25 mm border, double with airfoil shape, horizontal face and vertical rear bars.
 - .1 Acceptable manufacturers: E.H. Price, Nailor, Titus.
- 2.5 RETURN AND EXHAUST GRILLES
- .1 General: with opposed blade dampers.
 - .2 Sidewall:
 - .1 Steel, 19 mm border, single 45 degrees deflection, horizontal face bars.
 - .3 Ceiling:
 - .1 Steel, 19 mm border, egg crate core.
-

2.5 RETURN AND
EXHAUST GRILLES
(Cont'd)

.4 Acceptable manufacturers: E.H. Price, Nailor, Titus.

2.6 DIFFUSERS

.1 Square Plaque Diffuser - T-Bar:

.1 Furnish and install square plaque ceiling diffusers of sizes and mounting types designated by the plans and Grille and Diffuser Schedule on the drawings.

.2 Construction:

.1 Diffusers shall be steel construction, and shall consist of a seamless, one-piece, precision formed backpan that incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.

.2 An inner plaque assembly shall be incorporated and shall drop no more than 1/4 inch below the ceiling plane to assure proper air distribution performance.

.3 The inner plaque assembly shall be completely removable from the room side to allow for full access to any dampers or other ductwork components located near the diffuser neck.

.4 The diffuser shall integrate with all duct sizes shown on the plans without affecting the face size and appearance of the unit.

.5 The face panel shall have smooth edges and rounded corners to blend with the back cone.

.6 The diffuser ceiling module size shall be: 300 x 300 millimeters.

.3 Paint Specification: All components shall have a baked-on powder coat finish.

.4 Mounting Frame:

.1 The diffuser mounting frame shall be suitable for lay-in.

.2 Steel Panel:

.1 The diffuser shall be mounted in a steel panel for lay-in applications.

.2 The panel size shall be for 600 x 600 for 300 x 300 diffuser.

.3 The diffuser shall be supplied with a beaded neck extended to a depth of 63 mm.

.4 Damper: The diffuser shall be supplied with a steel radial opposed blade volume control damper.

- 2.6 DIFFUSERS
(Cont'd)
- .1 (Cont'd)
 - .4 (Cont'd)
 - .2 Modular Louvered Diffuser - Surface Mount:
 - .1 Furnish and install modular louvered ceiling diffusers of sizes and mounting types designated by the plans and Grille, Diffuser and Register Schedule on the drawings.
 - .2 Construction:
 - .1 Diffusers shall be steel construction.
 - .2 The diffuser shall consist of:
 - .1 An outer frame assembly, which facilitates mounting in the application shown in the project plans.
 - .2 An integral collar that allows connection to the square duct.
 - .3 An inner core assembly consisting of fixed louvers capable of producing the airflow discharge pattern as indicated on the project plans, and shall be fully removable from the installed diffuser frame for access to any dampers or other ductwork components located in or near the diffuser neck.
 - .3 Paint Specification: All components shall have a baked-on powder coat finish.
 - .4 Mounting Frame:
 - .1 The diffuser mounting frame shall be suitable for surface mount.
 - .2 Damper: The diffuser shall be supplied with a steel radial opposed blade volume control damper.
 - .3 Acceptable manufacturers: E.H. Price, Nailor, Titus.
- 2.7 DOOR GRILLES
- .1 Steel construction, border both sides, sightproof core, aluminum powder coat. adjustment.
 - .2 Acceptable manufacturers: E.H. Price, Nailor, Titus.
-

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 diffuser, register and grille installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Parks Canada Representative.
 - .2 Inform Parks Canada 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 Parks Canada Representative.
- 3.2 INSTALLATION
- .1 Install in accordance with manufacturer's instructions.
 - .2 Install with flat head cadmium plated screws in countersunk holes where fastenings are visible.
 - .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- 3.3 CLEANING
- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .3 Waste Management:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 23 31 13.01 - Metal Ducts - Low Pressure to 500 Pa.
- 1.2 REFERENCE STANDARDS
- .1 American Society for Testing and Materials (ASTM International)
.1 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Indicate following:
.1 Pressure drop.
.2 Face area.
.3 Free area.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.3 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

1.4 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .2 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 louvers, intakes and vents from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 FIXED LOUVRES -
ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
 - .2 Material: extruded aluminum alloy 6063-T5.
 - .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
 - .4 Frame, head, sill and jamb: 150 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
 - .5 Mullions: at 1500 mm maximum centres.
 - .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
 - .7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
 - .8 Finish: factory applied. Colour: from supplier's full range of colour selections.
 - .9 Acceptable manufacturers: Ruskin, Greenheck, Airolite, E.H. Price.
-

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 louvres, intakes and vents installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Parks Canada Representative.
 - .2 Inform Parks Canada 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 Parks Canada Representative.
- 3.2 INSTALLATION
- .1 In accordance with manufacturer's and SMACNA recommendations.
 - .2 Reinforce and brace as indicated.
 - .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.
- 3.3 CLEANING
- .1 Progress Cleaning:
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
 - .3 Waste Management:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Division 01 - General Requirements.
 - .2 Section 23 05 00 - Common Work Results for Mechanical.
- 1.2 PRODUCT DATA
- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 01.
 - .3 Submit product data sheets for unit heaters.
Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Mounting methods.
 - .4 Physical size.
 - .5 kW rating, voltage, phase.
 - .6 Cabinet material thicknesses.
 - .7 Colour and finish.
 - .4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- 1.3 SHOP DRAWINGS
- .1 Submit shop drawings in accordance with Division 01.
 - .2 Indicate:
 - .1 Equipment, capacity and piping connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.
- 1.4 CLOSEOUT SUBMITTALS
- .1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Division 01.
-

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 02 41 20 - Selective Demolition.
- 1.2 REFERENCE STANDARDS
- .1 Canadian Standards Association (CSA International)
.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd edition), Safety Standard for Electrical Installations.
.2 CAN/CSA C22.3 No. 7-15, Underground Systems.
- .2 Canadian National Standards/Canadian Standards):
.1 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .3 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).
- 1.3 DESIGN REQUIREMENTS
- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.
-

1.4 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Quality Control:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to Electrical Inspection Department 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.
- .2 Manufacturer's Field Reports: submit to the Parks Canada Representative manufacturer's written report, within 3 days of review, verifying compliance of Work as described in PART 3 - FIELD QUALITY CONTROL.

1.5 CLOSEOUT
SUBMITTALS

- .1 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.

1.6 PERMITS, FEES
AND INSPECTIONS

- .1 Submit to Electrical Inspection, New Brunswick Power the necessary number of drawings and specifications for examination and approval prior to commencement of work.
 - .2 Pay all associated fees.
 - .3 The Parks Canada Representative will provide drawings and specifications as required by the Electrical Inspection Department at no cost.
 - .4 Obtain an electrical work permit for the entire project and pay associated fees.
 - .5 Notify Parks Canada Representative of any changes required by Electrical Inspection Department prior to making the changes.
 - .6 The Contractor shall request inspections by the Electrical Inspection Department and provide Parks Canada with advance notice of the time of each inspection.
-

- 1.6 PERMITS, FEES AND INSPECTIONS (Cont'd) .7 Provide a Certificate of Acceptance from Electrical Inspection Department upon completion of work to Parks Canada Representative.
- 1.7 QUALITY ASSURANCE .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of The Provincial Act respecting manpower vocational training and qualification.
.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .2 Site Meetings:
.1 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
.1 Upon completion of Work, after cleaning is carried out.
- 1.8 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Material Delivery Schedule: provide the Parks Canada Representative with schedule within 2 weeks after award of Contract.
- .3 Storage and Handling Requirements:
.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Replace defective or damaged materials with new.
-

1.9 WASTE MANAGEMENT AND DISPOSAL .1 Dispose of unused wood preservative, unused solvent cement, old or unused antifreeze at an official hazardous material collection site as approved by the Parks Canada Representative. Do not dispose of those materials in the sewer system, into streams, lakes, onto the ground or in other locations where they will pose health or environmental hazards.

1.10 SYSTEM STARTUP .1 Instruct the Parks Canada Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from the Electrical Inspection Department before delivery to site and submit such approval as described in PART 1 - Submittals.
.2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS (Cont'd) .2 Control wiring and conduit: are the responsibility of Division 26, except for conduit, wiring and connections 120 volts and below which are related to control systems specified in mechanical sections and as shown on mechanical drawings. Energy Management System (EMCS) wiring shall be supplied and installed by Division 23.

2.3 WARNING SIGNS .1 Warning Signs: in accordance with requirements of the Parks Canada Representative.

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

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

NAMEPLATE SIZES

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

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by the Parks Canada 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.

2.5 EQUIPMENT
IDENTIFICATION
(Cont'd)

- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Each receptacle to have panel and circuit number identified on a lamicoid plate wall mounted above outlet.
- .9 All junction boxes to have back of covers marked with panel and circuit numbers clearly written in permanent marker.

2.6 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. Neutral conductors: indicate in panel the circuit that the neutral conductor corresponds to.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND
CABLE
IDENTIFICATION

- .1 Colour code conduits and boxes.
- .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.

	Prime	Auxiliary
up to 250 V	Yellow	
Voice	Purple	
Communication Systems	Purple	
Fire Alarm	Red	
Emergency	Red	Blue
Other Security Systems	Red	Yellow

2.7 CONDUIT AND
CABLE
IDENTIFICATION
(Cont'd)

- .4 Provide a colour code legend framed under glass in the main electrical room.

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 "Canadian Electrical Code" except where specified otherwise.
- .2 Do underground systems in accordance with CSA C22.3 No.7 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

- .1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
 - .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
-

- 3.4 LOCATION OF OUTLETS (Cont'd)
- .3 Change location of receptacles or light switches at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
 - .4 Locate light switches on latch side of doors.
- 3.5 MOUNTING HEIGHTS
- .1 Mounting height of equipment is from finished floor to centreline of equipment unless indicated otherwise. Light fixtures are to underside of fixture.
 - .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: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm and 1200 mm in service spaces unless noted otherwise.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm. Verify against millwork drawings.
- 3.6 CO-ORDINATION OF PROTECTIVE DEVICES
- .1 Ensure all protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- 3.7 FIELD QUALITY CONTROL
- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .2 Carry out tests in presence of the Parks Canada Representative.
-

3.7 FIELD QUALITY CONTROL (Cont'd) .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

- .4 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.
 - .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.

3.8 CLEANING .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

3.9 FIRESTOPPING .1 Firestopping of openings through which conduits and cables pass shall be done under Section 07 84 00.

3.10 CUTTING AND PATCHING .1 Cutting and patching and associated costs for Division 26 shall be the responsibility of Division 26.

3.11 WORK IN EXISTING AREAS .1 Electrical Contractor shall be responsible for all electrical demolition work.

.2 Schedule work in existing areas to the approval and convenience of the Parks Canada Representative.

3.11 WORK IN
EXISTING AREAS
(Cont'd)

- .3 Where partitions are to be removed, disconnect electrical services to items on the wall and make wiring safe. Where power passes through partitions to be removed, maintain the service to all electrical devices by extending wiring or rerouting as necessary. Relocate essential electrical devices found where partitions are to be removed.
- .4 Disconnect and remove all existing services which are abandoned. Disconnect and remove all redundant conduit and wiring back to source.
- .5 Where existing wiring devices are abandoned, and outlet boxes are to remain, provide blank cover plates.
- .6 Do not reuse existing conduit or wire after it has been removed.

3.12 POWER
INTERRUPTIONS AND
CHANGEOVERS

- .1 Make arrangements to carry out all power interruptions and changeovers required to connect services to new or existing switchboards, panels and equipment.
- .2 Make the interruptions at times suitable to the Parks Canada Representative. Notify the Parks Canada Representative in advance so that he may attend.
- .3 The pre-arranged power interruptions may be delayed or postponed by the Parks Canada Representative, if an emergency or unforeseen condition arises.
- .4 Submit a complete schedule of power interruptions and changeovers with approximate dates required, durations and times of day for approval before proceeding with the Work.

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS
- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18.3-12, Conduit, Tubing and Cable Fittings.
 - .2 CSA C22.2 No. 65-13, Wire Connectors.
 - .2 National Electrical Manufacturers Association (NEMA)
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS
- .1 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Pressure type wire connectors to: CSA C22.2 No. 65, with current carrying parts of copper or copper alloy sized to fit copper conductors as required. Used for conductors greater than No. 10 AWG.
-

- 2.1 MATERIALS
(Cont'd)
- .2 Fixture type splicing connectors to: CSA C22.2 No. 65, with current carrying parts of copper or copper alloy sized to fit copper conductors 10 AWG or less.
 - .3 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2 No. 18.3.
 - .4 All wire connectors are to be "plier-tightened" (finger-tight is not acceptable).

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install watertight glands and connectors for Teck Cable connections to exterior equipment requiring flexible connections.

- 3.2 CLEANING
- .1 Project Cleaning:
 - .1 Upon completion, remove surplus materials, rubbish, tools and equipment.
 - .2 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENT .1 Section 26 05 20 - Wire and Box Connectors
- 0-1000 V.

1.2 REFERENCE STANDARDS .1 CSA C22.2 No. 0.3-09(R2014), Test Methods for
Electrical Wires and Cables, Includes Update No. 1
(2010).
.2 CSA C22.2 No. 131-17, Type TECK 90 Cable.

PART 2 - PRODUCTS

2.1 BUILDING WIRES .1 Wiring for circuits exceeding 50 volts to ground
shall be minimum size #12 AWG, soft drawn copper, of
98% conductivity rated at (600 volts) unless
specifically indicated otherwise. Wires #10 AWG and
smaller shall be permitted to be solid. Wires #8 AWG
and larger shall be stranded.
.2 Bonding and grounding conductors shall be copper.
.3 Current carrying and neutral conductors for all
systems rated 600 volts and less, shall have RW90 -
XLPE type insulation rated accordingly.
.1 The supply and installation of 1000 volt rated
conductors shall be considered only where equipment
manufacturer or other applications warrants same.
.4 Grounding and bonding conductors sized up to and
including #2/0 AWG, are to have green coloured RW90
X-link insulation.
.5 The tye-wrapping of the neutral conductor with its
respective phase conductors is to be made at the
closest point of entry "within" all panelboards,
pull boxes, junction boxes, outlet boxes, etc.
.6 All branch circuits which do not have neutral
conductors, are to have their respective phase
conductors tye-wrapped together in accordance with
previously described methods.

- 2.1 BUILDING WIRES (Cont'd)
- .7 All cables are to be secured to concrete, concrete block, brick, metal decking/siding, with nylon type inserts c/w self-tapping metal screws.
 - .1 Pliable type cables are to be secured to building structure at 1200 mm intervals, and tye-wrapped together at mid-point between each structure support.
 - .2 Cables are to have insulation qualities as indicated.
 - .8 All "stranded" conductors are to be "twisted together" prior to any types of terminations taking place, but not necessarily limited to, some of the following areas:
 - .1 Receptacles, Light switches, neutral terminal strips, bonding terminal strips, circuit breakers, disconnect switches, all types of termination lugs, panelboards.
- 2.2 TECK CABLE
- .1 Cable: to CSA-C22.2 No. 131.
 - .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
 - .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90XLPE, 600 V.
 - .4 Inner jacket: polyvinyl chloride material.
 - .5 Armour: interlocking aluminum.
 - .6 Overall covering: low-acid-gas-emitting FT4 rated polyvinyl chloride material.
 - .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1500 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
 - .8 Connectors:
 - .1 Watertight, approved for TECK cable.
-

- 2.3 WIRING METHODS .1 Wiring methods related to the installation of main feeders:
.1 Unless specifically indicated otherwise, surface installed "feeder" conductors are to always be installed in EMT type conduits, run parallel and perpendicular to building lines.
- 2.4 CONTROL WIRES .1 Type LVT: soft annealed copper conductors, sized as indicated, with PVC insulation and outer PVC jacket.
.2 For circuits under 50 V and less: low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with polyethylene insulation and overall covering of PVC jacket.
.3 For circuits over 50 V: 600 V type: stranded annealed copper conductors, sizes as indicated with XLPE insulation and overall jacket of PVC.
.4 All control wires to be rated FT6.
.5 All control wires to be installed in conduit.
- 2.5 ARMOURED CABLES .1 Conductors: insulated, copper, size as indicated.
.2 Type: AC90.
.3 Armour: interlocking type fabricated from aluminum strip.
.4 Connectors: sized to suit conductors: complete with anti-short bushings.
.5 All types of "armoured" cables are to be installed concealed, parallel and perpendicular to building lines and shall be adequately secured to the building structure at not less than 1500 mm intervals or as otherwise indicated, in such manner as to ensure they are protected from potential types of mechanical damage occurring. Install independent supports for cabling in ceiling spaces, and do not use those of other trades. Do not secure cables to mechanical systems piping, ducts, or suspended ceiling support wires. The laying of "un-supported" cables directly atop the ceiling grid system is strictly prohibited.
-

- 2.5 ARMOURED CABLES (Cont'd)
- .6 Always install and secure surface cables directly to underside of roof structure and where located in concealed ceiling spaces.
- .7 AC-90 cable is to be installed as per the following guidelines:
- .1 AC-90 shall only be permitted for branch circuit wiring.
 - .2 All AC-90 fixture feeds shall originate from the sides of outlet boxes and not from the box cover. Where 3 and/or 4 fixture drops extend from any one outlet box.
 - .3 Fixture drop is defined as that portion of AC-90 cable or flexible conduit being used to make final connection between "accessible" type junction or outlet box located in ceiling space and its respective light fixture.
 - .1 Fixture drops are not to exceed 4.5 m in total length unless specifically indicated otherwise.
 - .2 There shall be not more than 4 drops permitted to be fed from any one box regardless of its size. All AC-90 cables used for fixture drops are to be secured within 300 mm of the junction box. Each light fixture is to be complete with its own separate fixture drop originating from junction box located within same ceiling of room as fixture.
 - .3 Both, #12 AWG and #14 AWG type AC-90 armoured cables may be used where total fixture drop "loads" do not exceed the following:
 - .1 Maximum of 1800 watts @ 120 volts using #12 AWG drop.
 - .2 Maximum of 1300 watts @ 120 volts using #14 AWG drop.
 - .4 Separate pig-tail type leads shall be provided in each light fixture junction/outlet box for "final" connections to fixture drops. These pig-tail leads are to be "only" connected to light fixture "returns" and associated "neutral" conductors.
- .8 The grouping together of AC-90 cables to form a "bundle" for securing purposes is acceptable providing the following procedures are adhered to:
-

2.5 ARMOURED CABLES .8
(Cont'd)

(Cont'd)
.1 In addition to securing type AC-90 cables at 1500 mm intervals to structure, multiple or bundled groups of armoured cables shall be tye-wrapped together at mid-point between each structure support, or every 750 mm and are to be secured to structure at 1500 mm intervals, and also secured together (between each structure support) at 1500 mm intervals.

2.6 VOLTAGE DROP .1

Voltage drop in no instance shall exceed 3% of the line voltage. The following tables are intended for all 120 volt, 15 and 20 amp branch circuits and include both vertical and horizontal lengths of conductor runs. Minimum size of branch circuit neutral where dedicated to its own branch circuit phase conductor shall not be less than #12 AWG.

120 V, 15 A Circuits

Branch Circuit Length of Run	Phase Wire Size	Separate Neutral	Bond Wire Size
0 to 25 m	#12	#12	#14
26 m to 38 m	#10	#10	#12
39 m to 56 m	#8	#8	#10

120 V, 20 A Circuits

Branch Circuit Length of Run	Phase Wire Size	Separate Neutral	Bond Wire Size
0 to 18 m	#12	#12	#14
19 m to 29 m	#10	#10	#12
30 m to 46 m	#8	#8	#10
47 m to 73 m	#6	#6	#8

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING WIRES .1

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

- 3.2 INSTALLATION OF ARMOURED CABLES
- .1 Group cables wherever possible.
 - .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0-1000 V.
- 3.3 INSTALLATION OF CONTROL CABLES
- .1 Install control cables in conduit.
 - .2 Ground control cable shield.
- 3.4 TERMINATIONS OF CABLES AND WIRES AT EQUIPMENT
- .1 Use copper compression connectors only.
 - .2 Use proper and uniform system of phase orientation throughout. For safety switches, red conductors shall be placed on the right when facing the switch. For panelboards and switchboards, the outgoing conductor colours shall correspond to and be phased in with the incoming feeder phase colours.
 - .3 Use proper stripping tools for removal of insulation. Use of knives for insulation stripping is not permitted.
- 3.5 CIRCUITING
- .1 Provide dedicated neutrals for each lighting circuit. Do not circuit by the common neutral method.
 - .2 Provide dedicated neutrals for each receptacle circuit. Do not circuit by the common neutral method.
- 3.6 TESTING
- .1 Test all circuits to Section 26 05 00 - Common Work Results - For Electrical.
- 3.7 CLEANING
- .1 Project Cleaning:
 - .1 Upon completion, remove surplus materials, rubbish, tools and equipment.
 - .2 Leave Work area clean at end of each day.

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS
- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837-2014, Qualifying Permanent Connections Used in Substation Grounding.
 - .2 Canadian Standards Association, (CSA International)
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 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.
- 1.3 CLOSEOUT SUBMITTALS
- .1 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT
- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
-

- 2.1 EQUIPMENT
(Cont'd)
- .2 Insulated grounding/bonding conductors: green, type. RW90 XLPE.
 - .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Protective type clamps.
 - .2 Bolted type conductor connectors.
 - .3 Bonding jumpers, straps.
 - .4 Pressure wire connectors.
 - .5 Compression connectors.

PART 3 - EXECUTION

- 3.1 INSTALLATION
GENERAL
- .1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run green insulated bond wire in conduit sized as per the CEC or as indicated in all circuits with 50 V and greater. All conduit for all electrical systems is to contain a minimum #14AWG copper bond wire.
 - .2 All cables and feeder and branch circuit conductors installed in conduit are to be c/w a separate minimum size #14 (solid) AWG copper bond/ground wire as follows:
 - .1 Where bond wire sizes larger than #14 AWG are required, they are to be increased as required by CEC, or as otherwise noted.
 - .2 No. 14 AWG and larger size ground or bond conductors shall be of soft drawn stranded copper of 98% conductivity, and of full size and AWG gauge.
 - .3 Size of bond conductor is to be based upon the CEC.
 - .4 Minimum size #14 AWG (solid) green insulated conductors are acceptable for bonding purposes associated with various other systems rated at 50 volts or less.
 - .3 The "feed" bonding conductor shall be secured (wrapped around unbroken) to the grounding screw of each outlet/device box, before connecting to the other grounding conductors, and/or providing a "pig-tail" lead for device terminations.
-

- 3.1 INSTALLATION GENERAL (Cont'd)
- .4 All ground wires are to be twisted together with a screw-on type wire connector, and then placed in rear of outlet box in such manner as to minimize obstructions.
 - .5 Install connectors in accordance with manufacturer's instructions.
 - .6 Protect exposed grounding conductors from mechanical injury.
 - .7 Soldered joints not permitted.
 - .8 Use mechanical connectors for grounding connections to equipment provided with lugs.
- 3.2 SYSTEM AND CIRCUIT GROUNDING
- .1 Install system and circuit grounding connections to neutral of 240 V / 120 V systems.
- 3.3 EQUIPMENT GROUNDING
- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Duct systems, frames of motors, starters, control panels, distribution panels.
 - .2 Provide a green insulated ground conductor in all power circuits feeding equipment.
- 3.4 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - for Electrical.
 - .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Parks Canada Representative.
 - .3 Perform tests before energizing electrical system.
- 3.5 CLEANING
- .1 Project Cleaning:
 - .1 Upon completion, remove surplus materials, rubbish, tools and equipment.
 - .2 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

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

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to finished masonry, drywall tile surfaces with nylon shields.
 - .2 Secure equipment to poured concrete with expandable inserts.
 - .3 Secure equipment to hollow masonry with toggle bolts.
-

3.1 INSTALLATION
(Cont'd)

- .4 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole galvanized steel straps to secure surface conduits and cables 32 mm and smaller.
 - .2 Two-hole galvanized steel straps for conduits and cables larger than 32 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
 - .5 Power-activated fasteners and drop-in anchors shall not be used for tension loads.
 - .6 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
 - .7 Do not use wire lashing or perforated strap to support or secure raceways or cables.
 - .8 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Parks Canada Representative.
 - .9 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
 - .10 Various suspended types of outlet, pull and/or junction boxes including conduits, are to be supported with minimum size 9 mm threaded rod, nuts and flat washers. Threaded rods are to be secured to boxes with one flat washer and nut installed on both sides of box.
 - .1 One rod required for all types of boxes sized 150 mm x 150 mm and smaller;
 - .2 Two rods required for all types of boxes sized larger than 150 mm x 150 mm, up to, and including those sized 305 mm x 305 mm
 - .3 Minimum of four rods required for all boxes sized larger than 305 mm x 305 mm.
-

3.1 INSTALLATION
(Cont'd)

- .11 EMT or armoured cable shall be securely fastened in place within 915 mm of each outlet box, junction box, pull box, cabinet or conduit fitting, with spacing between supports as per the C.E.C. Securing of surface and concealed conduits to structure for sizes up to and including 35 mm diameter may be done utilizing one hole steel straps. Two-hole steel straps for all sizes 41 mm and larger. Grouped or singularly suspended conduits of all sizes to be supported with minimum sized 9 mm threaded rods and concrete shields. Where possible, two or more suspended type conduits shall be secured to a common steel support channel system and are to be suspended utilizing minimum size 9 mm threaded rods, washers and nuts. Channel is to be sandwiched between nuts and washers located on both upper and underside portions of channels.
- .12 All excess rod is to be cut-off within 25 mm of channel bottom. In addition to C.E.C. minimum conduit spacing requirements, all suspended conduit runs containing horizontal or vertical elbows are to have one additional support rod installed not greater than 305 mm from mid point of "all" 90° bends. Maximum spacing between conduit support channels shall be as dictated by smallest size conduit(s) being supported and/or secured to same.
- .13 The use of tye-wraps for "supporting" purposes, is strictly prohibited and will be strictly enforced. Tye-wraps may "only" be utilized to secure various systems wiring "in-place," but in no instance are they to be used as a substitute for approved type metal straps, clamps, etc.
- .14 Do not fasten cable to outside of any conduit.
- .15 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .16 For surface mounting of two or more conduits, use channels at 150 mm on centre spacing.

3.2 CLEANING

- .1 Project Cleaning:
 - .1 Upon completion, remove surplus materials, rubbish, tools and equipment.
 - .2 Leave Work area clean at end of each day.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - for Electrical.

.2 Section 26 50 00 - Lighting.

1.2 ACTION AND INFORMATIONAL SUBMITTALS .1 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

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 nations: 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 Welded steel construction with screw-on flat covers for surface mounting.
.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION .1 Mount plumb, true and square to building lines.

3.1 SPLITTER
INSTALLATION
(Cont'd)

- .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. Where boxes are located above fixed ceilings, provide access hatches.
- .2 Mount cabinets with top not higher than 1800 mm above finished floor.
- .3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - for Electrical.

3.4 CLEANING

- .1 Project Cleaning:
 - .1 Upon completion, remove surplus materials, rubbish, tools and equipment.
 - .2 Leave Work area clean at end of each day.

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS
- .1 CSA C22.1-15, Canadian Electrical Code, Part I (23rd edition), Safety Standard for Electrical Installations.

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 for special devices.
 - .3 Pre-ganged boxes where wiring devices are grouped. Gangable boxes are not acceptable.
 - .4 Blank cover plates for boxes without wiring devices.
 - .5 Combination boxes with barriers where outlets for more than one system are grouped.
 - .6 Boxes connected to AC90 cables are to be specifically made for this purpose. Dual rated boxes (9AC90/NMD90, etc.) are not acceptable.
 - .7 Cast FD ferrous alloy boxes with factory-threaded hubs and mounting feet for surface wiring of devices as indicated.

- 2.2 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 32 mm and pull boxes for larger conduits.
 - .4 Double locknuts and insulated bushings on sheet metal boxes.

- 2.3 GROMMET WALL PLATE
- .1 38 mm opening for cable pass through with protective rubber grommet. Brushed aluminum finish.
-

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 and armoured cable connections. Reducing washers are not allowed.
- 3.2 CLEANING
- .1 Project Cleaning:
 - .1 Upon completion, remove surplus materials, rubbish, tools and equipment.
 - .2 Leave Work area clean at end of each day.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18.1-13, Metallic Outlet Boxes.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-06(R2016), Rigid PVC (Unplasticized) Conduit.

PART 2 - PRODUCTS

- 2.1 CONDUITS
- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot-dipped galvanized steel threaded.
 - .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
 - .3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- 2.2 CONDUIT FASTENINGS
- .1 One-hole steel straps to secure surface conduits NPS 2 50 mm and smaller. Two-hole galvanized 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 1.5 m oc or less where required by the CEC for the smallest conduit.
 - .4 Threaded rods, 6 mm dia., to support suspended channels.
 - .5 Power-activated fasteners and drop-in anchors shall not be used for tension loads.
-

2.3 CONDUIT
FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Steel set-screw fittings for EMT.

2.4 EXPANSION
FITTINGS FOR RIGID
CONDUIT

- .1 Weatherproof expansion fittings with integral 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 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 unfinished areas.
 - .3 Use rigid galvanized steel threaded conduit where exposed to mechanical damage and in hazardous locations.
 - .4 Use electrical metallic tubing (EMT) except in cast concrete, above 2.4 m not subject to mechanical injury. Use EMT for all branch circuits and systems wiring unless otherwise noted. Panel feeders to be EMT unless otherwise indicated.
 - .5 Use flexible metal conduit for connection to motors in dry areas.
-

3.1 INSTALLATION
(Cont'd)

- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
 - .7 Minimum conduit size for lighting and power circuits: 21 mm.
 - .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .9 Mechanically bend steel conduit over 21 mm dia. A hickey may be used on 21 mm dia. conduit.
 - .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .11 Install fish cord in empty conduits.
 - .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
 - .13 Dry conduits out before installing wire.
 - .14 Provide a green insulated ground conductor in all conduits containing circuits 50V and greater, minimum size #12 AWG.
 - .15 Install in each conduit run sufficient number of pull boxes or fittings located such that there shall be not more than a total of four (4) 90° bends nor more than 30 m length between pull points. Install junction box, pull box and raceway fittings such that they will be accessible after construction.
 - .16 Coordinate the installation of conduit with other electrical and mechanical services.
 - .17 Provide raceway expansion joints for exposed or concealed raceways with necessary bonding jumper at building expansion joints and where necessary to compensate for building expansion or contraction.
 - .18 Use maximum length of 3.0 m of flexible metal conduit or armoured cable for connection to surface or recessed lighting fixtures. Do not use flexible conduit or armoured cable for branch circuit wiring.
-

3.2 SURFACE
CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Run conduits in flanged portion of structural steel.
- .3 Group conduits wherever possible on channels.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED
CONDUITS

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

3.4 SEALS AND
DRAINS

- .1 Provide a conduit seal and drain fitting wherever conduits pass from the Facility interior to the exterior or from a heated area to an unheated area.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International).
.1 CSA C9-17, Dry-Type Transformers.
.2 CAN/CSA-C802.2-12(R2017), Minimum Efficiency Values for Dry Type Transformers.
- 1.2 SUBMITTALS .1 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 CLOSEOUT SUBMITTALS .1 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.2 Storage and Handling Requirements:
.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect dry type transformers from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- 2.1 DESIGN DESCRIPTION .1 Design 1.
.1 Type: ANN
.2 Single-phase, 25 kVA, 600 V input, 240 Y/120 V output, 60 Hz transformer.
.3 Voltage taps: four 2.5%, 2 FCAN, 2 FCBN.
.4 Basic Impulse Level (BIL): standard.
-

- 2.1 DESIGN DESCRIPTION (Cont'd)
- .1 (Cont'd)
 - .5 Hipot: standard.
 - .6 Average sound level: not to exceed 50 dB on scale A at 3 m.
 - .7 Impedance at 170 degrees C: minimum 4%, maximum 6%.
 - .8 Enclosure: CSA Type 3R sprinkler-proof.
 - .9 Finish: shop finish metal enclosure surfaces by application of rust-resistant primer inside and outside, and at least two coats of finish enamel.
 - .10 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.
 - .11 Copper windings only.
 - .12 Winding configuration to be as noted on drawings.
 - .13 SEE PRE-PURCHASE TENDER #2 FOR FINAL EQUIPMENT.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Mount dry type transformers as indicated on the drawings.
 - .2 Ensure adequate clearance around transformer for ventilation.
 - .3 Install transformers in level upright position.
 - .4 Remove shipping supports only after transformer is installed and just before putting into service.
 - .5 Loosen isolation pad bolts until no compression is visible.
 - .6 Make primary and secondary connections in accordance with wiring diagram.
 - .7 Energize transformers after installation is complete.
 - .8 Make conduit entry into bottom 1/3 of transformer enclosure.
- 3.2 CLEANING
- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
-

3.3 PROTECTION

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

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Materials and installation for standard and custom breaker type panelboards.
- 1.2 RELATED REQUIREMENTS .1 Section 06 10 00 - Rough Carpentry.
.2 Section 26 05 00 - Common Work Results - for Electrical.
.3 Section 26 28 21 - Moulded Case Circuit Breakers.
- 1.3 REFERENCE STANDARDS .1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.29-2015, Panelboards and Enclosed Panelboards.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS .1 Shop Drawings:
.1 Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.5 CLOSEOUT SUBMITTALS .1 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.
- 1.6 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

1.6 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .2 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 panelboards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
 - .2 250 V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity or as indicated.
 - .3 Circuit breakers shall be fully rated for the short circuit capacity. Series rated circuit breakers are not acceptable for achieving the short circuit rating.
 - .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
 - .5 Panelboards: 120/240 V. 1 dia., 3 W, 150A-2P main, 42 circuit panelboard with the following branch circuit breakers:
 - .1 1 - 70A-2P
 - .2 2 - 15A-2P
 - .3 20 - 15A-1P
 - .4 6 - 20A-1P
 - .6 Two keys for each panelboard and key panelboards alike.
 - .7 Copper bus with copper neutral of same ampere rating as mains.
 - .8 Mains: suitable for bolt-on breakers.
-

2.1 PANELBOARDS
(Cont'd)

- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked grey enamel.
- .11 Copper ground terminal strip.
- .12 Copper connectors and lugs.
- .13 SEE PRE-PURCHASE TENDER #2 FOR FINAL EQUIPMENT.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - for Electrical.
- .2 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Connect loads to circuits.
- .2 Connect neutral conductors to common neutral bus with respective neutral circuit identified.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Switches, receptacles, wiring devices, cover plates and their installation.
- 1.2 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - for Electrical.
- 1.3 REFERENCE STANDARDS .1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.42-10(R2015), General Use Receptacles, Attachment Plugs and Similar Wiring Devices.
.2 CAN/CSA-C22.2 No. 42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
.3 CSA-C22.2 No. 55-15, Special Use Switches.
.4 ANSI/CSA-C22.2 No. 111-10(R2015), General-Use Snap Switches (Bi-national standard, with UL 20.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS .1 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.
- 1.5 CLOSEOUT SUBMITTALS .1 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.
- 1.6 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.2 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.
-

- 1.6 DELIVERY, STORAGE AND HANDLING (Cont'd)
- .2 (Cont'd)
 - .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 A, 120 V, single pole.
 - .1 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 molding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory nylon toggle.
 - .2 Switches of one manufacturer throughout project.
 - .3 Acceptable manufacturers: Leviton, Hubbell, Cooper, Pass & Seymour.
- 2.2 RECEPTACLES - 120 V AND 240 V
- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
 - .1 Nylon face and back body.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .2 Duplex receptacles, CSA type 5-20R, 125 V, 20A, U ground as above.
 - .3 Ground fault interrupting duplex receptacles, CSA Type 5 - 15R, 125 V, 15 A, with the following features:
 - .1 Nylon face.
 - .2 Back and side wiring.
 - .3 Ivory.
 - .4 Class A circuit interrupter, 4-6 ma sensitivity.
-

- 2.2 RECEPTACLES - .3 (Cont'd)
120 V AND 240 V .5 Test and reset buttons.
(Cont'd) .6 Pilot light.
.7 Operating temperature: -35°C to 66°C.
- .4 Ground fault interrupting duplex receptacles, CSA Type 5 - 20R, 125 V, 20 A, with the following features:
.1 Nylon face.
.2 Back and side wiring.
.3 Ivory.
.4 Class A circuit interrupter, 4-6 ma sensitivity.
.5 Test and reset buttons.
.6 Pilot light.
.7 Operating temperature: -35°C to 66°C.
- .5 Other receptacles with ampacity and voltage as indicated.
- .6 Receptacles of one manufacturer throughout project.
- .7 Acceptable manufacturers: Hubbell, Woodhead, Bryant.
- 2.3 COVER PLATES .1 Cover plates for wiring devices.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in interior surface-mounted utility boxes.
- .4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box in finished indoor areas.
- .5 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 While-in-use weatherproof cast aluminum cover plates, complete with gaskets for duplex receptacles.
-

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - for Electrical or as indicated.
 - .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 - Common Work Results - for Electrical or as indicated.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- 3.2 FIELD QUALITY ASSURANCE
- .1 Test function of each receptacle on GFI circuit.
 - .2 Test each receptacle for correct polarity.

PART 1 - GENERAL

- 1.1 REFERENCES .1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No. 248.14-00(R2015), Low-Voltage Fuses - Part 14: Supplemental Fuses.
- 1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics.
- 1.3 DELIVERY AND STORAGE .1 Ship fuses in original containers.
.2 Do not ship fuses installed in switchboard.
.3 Store fuses in original containers in storage cabinet.
- 1.4 MAINTENANCE MATERIALS .1 Six spare fuses of each type and size installed up to and including 600 A.

PART 2 - PRODUCTS

- 2.1 FUSES GENERAL .1 All fuses up to 600 A shall be Class J time delay type.
.2 Fuses: product of one manufacturer for entire project.
.3 SEE PRE-PURCHASE TENDER #2 FOR FINAL EQUIPMENT.
- 2.2 FUSE TYPES .1 Class J fuses (formerly HRCI-J).
.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
-

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install fuses in mounting devices immediately before energizing circuit.
 - .2 Ensure correct fuses fitted to physically matched mounting devices.
 - .3 Ensure correct fuses fitted to assigned electrical circuit.
 - .4 Install fuse storage cabinet in Electrical Room.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 26 24 16.01 - Panelboards Breaker Type.
- 1.2 REFERENCES .1 Canadian Standards Association (CSA International).
.1 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard, with UL 489 and NMX-J-266-ANCE-2016).
- 1.3 SUBMITTALS .1 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 - PRODUCTS

- 2.1 BREAKERS GENERAL .1 Moulded-case circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Circuit breakers to have minimum 10 kA symmetrical rms interrupting capacity rating.
-

2.1 BREAKERS .7 SEE PRE-PURCHASE TENDER #2 FOR FINAL EQUIPMENT.
GENERAL
(Cont'd)

2.2 THERMAL .1 Moulded case circuit breaker to operate
MAGNETIC BREAKERS
DESIGN A automatically by means of thermal and magnetic
tripping devices to provide inverse time current
tripping and instantaneous tripping for short
circuit protection.

PART 3 - EXECUTION

3.1 EXAMINATION .1 Verification of Conditions: verify that conditions
of substrate previously installed under other
Sections or Contracts are acceptable for
installation in accordance with manufacturer's
written instructions.
.1 Visually inspect substrate in presence of Parks
Canada Representative.
.2 Inform Parks Canada 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 Parks
Canada Representative.

3.2 INSTALLATION .1 Install circuit breakers as indicated.

3.3 CLEANING .1 Progress Cleaning:
.1 Leave Work area clean at end of each day.
.2 Final Cleaning: upon completion remove surplus
materials, rubbish, tools and equipment.
.3 Waste Management:
.1 Remove recycling containers and bins from site
and dispose of materials at appropriate facility.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - for Electrical.
- 1.2 REFERENCE STANDARDS .1 Canadian Standards Association (CSA International).
.1 CSA C22.2 No. 4-16, Enclosed and Dead-Front Switches.
.2 CSA C22.2 No. 39-13, Fuseholder Assemblies.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.4 DELIVERY, STORAGE AND HANDLING .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
.2 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 disconnect switches - fused and non-fused from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

- 2.1 DISCONNECT SWITCHES .1 Fusible and non-fusible, heavy duty horsepower rated disconnect switch in CSA Enclosure, Type 1, to CAN/CSA C22.2 No. 4.
.2 Provision for padlocking in on-off switch position by three locks.
-

- 2.1 DISCONNECT SWITCHES
(Cont'd)
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
 - .4 Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage.
 - .5 Fuseholders: to CSA C22.2 No. 39 suitable without adaptors, for type and size of fuse.
 - .6 Quick-make, quick-break action.
 - .7 ON-OFF switch position indication on switch enclosure cover.
 - .8 Class J fuse formerly (HRC1J) time delay capable of carrying 500% of its rated current for 10 seconds minimum.
 - .9 SEE PRE-PURCHASE TENDER #2 FOR FINAL EQUIPMENT.

- 2.2 EQUIPMENT IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - for Electrical.
 - .2 Indicate name of load controlled on size 4 nameplate.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install disconnect switches complete with fuses if applicable.
 - .2 Install disconnect switches as indicated or required for mechanical equipment.
 - .3 Where disconnecting means is indicated or required at small motors, a manual starter with overloads may be used.

- 3.2 FIELD QUALITY CONTROL
- .1 Verify that all disconnect switches function. Submit date of test and indicate if the switch passed or failed.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS .1 Section 26 05 00 - Common Work Results - for Electrical.
- 1.2 REFERENCES .1 Electrical and Electronic Manufacturers Association of Canada (EEMAC)
.1 EEMAC E14.1 Industrial Controls and Systems Standard, latest edition.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Indicate:
.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.
- 1.4 CLOSEOUT SUBMITTALS .1 Provide operation and maintenance data for motor starters for incorporation into manual.
.2 Include operation and maintenance data for each type and style of starter.
- 1.5 EXTRA MATERIALS .1 Provide listed spare parts for each different size and type of starter:
.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.
-

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Starters: to EEMAC E14.1 Industrial Controls and Systems Standard.
 - .2 Acceptable manufacturers: Allen Bradley, Cutler Hammer, Siemens, Telemecanique.
- 2.2 MANUAL MOTOR STARTERS
- .1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One overload heater, manual reset, trip indicating handle.
 - .2 Accessories:
 - .1 Toggle switch: heavy duty labelled as indicated.
 - .2 Indicating light: heavy duty type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.
- 2.3 FULL VOLTAGE MAGNETIC STARTERS
- .1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Wiring and schematic diagram inside starter enclosure in visible location.
 - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
 - .5 Power and control terminals.
 - .6 Adjustable magnetic trips.
 - .7 Terminal blocks for all external control connections to starter.
 - .8 Phase loss protection for all three phase motors. Bi-metallic overloads not acceptable for this purpose.
-

- 2.3 FULL VOLTAGE
MAGNETIC STARTERS
(Cont'd)
- .2 Combination type starters to include circuit breaker or non-fused disconnect switch as indicated, with operating lever on outside of enclosure to control circuit breaker or switch, and provision for:
 - .1 Locking in "OFF" position with up to 3 padlocks.
 - .2 Independent locking of enclosure door.
 - .3 Provision for preventing switching to "ON" position while enclosure door open.
 - .3 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty labelled as indicated.
 - .2 Indicating lights: heavy duty type and color as indicated.
 - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

- 2.4 FINISHES
- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - for Electrical.

- 2.5 EQUIPMENT
IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
 - .2 Manual starter designation label, black plate, white letters, size 1, engraved as directed by Parks Canada Representative.
 - .3 Magnetic starter designation label, black plate, white letters, size and engraving as directed by Parks Canada Representative.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install starters, connect power and control as indicated.
 - .2 Ensure correct fuses and overload devices elements installed.
-

- 3.1 INSTALLATION
(Cont'd)
- .3 Label terminal blocks to correspond with terminals listed on wiring diagram. Install jumper across EMCS control point connection and label "EMCS".
- 3.2 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - for Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 26 27 26 - Wiring Devices.
- 1.2 REFERENCE STANDARDS
- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
.1 ANSI/IEEE C62.41.1-2002, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
.2 ANSI/IEEE C42.45-2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
- .2 American Society for Testing and Materials (ASTM International)
.1 ASTM F1137-11e1, Standard Specification for Phosphate/Oil Corrosion Protective Coatings for Fasteners.
- .3 ICES 005-15, Lighting Equipment.
- .4 Canadian General Standards Board (CGSB)
.1 CGSB 31-GP-103Ma, Heavy Phosphate Conversion Coatings for Iron and Steel (for Corrosion Resistance).
.2 CGSB 31-GP-105Ma, Zinc Phosphate Conversion Coatings for Paint Base.
.3 CGSB 31-GP-106M, Coating, Conversion, Iron Phosphate, for Paint Base.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Parks Canada Representative. Photometrics shall be submitted in hard copy as well as IES data formats.
.3 Photometric data to include: VCP table and spacing criterion.
-

1.3 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd) .2 Quality assurance submittals:
.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.4 DELIVERY, STORAGE AND HANDLING .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
.2 Divert unused metal materials from landfill to metal recycling facility.

PART 2 - PRODUCTS

2.1 FIXTURE SCHEDULES .1 Refer to Electrical Drawings.

2.2 FINISHES .1 Refer to Lighting Fixture Schedule.

2.3 LUMINAIRES .1 Refer to Lighting Fixture Schedule on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Locate and install luminaires as indicated.
.2 Align luminaires mounted in continuous rows to form a straight uninterrupted line.
.3 Connect luminaires to lighting circuits.
.4 Support luminaires independent of suspended ceilings.
.5 Align luminaires mounted individually parallel or perpendicular to building grid lines, unless specifically noted otherwise.

PART 1 - GENERAL

- 1.1 RELATED REQUIREMENTS
- .1 Section 26 05 21 - Wires and Cables (0-1000 V).
 - .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- 1.2 REFERENCE STANDARDS
- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-15, Emergency Lighting Equipment.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Data to indicate system components, mounting method, source of power and special attachments.
- 1.4 WARRANTY
- .1 For batteries, the 12 month warranty period is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT
- .1 Emergency lighting equipment: to CSA C22.2 No.141.
 - .2 Supply voltage: 120 V.
 - .3 Output voltage: 12 V dc.
 - .4 Operating time: 30 min.
 - .5 Battery: sealed, maintenance free.
 - .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.
 - .7 Solid state transfer circuit.
-

2.1 EQUIPMENT
(Cont'd)

- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, wattage as indicated on Emergency Lighting Fixture Schedule.
- .11 Cabinet: suitable for direct mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12 Finish: white.
- .13 Cord and plug.
- .14 Auxiliary equipment:
 - .1 Test switch.
 - .2 Battery disconnect device.
 - .3 ac input and dc output terminal blocks inside cabinet.
 - .4 RFI suppressors.
- .15 Acceptable material: Refer to Emergency Lighting Fixture Schedule on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Mount emergency lamp heads 150 mm below 2700 mm high ceilings. Where ceilings are higher, mount units at 2700 mm AFF. In 2400 mm high ceilings, the battery packs shall have lamp heads so that the electrical code minimum height requirement of 2000 mm to the bottom of the battery pack enclosure is observed.
- .2 Direct heads.

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Division 03 for concrete work.
- .2 Section 07 26 16 – Underslab Vapour Retarder.
- .3 Section 31 22 23 – Rough Grading.
- .4 Section 32 91 21 – Topsoil Placement and Grading.
- .5 Electrical, Mechanical and Civil disciplines for services.

1.2 STANDARDS

- .1 Materials and quality of work results shall meet or exceed the requirements of Department of Transportation and Infrastructure Standard Specifications for Highway Construction, New Brunswick (NBDOT), January 2015, and as herein specified.

1.3 DEFINITIONS

- .1 Backfill: Soil material or controlled low strength material used to fill excavations.
 - .1 Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - .2 Final Backfill: Backfill placed over initial backfill to fill a trench.
- .2 Base Course: Course placed between the sub-base course and hot mix asphalt paving.
- .3 Bedding Course: Course placed over the excavated sub grade in a trench before laying pipe.
- .4 Borrow Soil: Satisfactory soil imported from off site for use as fill or backfill.
- .5 Capillary Break: Course supporting slab on grade that also minimizes upward capillary flow of pore water.
- .6 Common Excavation:
 - .1 The excavation of materials, including hardpan, quicksand, and frozen earth; also rock, concrete or masonry less than 1.0 m³ in volume shall be classified as common excavation.
- .7 Fill: Soil materials used to raise existing grades.
- .8 Rock:
 - .1 The excavation of rock, concrete or masonry exceeding 1.0 m³ in volume; and solid ledge rock, concrete or masonry that requires for its removal drilling, blasting, wedging, sledging, barring or breaking with a power operated hand tool shall be classified as rock excavation. Soft or disintegrated rock, concrete or masonry that can be removed with a hand pick, power operated excavator or shovel; and loose, shaken or previously blasted rock will not be classified as rock excavation.
- .9 Site Excavated Materials: Site excavated soil is considered as only site material removed by required excavation and grading.
- .10 Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below ground surface.

- .11 Sub-Base Course: Course placed between the sub-grade and base course for hot mix asphalt pavement, and cement concrete pads, pavement or sidewalks.
- .12 Sub-Grade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below sub base, drainage fill, or topsoil materials.
- .13 Utilities: On site underground pipes, conduits, ducts, and cables including, but not limited to underground services within buildings.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide required information in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Submit product data for the following:
 - .1 Geotextile cloth.
 - .2 Controlled low-strength material, including design mixture.
- .3 Conduct condition survey of adjoining construction and site improvements, including finish surfaces, survey benchmarks, and monuments that may be affected by work:
- .4 Submit pre-excavation photographs or videotape before starting any earthwork indicating existing conditions of adjoining construction and site improvements, including finish surfaces that may be misconstrued as damage caused by earthwork operations for this Project
- .5 Identify any interferences that could affect the Work and notify the Departmental Representative for additional information.

1.5 QUALITY ASSURANCE

- .1 Departmental Representative will carry out testing of materials and compaction of backfill, fill and unshrinkable fill using a testing agency selected by the Departmental Representative. Testing and sampling shall be to NBDOT guidelines.
- .2 Notify Departmental Representative and testing agency minimum one week before backfilling or filling operations; provide a 20 kg sample of backfill, fill and unshrinkable fill material proposed for use to confirm properties; start backfilling or filling operations when material has been accepted by Departmental Representative for intended use.
- .3 Notify Departmental Representative and testing agency no later than 48 hours before backfilling or filling operations so that compaction tests can be carried out by designated testing agency; inspect footing excavations before placing footings; results of compaction tests will be provided to the Contractor.
- .4 Correct deficiencies noted in field testing reports as directed by Departmental Representative.

1.6 PROTECTION

- .1 The Contractor shall be responsible for locating and protecting all existing underground and surface structures, utility pipelines, overhead lines and poles, fences, water and sewer mains, building services, cables, culverts, sidewalks and other works. All damage incurred shall be repaired by the Contractor at its expense.

1.7 MEASUREMENT FOR PAYMENT

- .1 The work of this section is part of Contract and included in Bid Price, which shall be full compensation for all labour, materials and equipment necessary to complete the work, including all subsidiary and incidental items.

Part 2 Products

2.1 GENERAL

- .1 Supply all labour, materials and equipment required for site grading.

2.2 SOURCE OF SUPPLY

- .1 Imported Fill Materials: Consider only fill materials that fully meet specified requirements, including gradations.

2.3 SOIL FILL MATERIALS

- .1 General Engineered Fill: Comprised of clean, inorganic granular or clay soils.
- .2 Select Engineered Fill: Comprised of clean, well graded granular soils or inorganic low plastic clay soils:
 - .1 Granular soils used for select engineered fill shall consist of relatively clean, well graded, sand or mixture of sand and gravel (maximum size 75 mm).
 - .2 Low plastic clay used for select engineered fill shall have the following range of Atterberg limits:
 - .1 Liquid Limit = 20 to 40%
 - .2 Plastic Limit = 10 to 20%
 - .3 Plasticity Index = 10 to 30%
- .3 Structural Fill: Comprised of clean, well graded inorganic granular soils.
- .4 Lean Mix Concrete: Self-compacting, low-strength concrete having a minimum 28-day compressive strength of 3.5 MPa.

2.4 GRANULAR FILL MATERIALS – AROUND STRUCTURES

- .1 Class A backfill for structures: shall be a well graded granular material of clean, uncoated particles free of lumps of clay or other deleterious material, to NBDOT, Division 100 – Grading, item 167.2.
- .2 Class B backfill for structures: shall be a well graded granular material, to NBDOT, Division 100 – Grading, item 167.2.

2.5 GRANULAR FILL MATERIALS – PAVEMENT STRUCTURES

- .1 Aggregate materials shall conform to the requirements of NBDOT, Division 200 – Pavement Structures, articles 201.2, 201.3 and 201.4, inclusive.
- .2 Properties of Rock and Gravel Aggregate: to NBDOT Table 201-1.
- .3 Crushed Rock Base/Subbase: Granular Sub-Base: to NBDOT Table 201-2.
- .4 Grading Limits – Crushed Stone Base/Subbase: to NBDOT Table 201-3.
- .5 Grading Limits – Pit Run Gravel Subbase: to NBDOT Table 201-4.
- .6 Grading Limits – Crushed Sandstone Subbase: to NBDOT Table 201-5.

- .7 Grading Limits – Crushed Shoulder Material: to NBDOT Table 201-6.
- .8 Grading Limits – Cover Material: to NBDOT Table 201-7.
- .9 Select Backfill Material: from excavations or other sources, approved by Departmental Representative for use intended, dry, unfrozen and free from ricks larger than 80 mm, cinders, ashes, sods, refuse or other deleterious or unsuitable materials.
- .10 Unshrinkable Fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength: 1.0 MPa at 28 days.
 - .2 Maximum Portland cement content: 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 hours.
 - .4 Concrete aggregates: to CAN/CSA A23.1.
 - .5 Portland cement: Type GU.
 - .6 Slump: 150 mm minimum.

2.6 GEOTEXTILE MATERIALS

- .1 Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, manufactured from polyolefin or polyester and having elongation less than 50% in accordance with AASHTO M288 and as follows:
 - .1 Survivability: Class 2.
 - .2 Apparent Opening Size: 0.250 mm sieve, maximum in accordance with ASTM D4751.
 - .3 Permittivity: 0.02 per second, minimum in accordance with ASTM D4491.
 - .4 UV Stability: 50% after 500 hours' exposure in accordance with ASTM D4355.

2.7 ACCESSORIES

- .1 Warning Tape for Buried Utilities: Acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 150 mm wide x 100 mm thick, continuously inscribed with a description of the utility; coloured as follows:
 - .1 Red: Electric.
 - .2 Yellow: Gas, oil, steam, and dangerous materials.
 - .3 Orange: Telephone and other communications.
 - .4 Blue: Water systems.
 - .5 Green: Sewer systems

Part 3 Execution

3.1 PREPARATION

- .1 Notify Departmental Representative minimum two days before beginning excavating operations.
- .2 Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations:
- .3 Contact all affected utility companies regarding exact location and status of all utilities, voltage of underground and overhead power lines and pressure of natural gas lines.
- .4 Notify Departmental Representative if any utility lines have been omitted from or incorrectly indicated on Drawings.

- .5 Identify known underground utilities. Stake and flag locations. Identify and flag surface and aerial utilities.
- .6 Notify utility company to remove and relocate utility lines.
- .7 Coordinate preparation of sub-grade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as required.
- .8 Fence open excavations in accordance with Section 01 11 00 – General Requirements: Temporary Barriers and Enclosures
- .9 Coordinate and maintain erosion and sedimentation controls in accordance with Section 01 34 43 - Environmental Procedures during earthwork operations.
- .10 Provide protective insulating materials to protect sub-grades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- .1 Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.
- .2 Protect sub-grades from softening, undermining, washout, and damage by rain or water accumulation.
- .3 Reroute surface water runoff away from excavated areas; do not allow water to accumulate in excavations; do not use excavated trenches as temporary drainage ditches.

3.3 SHORING AND UNDERPINNING

- .1 Coordinate and maintain shoring and underpinning as required.

3.4 EXCAVATION: GENERAL

- .1 Excavation work shall meet or exceed NBDOT guidelines.
- .2 Excavate when conditions are dry; avoid excavating under wet conditions or when wet conditions are anticipated.
- .3 Perform work by hand and cut roots with a sharp axe when excavating is necessary through roots of plant materials identified to remain.
- .4 Protect excavations for bearing surfaces from freezing, excessive wetting or drying; recondition or replace bearing surfaces that have been wetted, dried or frozen using non-shrink fill; notify the Departmental Representative for additional criteria before proceeding with reconditioning.
- .5 Place spoil piles a minimum of 1000 mm back from edge of excavations; place any other material capable of causing injury or sliding into excavation on the back side of spoil piles; do not operate machinery in close proximity to edge of excavation, and as follows:
 - .1 Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing.
 - .2 Place, grade, and shape stockpiles to drain surface water.
 - .3 Cover to prevent windblown dust.
 - .4 Keep spoil materials outside of drip line of remaining trees.

- .6 Provide sufficient ventilation to excavations where gas powered compaction equipment will be used in accordance with Section 01 11 00 – General Requirements: Health and Safety Requirements.
- .7 Expose service connections and utilities to be crossed to confirm horizontal and vertical alignment of existing utilities.
 - .1 Expose existing utility lines by hand excavation to confirm location before machine digging within 600 mm of lines.
 - .2 Maintain and protect existing above and below grade utilities that pass through work area.
 - .3 Protect active utility lines exposed by excavation, from damage.
 - .4 Hand excavate to final elevations and dimensions.
 - .5 Support trench in a manner approved by utility where existing pipes, ducts or other underground services intersect a trench.
- .8 Use safe operating practices and maintain safe working distances where existing overhead lines are in traffic areas, or where equipment will be operating in close proximity to overhead lines:
 - .1 Temporarily support poles in a manner approved by utility where existing overhead line poles are adjacent to excavations.
 - .2 Tag safe operating distance with fluorescent flagging or other highly visible means.
 - .3 Post signs to identify overhead line voltage.
- .9 Excavate to sub-grade elevations indicated, and as follows:
 - .1 Replace unsatisfactory soil materials with satisfactory soil materials where excavated materials intended for fill and backfill include unsatisfactory soil materials and Rock.
 - .2 Remove Rock to lines and grades indicated to permit installation of permanent construction to the following tolerances:
 - .1 Minimum of 600 mm from outside of concrete forms other than at footings.
 - .2 Minimum of 300 mm from outside of concrete forms at footings.
 - .3 Minimum of 150 mm from outside of minimum required dimensions of concrete cast against grade.
 - .4 Outside dimensions of concrete walls indicated as cast against Rock without forms or exterior waterproofing treatments.
 - .5 Minimum of 150 mm from beneath bottom of concrete slabs on grade.
 - .6 Minimum of 150 mm from beneath pipe in trenches, and the greater of 600 mm wider than pipe or 1065 mm wide.

3.5 EXCAVATION: STRUCTURES

- .1 Excavate to indicated elevations and dimensions within a tolerance of 25 mm; extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and to allow for site reviews and inspections.
- .2 Take care not to disturb bottom of excavation for load bearing foundations and footings; excavate by hand to final grade just before placing concrete reinforcement; trim bottoms to required lines and grades to leave solid base to receive other work.

- .3 Stop excavations 150 mm to 300 mm above bottom of pile cap before piles are placed; remove loose and displaced material after piles are driven; excavate to final grade, leaving solid base to receive concrete pile caps.
- .4 Excavate for underground utility structures to elevations and dimensions indicated within a tolerance of 25 mm; prevent disturbance to bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION: SIDEWALKS AND PAVEMENTS

- .1 Excavate surfaces at intended sidewalk and pavement areas to indicated lines, cross sections, elevations, and sub-grades.

3.7 EXCAVATION: UTILITY TRENCHES

- .1 Excavate trenches to indicated gradients, lines, depths, and elevations; excavate trenches beyond building perimeter to allow for installation of top of pipe below frost line.
- .2 Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit and as follows:
 - .1 Excavate trench walls vertically from trench bottom to 300 mm higher than top of pipe or conduit.
 - .2 Allow for 300 mm clearance on each side of pipe or conduit.
- .3 Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit; shape sub grade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits; remove projecting stones and sharp objects along trench sub grade, and as follows:
 - .1 Hand excavate trench bottoms and support pipe and conduit on undisturbed sub grade for pipes and conduit less than 150 mm in nominal diameter and flat bottomed, multiple duct conduit units.
 - .2 Shape bottom of trench to support bottom 90 mm of pipe circumference for pipes and conduit greater than 150 mm in nominal diameter; fill depressions with tamped sand backfill.
 - .3 Excavate trenches 150 mm deeper than elevation required in Rock or other unyielding bearing material to allow for bedding course.

3.8 SUB-GRADE REVIEW

- .1 Notify Departmental Representative when excavations have reached required sub-grade.
- .2 Continue excavation and replace with compacted backfill or fill material as directed where Departmental Representative determines that unsatisfactory soil is present.
- .3 Proof roll sub grade below the building slabs and pavements using heavy pneumatic tired equipment to identify soft pockets and areas of excess yielding; proof roll dry sub-grades having optimal moisture content, and as follows:
 - .4 Completely proof roll sub grade in one direction, repeating proof rolling in direction perpendicular to first direction; limit vehicle speed to 5 km/h.
 - .5 Proof roll using a loaded 10 wheel, tandem axle dump truck weighing not less than 14 tonnes.
 - .6 Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting as determined by Departmental Representative and replace with compacted backfill or fill as directed.

- .7 Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Departmental Representative, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- .1 Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation using lean concrete fill having 28-day compressive strength of 17.2 MPa.
- .2 Fill unauthorized excavations under other construction or utility pipe as directed by Departmental Representative.

3.10 BACKFILL

- .1 Place backfill on sub-grades free of mud, frost, snow, or ice.
- .2 Place and compact backfill in excavations promptly after the completion of the following:
 - .1 Construction below finish grade.
 - .2 Surveying locations of underground utilities for Project Record Documents.
 - .3 Testing and inspecting of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of trash and debris.
 - .6 Removal of temporary shoring and bracing, and sheeting.
 - .7 Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 UTILITY TRENCH BACK FILL

- .1 Place backfill on sub-grades free of mud, frost, snow, or ice.
- .2 Place and compact bedding course on trench bottoms; shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- .3 Backfill trenches excavated under footings and within 450 mm of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
- .4 Provide 100 mm thick, concrete base slab support for piping or conduit less than 750 mm below surface of roadways; completely encase piping or conduit in a minimum of 100 mm of concrete before backfilling or placing roadway sub-base after installing and testing.
- .5 Place and compact initial soil backfill, free of particles larger than 25 mm in any dimension to a height of 300 mm over utility pipe or conduit.
- .6 Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit; coordinate backfilling with utilities testing.
- .7 Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- .8 Place and compact final backfill of satisfactory soil to final sub grade elevation.
- .9 Install warning tape directly above utilities 300 mm below finished grade in landscaped areas and 150 mm below sub grade under pavements and slabs.

3.12 SOIL FILL

- .1 Plough, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- .2 Place soil fill on sub-grades free of mud, frost, snow, or ice.
- .3 Place and compact fill material in layers to required elevations as follows:
 - .1 Under grass and planted areas: use satisfactory soil material.
 - .2 Under walks and pavements: use satisfactory soil material.
 - .3 Under steps and ramps: use engineered fill.
 - .4 Under building slabs: use engineered fill.
 - .5 Under footings and foundations: use engineered fill.

3.13 SOIL MOISTURE CONTROL

- .1 Uniformly moisten or aerate sub grade and each subsequent fill or backfill soil layer before compaction to within 2% of optimum moisture content.
- .2 Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- .3 Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

- .1 Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- .2 Compact soil materials to not less than 98% Standard Proctor Density to ASTM D698.
- .3 Compact areas inaccessible to consolidation by mechanical rollers, and areas within 1500 mm of exterior walls by hand tampers or rollers operated to avoid any damage to existing work.
- .4 Sprinkle material with water where necessary to bring to optimum moisture content so that specified density is achieved.
- .5 Proof roll sub grade for exterior slabs and paving prior to placing any granular material

3.15 GRADING

- .1 Grading work shall meet or exceed NBDOT guidelines.
- .2 Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated, and as follows:
 - .1 Provide a smooth transition between adjacent existing grades and new grades.
 - .2 Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

- .3 Slope grades to direct water away from buildings and to prevent ponding; finish sub-grades to required elevations within the following tolerances:
 - .1 Lawn or Unpaved Areas: ± 35 mm.
 - .2 Walks: ± 25 mm.
 - .3 Pavements: ± 13 mm.
- .4 Finish sub grade on interior of building to a tolerance of 13 mm when tested with a 3 metre straightedge.

3.16 SUBSURFACE DRAINAGE

- .1 Coordinate and install subsurface drainage systems if subsurface drainage is indicated for the project.

3.17 SUB-BASE AND BASE COURSES

- .1 Placement and compaction of sub-base and base shall meet or exceed NBDOT guidelines.
- .2 Place sub-base and base course on sub-grades free of mud, frost, snow, or ice.
- .3 Place sub-base and base course under pavements and walks on prepared sub grade as follows:
- .4 Install separation geotextile on prepared sub grade in accordance with manufacturer's written instructions, overlapping sides and ends.
- .5 Place base course material over sub base course under hot mix asphalt pavement.
- .6 Shape sub-base and base course to required crown elevations and cross slope grades.
- .7 Place sub-base and base course 150 mm or less in compacted thickness in a single layer.
- .8 Place sub-base and base course that exceeds 150 mm in compacted thickness in layers of equal thickness, with no compacted layer more than 150 mm thick or less than 75 mm thick.
- .9 Compact sub-base and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98% of maximum dry unit weight in accordance with ASTM D698.

3.18 CAPILLARY BREAK

- .1 Place capillary break on sub-grades free of mud, frost, snow, or ice.
- .2 On prepared sub-grade, place and compact capillary break under cast in place concrete slabs on grade as follows:
 - .1 Install geotextile on prepared sub-grade in accordance with manufacturer's written instructions, overlapping sides and ends.
 - .2 Place capillary break 150 mm or less in compacted thickness in a single layer.
 - .3 Place capillary break that exceeds 150 mm in compacted thickness in layers of equal thickness, with no compacted layer more than 150 mm thick or less than 75 mm thick.
 - .4 Compact each layer of capillary break to required cross sections and thicknesses to not less than 95% of maximum dry unit weight in accordance with ASTM D698.

3.19 FIELD QUALITY CONTROL

- .1 Notify testing agency to inspect and test sub-grades and each fill or backfill layer; proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- .2 Make compaction tests at following frequencies:
 - .1 Exterior side of perimeter walls: One test/100 lineal m of compacted lift of backfill.
 - .2 Within building area under basement and sub-basement floating slabs on grade: one test/1,000 m² of compacted lift of backfill.
 - .3 Within building area under main floor structural slabs: one test/2,500 m² of compacted lift of backfill.
 - .4 Under exterior floating concrete slabs: one test/1,000 m² of compacted lift of backfill.
 - .5 Under exterior structural slabs: one test/2,500 m² of compacted lift of backfill.
 - .6 Retaining walls: one test/100 lineal m of compacted lift of backfill.
 - .7 Asphalt pavement sub base: one test/1000 m² of compacted lift of backfill or re-compacted lift of native material.
 - .8 Asphalt pavement granular base: one test/1000 m² of compacted lift of backfill.
 - .9 Trenches more than 15 metres in length: 2 density tests per 600 mm of trench depth per 100 m of trench length.
 - .10 Trenches 15 m or less in length: minimum of 3 density test evenly spaced through the depth and length of trench.
 - .11 Landscaped areas: One test/2,500 m² of compacted lift of backfill.
- .3 Scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and re-test until specified compaction is obtained when testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified

3.20 PROTECTION

- .1 Protect newly graded areas from traffic, freezing, and erosion; keep free of trash and debris.
- .2 Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- .3 Remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing where settling occurs before Project correction period elapses; restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 RESTORATION

- .1 Remove surplus materials and debris, trim slopes, and correct defects noted by Departmental Representative upon completion of work.
- .2 Replace topsoil as indicated.
- .3 Reinstatement pavement, sidewalks, and landscaping to condition and elevation that existed before excavation.
- .4 Clean and reinstate areas affected by work as directed by Departmental Representative.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- .1 Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off property in conformance with province of New Brunswick requirements.

3.23 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .3 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 31 00 99 – Common Work Results for Earthworks.

1.2 REFERENCE STANDARDS

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 DEFINITIONS

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide required information in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for polyurethane foam sprayed insulation and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 11 00 – General Requirements: Health and Safety Requirements.
- .3 Samples:
 - .1 Submit 3 samples of each material listed below for approval prior to delivery of materials to project site.
 - .2 Tree wound paint: one litre can with manufacturer's label.
- .4 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Provide manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Do construction occupational health and safety in accordance with Section 01 11 00 – General Requirements: Health and Safety Requirements.
- .2 Comply with recommended WHMIS MSDS procedures and personal protection equipment.

1.6 STORAGE AND PROTECTION

- .1 Prevent damage to features to remain; for example, fencing, trees, shrubs, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees which are to remain.
- .2 Repair damaged items to approval of Departmental Representative.
- .3 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.
 - .1 Trim limbs and tops, and saw into saleable lengths.
 - .2 Stockpile adjacent to site.
- .3 Ash wood mixed with the wood of other species is to all be managed and disposed of as ash wood.

Part 2 Products

2.1 MATERIALS

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reuse.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

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

- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
- .3 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
- .4 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
- .5 Notify utility authorities before starting clearing and grubbing.
- .6 Keep roads and walks free of dirt and debris.

3.3 APPLICATION

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

3.4 CLEARING

- .1 All cutting must be saw cut. Mechanical mulching heads are prohibited.
- .2 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .3 Clear as indicated or directed by Departmental Representative by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
- .4 Cut off branches overhanging area cleared as directed by Departmental Representative.
- .5 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.5 CLOSE CUT CLEARING

- .1 Close cut clearing to ground level.
- .2 Perform close cut clearing by hand.
- .3 Cut off branches overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.6 ISOLATED TREES

- .1 Cut off isolated trees as indicated or directed by Departmental Representative at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.

- .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.7 UNDERBRUSH CLEARING

- .1 Clear underbrush from areas as indicated at ground level.

3.8 GRUBBING

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m².
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.9 REMOVAL AND DISPOSAL

- .1 Remove cleared and grubbed materials off site to disposal area designated by Departmental Representative.
- .2 Cut timber greater than 125 mm diameter to approved lengths and stockpile as indicated. Stockpiled timber becomes property of Departmental Representative.
- .3 Dispose of cleared and grubbed materials by methods approved by authority having jurisdiction and Departmental Representative.
- .4 Bury to approval of Departmental Representative by:
 - .1 Consolidating.
 - .2 Covering with minimum 500 mm of mineral soil.
 - .3 Finishing surface.
- .5 Chip or mulch and stockpile cleared and grubbed vegetative material on site as directed by Departmental Representative.
- .6 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.
- .7 Any ash wood materials in the form of wood chips or logs are to be scattered widely, to maximum 75 mm depth as directed by Departmental Representative.
- .8 Any ash wood materials or firewood which is removed from the site is to be transported in an enclosed vehicle and disposed of at an authorized disposal facility.
- .9 The Contractor is responsible for monitoring all cut ash wood and firewood until it is properly disposed of as determined by Departmental Representative.

3.10 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading operations or stripping of topsoil to approval of Departmental Representative.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .3 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 31 00 99 – Common Work Results for Earthworks.
- .2 Section 31 22 13 – Rough Grading.

1.2 REFERENCE STANDARDS

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

Part 2 Products

2.1 TOPSOIL

- .1 Topsoil shall remain property of the Departmental Representative.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

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

3.2 STRIPPING OF TOPSOIL

- .1 Ensure that procedures are conducted in accordance with applicable federal, provincial and local requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.
- .5 Remove brush from targeted area by non-chemical means and dispose of through alternative disposal.
- .6 Strip topsoil to depths as indicated or as directed by Departmental Representative.
- .7 Avoid mixing topsoil with subsoil.
- .8 Pile topsoil in berms in locations as directed by Departmental Representative.
- .9 Stockpile height not to exceed 3 m.

- .10 Dispose of unused topsoil off-site only upon written direction from the Departmental Representative.
- .11 Protect stockpiles from contamination and compaction.
- .12 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.
- .13 All unused topsoil to be disposed of site at end of the project.

3.3 PREPARATION OF GRADE

- .1 Verify that grades are correct and notify Departmental Representative if discrepancies occur. Do not begin work until instructed by Departmental Representative.
 - .1 Grade area only when soil is dry to lessen soil compaction.
 - .2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

3.4 PLACING OF TOPSOIL

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedure.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .3 Waste Management: Separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal. 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 31 00 99 – Common Work Results for Earthworks.
- .2 Section 31 11 00 – Clearing and grubbing.
- .3 Section 31 14 13 – Soil Stripping and Stockpiling.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
- .2 Underwriters' Laboratories of Canada (ULC).

1.3 EXISTING CONDITIONS

- .1 Known underground and surface utility lines and buried objects are as indicated on site plan.
- .2 Refer to dewatering in Section 31 00 99 – Common Work Results for Earthworks.

Part 2 Products

2.1 MATERIALS

- .1 Fill material: to Section 31 00 99 – Common Work Results for Earthworks as approved by Departmental Representative.
- .2 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading installation in accordance with manufacturer's written instructions.
- .2 Visually inspect substrate in presence of Departmental Representative.
- .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.

3.2 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finish grades:
 - .1 150 mm for grassed areas.
 - .2 300 mm for flowerbeds.
 - .3 400 mm for shrub beds.

- .4 600 mm for asphalt paving.
- .5 150 mm for gravel paving at pavilions and for crusher dust trails.
- .6 350 mm for concrete paving.
- .3 Slope rough grade away from building 1:50 minimum.
- .4 Grade ditches to depth required for maximum run-off.
- .5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .6 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
 - .1 85% under landscaped areas.
 - .2 95% under paved and walk areas.
- .7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .4 Waste Management: separate and divert waste materials from landfill in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, and surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 11 00 – Clearing and Grubbing.
- .2 Section 32 92 23 – Sodding.
- .3 Section 32 93 43.01 – Tree Pruning.

1.2 REFERENCE STANDARDS

- .1 American National Standard Institute (ANSI) / Trees Care Industry Association
 - .1 ANSI A300 National Tree Care Standards:
 - .1 ANSI A300 (Part 1) - 2008 (R2014) Pruning.
 - .2 ANSI A300 (Part 2) - 2011 Soil Management: a. Modification, b. Fertilization, and c. Drainage.
 - .3 ANSI A300 (Part 3) - 2013 Supplemental Support Systems (includes Cabling, Bracing, Guying, and Propping).
 - .4 ANSI A300 (Part 5) - 2012: Management of Trees and Shrubs During Site Planning, Site Development, and Construction.
 - .5 ANSI A300 (Part 6) - 2012 Planting and Transplanting.
 - .6 ANSI A300 (Part 7) - 2012 Integrated Vegetation Management (IVM).
 - .7 ANSI A300 (Part 9) - 2011 Tree Risk Assessment.
 - .2 ASTM International
 - .1 ASTM A1064/A1064M-16b, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .3 Atlantic Canada Pesticide Applicator Training Manual Series
 - .1 Applicator Core Training Manual, July 2006.
 - .4 CSA Group
 - .1 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement, includes Update No. 1 (2012).
 - .5 Health Canada - Pest Management Regulatory Agency (PMRA)
 - .1 National Standard for Pesticide Education, Training and Certification in Canada (1995).
 - .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .7 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Fertilizers Act (R.S. 1985, c. F-10).
 - .3 Fertilizers Regulations (C.R.C., c. 666).
 - .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 DEFINITIONS

- .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Obtain approval from Departmental Representative of schedule indicating beginning of Work.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's instructions, printed product literature and data sheets for tree and shrub preservation materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Provide monthly written reports on maintenance during warranty period, to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.
 - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 11 00 – General Requirements: Health and Safety Requirements

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 11 00 – General Requirements: Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect tree and shrub preservation materials from damage.
 - .3 Replace defective or damaged materials with new.

1.7 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .2 Apply pesticides in accordance with the following:
 - .1 Atlantic Canada Applicator Core Training Manual.
 - .2 National Standard for Pesticide Education, Training and Certification in Canada.
 - .3 Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease.
 - .4 Obtain product approval from Departmental Representative prior to application.
 - .3 Apply fertilizer in early spring at manufacturer's suggested rate.

- .4 Remove dead, broken or hazardous branches from plant material. Dispose of debris through alternative disposal, composting or mulching as approved by Departmental Representative.

2 Products

2.1 MATERIALS

- .1 Fill:
 - .1 Obtain fill from local sources.
 - .2 Class A: clean, natural river sand and gravel material, free from silt, clay, loam, friable or soluble materials and organic matter.
 - .3 Class B: excavated pervious soil (or imported from local sources if excavated material not pervious), free from roots, rocks larger than 75 mm, building debris, and toxic ingredients (salt, oil, etc.). Excavated material shall be approved by Departmental Representative before use as fill.
- .2 Coarse washed stones: 35-75 mm diameter clean round hard stone.
- .3 Draintile: 100 mm diameter corrugated plastic perforated tubing, complete with snap couplings. Fill vents with 20 mm clear stone.
- .4 Unamended Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded minimum particle size: 5 mm.
 - .5 To have a natural pH and is not to be amended with lime.
- .5 Fertilizer:
 - .1 To Canada Fertilizer Act and Fertilizers Regulations.
 - .2 Complete, commercial, slow release with 35% of nitrogen content in water-insoluble form.
- .6 Anti-desiccant: commercial, wax-like emulsion.
- .7 Filter Cloth:
 - .1 Type 1: 100 % non-woven needle punched polyester, 2.75 mm thick, 240 g/m² mass.
 - .2 Type 2: biodegradable burlap.
- .8 Temporary site fencing materials:
 - .1 T-Bars: 2400 mm steel T-bars.
 - .2 Wire Ties: 9-gauge galvanized wire.
 - .3 Plastic Fencing: standard orange snow (safety) fencing, 1.2-metre-high plastic fence.
 - .4 Lumber, to Section 06 10 10 - Rough Carpentry: 25 mm x 75 mm.
- .9 Board Cladding: to consist of 50 x 100 mm lumber secured around the perimeter of tree trunks with plastic strapping or other means which will not damage the tree.

3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for tree and shrub preservation 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 IDENTIFICATION AND PROTECTION

- .1 Tree protection to be installed prior to the start of any on site work.
- .2 Identify plants and limits of root systems to be preserved as approved by Departmental Representative.
- .3 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.
- .4 Ensure no root pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

3.3 TREE PROTECTION

- .1 Drive T-bars into ground sufficient to withstand loads, spaced 1500 mm on centre. Wire T-bars to inside of plastic snow fencing at each T-bar location, using three wire connections per T-bar, equally spaced.
- .2 At framed hoarding locations, plastic snow fencing shall be supported by T-Bars at 1800 mm on centre, supported by lumber framing (25 mm x 75 mm) across top.

3.4 ROOT CURTAIN SYSTEM

- .1 Identify limits for required construction excavation as approved by Departmental Representative.
- .2 Prior to construction excavation, hand dig trench minimum 500 mm wide x 1500 mm deep, along perimeter of excavation limits.
- .3 Prune exposed roots cleanly at side of trench nearest plants to be preserved. Pruned ends to point obliquely downwards.
- .4 Install wooden posts and welded wire fabric against construction edge of trench.
- .5 Securely attach Type 2 filter fabric on plant side of wire mesh.
- .6 Prepare homogeneous mixture of fertilizer, parent material and organic matter.
 - .1 Add organic matter to mixture to achieve 7-9% organic matter content by weight.
 - .2 Incorporate with mixture grade 2:12:8 ratio fertilizer (dry) at rate of 1.5 kg/m².

- .7 Backfill with homogeneous mixture between curtain wall and plants to be preserved in layers not exceeding 150 mm in depth. Compact each layer to 85% Standard Proctor Density.
- .8 Protect root curtain from damage during construction operations.
- .9 Water plants and root curtain sufficiently during construction to maintain optimum soil moisture condition until backfill operations are complete.
- .10 Protect root curtain before during backfill operations, except as follows: ensure root curtain is cut down to 300 mm below finished grade and remove cut material.

3.5 AIR LAYERING SYSTEM

- .1 Using manual methods, carefully remove turf, plants, leaves and organic matter in area of root system, dispose of plant matter through compost site or alternative means acceptable to Departmental Representative and slightly loosen topsoil surface. Avoid damage to root system.
- .2 Lay horizontal system of perforated drain pipe on surface of existing grade.
 - .1 Slope drain tile minimum 3% for drainage away from trunk of tree.
 - .2 Connect system with general site drainage system or drain to low point on site.
- .3 Install plastic vent pipes vertically over joints in horizontal pipe system or where indicated. Top of vent pipe to be 20 mm above finished grade of fill. Keep top of vent pipe covered during construction.
- .4 Cover joints with Type 1 filter fabric and place coarse washed stone around joints and vertical pipes to secure their position.
- .5 Construct drywell around trunk of tree.
 - .1 Ensure open ends of horizontal pipe system and vertical vent pipes are left exposed for air circulation to root system.
 - .2 Protect openings from blockage during construction.
 - .3 Install protective caps on exposed horizontal openings.
- .6 Place 200 mm depth of coarse washed stone on surface of original ground and horizontal pipe system to limits.
- .7 Place Type 1 filter fabric over surface of granular layer.
- .8 Place Class A fill over filter fabric to required depth without disturbing or damaging drain pipe system. Avoid damage to filter fabric.
- .9 Complete topsoil and sodding, and finished paving over area of sub-surface system within 1 week of placing fill.
- .10 Remove temporary protective covering from vent pipe openings. Install protective caps flush with finished grade.

3.6 TRENCHING AND TUNNELING FOR UNDERGROUND SERVICES

- .1 Centre line location and limits of trench/tunnel excavation to be approved by Departmental Representative prior to excavation. Tunnel excavation to extend 2000 mm from edge of trunk on either side.
- .2 Excavate manually within zone of root system. Do not sever roots greater than 40 mm diameter except at greater than 500 mm below existing grade. Protect roots, and cut roots cleanly with sharp disinfected tools.
- .3 Excavate tunnel under centre of tree trunk using methods and equipment approved by Departmental Representative.
- .4 Minimum acceptable depth to top of tunnel: 1000 mm.
- .5 Backfill for tunnel and trench to 85% Standard Proctor Density. Avoid damage to trunk and roots of tree.
- .6 Complete tunnelling and backfilling at tree within 2 weeks of beginning Work.

3.7 LOWERING GRADE AROUND EXISTING TREE

- .1 Begin Work in accordance with schedule approved by Departmental Representative.
- .2 Cut slope not less than 500 mm from tree trunk to new grade level or retaining wall as applicable to site conditions and location.
- .3 Excavate to depths as indicated. Protect root zone designated to remain from damage.
- .4 When severing roots at excavation level, cut roots with clean, sharp tools.
- .5 Cultivate excavated surface manually to 15 mm depth.
- .6 Prepare homogeneous soil mixture consisting by volume of:
 - .1 60% excavated soil cleaned of roots, plant matter, stones, debris.
 - .2 25% coarse, clean sterile sand.
 - .3 15% organic matter.
 - .4 Grade 2:12:8 fertilizer at rate of 1.5 kg/m².
- .7 Place soil mixture over area of excavation to finished grade level. Compact to 85% Standard Proctor Density.
- .8 Water entire root zone to optimum soil moisture level.
- .9 Install surface cover of seeding and sodding in accordance with Section 32 92 19.16 – Hydraulic Seeding and Section 32 92 23 – Sodding.

3.8 PRUNING

- .1 Prune in accordance with Section 32 93 43.01 – Tree Pruning.
- .2 Prune crown to compensate for root loss while maintaining general form and character of plant. Dispose of debris through alternative disposal, composting or mulching as approved by Departmental Representative.

3.9 ANTI-DESICCANT

- .1 Apply anti-desiccant to foliage where applicable and as directed by Departmental Representative.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning.
- .3 Waste Management: separate and divert waste materials from landfill in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 31 00 99 – Common Work Results for Earthworks.
- .2 Section 31 14 13 – Soil Stripping and Stockpiling.
- .3 Section 31 22 13 – Rough Grading.
- .4 Section 32 92 19.16 – Hydraulic Seeding.

1.2 SOURCE QUALITY CONTROL

- .1 Topsoil shall be obtained from local source approved by Departmental Representative. Reuse site topsoil where possible, with deleterious materials removed after stripping.
- .2 Advise Departmental Representative of sources of any off-site soil, peat moss or sand to be utilized seven days in advance of starting work.
- .3 Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.

Part 2 PRODUCTS

2.1 GENERAL

- .1 Use of local sources for topsoil.

2.2 TOPSOIL FOR TURF AREAS

- .1 Class Loam for turf areas: mixture of mineral particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.
- .2 Soil texture based on the Canadian System of Soil Classification, to consist of minimum 30% sand and contains 5 to 10% organic matter by weight.
- .3 Fertility: major soil nutrients present in following ratios:
 - .1 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .2 Phosphorus (P): 10 to 20 micrograms of phosphate per gram of topsoil.
 - .3 Potassium (K): 80 to 120 micrograms of potash per gram of topsoil.
 - .4 Calcium, magnesium, sulphur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
 - .5 pH value: 6.0 to 7.5.
- .4 Contain no toxic or growth inhibiting materials.
- .5 Free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .3 Weed growth and weed seeds.
- .6 Consistency: friable when moist.

2.3 PLANTING SOIL MIX

- .1 Soil mix: 2 parts on-site topsoil, 1-part compost and 1-part horticultural sand, plus amendments and fertilizers as required by test results.
- .2 Bone Meal: 2-11-0 submit product test data for approval.
- .3 Same soil mix for planting beds, tree pits and turfstone seeding areas.

2.4 SOIL AMENDMENTS

- .1 Compost:
 - .1 Derived from organic waste compost.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
 - .5 pH value: submit test results for review.
- .2 Sand: washed coarse silica sand, medium to coarse textured.
- .3 Limestone:
 - .1 Ground agricultural limestone containing minimum calcium carbonate equivalent of 85%.
 - .2 Gradation requirements; percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .4 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizer Regulations".
 - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

Part 3 EXECUTION

3.1 PREPARATION OF SUB-GRADE

- .1 Do not perform work under adverse field conditions such as frozen soil, excessively wet or dry soil or soil covered with snow, ice or standing water.
- .2 Grade sub-grade in turf areas to eliminate uneven areas and low spots, ensuring positive drainage and allowing for soil placement depths.
- .3 Verify that sub-grade elevations are correct to within 25 mm and receive approval from Departmental Representative prior to soil placement.
- .4 Sub-grade to be clean of weeds, weed seeds, debris exceeding 50 mm diameter, and contamination by petroleum and other deleterious materials.
- .5 Coarse cultivate sub-grade in turf areas to a depth of 100 mm before soil placement. Cross cultivate those areas where equipment has compacted the sub-grade materials.

3.2 SOIL PLACING AND SPREADING

- .1 Place soil after sub-grade has been approved by Departmental Representative.
- .2 Spread soil in uniform layers not exceeding 150 mm lifts, over unfrozen sub-grade free of standing water.
- .3 Spread soil to 150 mm minimum depth after settlement and 80% compaction.

3.3 SOIL AMENDMENTS

- .1 Soil amendments may be pre-mixed before spreading or mixed after spreading to full depth of the soil.
- .2 Thorough mixing is required.

3.4 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Fine grade to final elevations to within 20 mm and ensure surface drainage away from structures to minimum 2% slope.
- .2 Consolidate soil to smooth, uniform and firm surface.

3.5 ACCEPTANCE

- .1 The soil is acceptable when:
 - .1 Soil testing and analysis meets the specifications.
 - .2 Soil material, depths and finish grading are inspected in place and approved by Departmental Representative.
- .2 Testing of soil to be carried out by testing laboratory approved by Departmental Representative paid for by Contractor. Soil sampling, testing and analysis are to be in accordance with Provincial regulations and standards.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 – General Requirements: Cleaning.
- .4 Waste Management: separate and divert waste materials from landfill in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.
- .5 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 31 05 99 – Common Work Results for Earthworks.
- .2 Section 32 92 21.13 – Topsoil Placement and Grading.

1.2 REFERENCE STANDARDS

- .1 Canadian Food Inspection Agency (CFIA); Plant Production Division, Fertilizer Section:
 - .1 Canadian Fertilizer Act and Regulations
 - .2 Canadian Fertilizer Quality Assurance Program
- .2 Canadian Nursery Landscape Association (CNLA):
 - .1 Canadian Standards for Nursery Stock, Nursery Sod

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
 - .2 Schedule hydraulic seeding between dates recommended by Nova Scotia Department of Agriculture.
- .2 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 31 19 - Project Meetings.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittals Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
 - .2 Submit product data relating to fertilizer and fertilizer application rates based on soils analysis of topsoil used for the project.
 - .3 Fibre mulch and tackifier manufacturer's product data, installation instructions and application rate for approval.
 - .4 Submit 2 copies of WHMIS MSDS in accordance with Section 01 11 00 – General Requirements: Health and Safety Requirements.
- .3 Site Plans:
 - .1 Submit site plan showing planned locations for seed mixture types for approval of Consultant.
- .4 Submit in writing 14 days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.
- .5 Written documentation for approval before commencing work regarding:
 - .1 Type and volume capacity of hydraulic seeding and mulching equipment in litres.
 - .2 Amount of each material in kilograms and including water in litres to be used per tank based on volume to achieve required application rate.

- .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.
- .6 Samples:
 - .1 Submit 500 g sample of each seed mixture intended for use. Submit samples in clean containers with label identifying project, seed sample and lot number, supplier and date. Seed mix sample shall match tested seed lots.
 - .2 Submit 0.5 kg container of each type of fertilizer used.
- .7 Certificates:
 - .1 Certificate(s) of analysis of each seed sample. Seed analysis report shall be current and show specie and variety of seed, date and results of all tests.
 - .2 Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .8 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Nova Scotia Horticultural Trades Association.
 - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
 - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.
- .2 All original seed labels and seed bags at completion of seeding to confirm amount of seed used on site.
- .3 Conform to requirements of Federal and Provincial seed regulations.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
 - .2 Inoculant containers to be tagged with expiry date.
- .3 Storage and Handling Requirements:
 - .1 Store fertilizer off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.7 WARRANTY

- .1 For seeding, 12 months' warranty period is extended to 1 full growing season.
- .2 Contractor hereby warrants that seeding will remain free of defects in accordance with Contract, but for 1 full growing season.
- .3 End-of-warranty inspection will be conducted by Consultant.

Part 2 Products

2.1 MATERIALS

- .1 Fertilizer: synthetic fertilizer, granular in composition, minimum 50% of elements derived from organic sources.
- .2 Grass seed: certified Canada No. 1 seed, free of disease, weed seeds or other foreign materials in accordance with the Canada "Seeds Act" and "Seeds Regulations" and having minimum purity of 97% and germination of 75%.
- .3 Water: clean, fresh, and free of substances or matter that would inhibit vigorous and healthy growth of grass.
 - .1 Contractor shall supply clean water, equipment, methods of transportation, water tanker, hoses, attachments, and other accessories as necessary for all seeding requirements, maintenance and other related work.
 - .2 All costs for supply of water incurred during the contract period shall be borne by Contractor.
 - .3 Tackifier: non-toxic, water dilatable, liquid dispersion, mulch binder free of growth or germination inhibiting factors.
- .4 Fibre mulch: wood or wood cellulose fibre meeting following requirements:
 - .1 Free of growth or germination inhibiting ingredients.
 - .2 Specially manufactured for use in hydraulic seeding and mulching equipment.
 - .3 Minimum organic matter content of 95%.
 - .4 Minimum moisture content of 12%.
 - .5 Water absorption potential of 800-900% for wood cellulose fibre mulch and 1200-1350% for wood fibre mulch.
- .5 Erosion control agent: A mulch binder with a pH value of 7 to 8.

2.2 GRASS SEED MIXTURES

- .1 Schedule: Use the following guide for seed mixture placement; submit seeding plan for approval to Consultant before seed purchase and placement:
- .2 Mixture A:
 - .1 Maintained lawns with adequate moisture, low intensity use turf areas-yards, berms, roadsides; seeded on sunny, open areas or partial shade (40% reduced sunlight maximum; fertilized at medium to high levels of nitrogen annually (1.5-2.0 kg/100m²).
 - .2 Seed mixture 'A':
 - .1 40% Mercury Kentucky Bluegrass.
 - .2 20% Touchdown Bluegrass.
 - .3 30% Creeping Red Fescue.
 - .4 10% Fiesta III Perennial Ryegrass.
- .3 Mixture B:
 - .1 Seeding of lawns and roadsides in dry and shaded areas with minimal watering available or planned.
 - .2 Seed mixture 'B':
 - .1 40% Kentucky Bluegrass.
 - .2 40% Creeping Red Fescue.
 - .3 20% Annual Ryegrass.

- .4 Mixture C:
 - .1 Grassed areas for dry locations with low maintenance requirements and for land stabilization along roadsides.
 - .2 Seed mixture 'C':
 - .1 52% Creeping Red Fescue.
 - .2 10% Perennial Ryegrass.
 - .3 35% Kentucky Bluegrass.
 - .4 3% White Clover

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that grades are correct and prepared ready for hydraulic seeding.
 - .1 Do not perform work under adverse conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
 - .2 Starting work of this Section indicates acceptance of conditions.

3.2 INSTALLERS

- .1 Installers shall be members in Good Standing of Landscape Nova Scotia Horticultural Trades Association. Submit evidence of membership to Consultant for all installers to be on site.

3.3 PROTECTION OF EXISTING CONDITIONS

- .1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.
- .2 Immediately remove any material sprayed where not intended as directed by Departmental Representative.

3.4 PREPARATION OF SURFACES

- .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .2 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.
- .3 Cultivated areas identified as requiring cultivation to depth of 25 mm.
- .4 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .5 Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.

3.5 FERTILIZING PROGRAM

- .1 Fertilize prior to fine grading applying fertilizer equally distributed.
- .2 Apply fertilizer at least 6 days before seeding or planting.
- .3 Spread fertilizer uniformly with mechanical spreaders at rate determined on basis of soil tests.
- .4 Incorporate fertilizer thoroughly into upper 50 mm of growing media.

3.6 HYDRAULIC SEEDING

- .1 Proceed with hydro seeding only after final grade has been reviewed by Departmental Representative.
- .2 Mix seed with water, mulch and fertilizer in recommended application rates:
 - .1 Grass seed: 2 kg / 100 m².
 - .2 Mulch: 16 kg / 100 m².
 - .3 Water: 160 litres / 100m².
 - .4 Fertilizer: 3.5 kg / 100m².
- .3 Thoroughly mix seed, fertilizer, mulch, binder (if required) and water in a uniform slurry.
- .4 Apply slurry within 24-hours of dry seeding. Apply slurry to produce a uniform cover and at specified rates.
- .5 Do not hydroseed when wind velocities would cause seed mix to be blown.
- .6 Apply hydroseed to all areas of seed or as shown on the Drawings.
- .7 Re apply where application is not uniform.
- .8 Remove slurry from items and areas not designated to be sprayed.

3.7 PROTECTION OF SEEDED AREAS

- .1 Provide adequate protection to protect seeded areas from all damage, disturbance, or other construction activity after seeding operations are complete. Remove protection after seed areas are properly established.
- .2 Damaged seed areas resulting from inadequate protection shall be promptly repaired with topsoil, fertilizer and seed at Contractor's expense. All damages shall be repaired prior to final acceptance.
- .3 Keep site well drained and landscape excavations dry.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning. 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 11 00 – General Requirements: Cleaning. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Manage and dispose of demolition and construction waste materials in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.

3.9 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by Work of this Section.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 01 90.33 – Tree and Shrub Preservation.
- .2 Section 32 93 10 – Tree, Shrub and Ground Cover Planting.
- .3 Section 32 93 11 – Landscape Maintenance and Warranty.

1.2 REFERENCE STANDARDS

- .1 American National Standard Institute (ANSI) / Trees Care Industry Association
 - .1 ANSI A300 National Tree Care Standards:
 - .1 ANSI A300 (Part 1) - 2008 (R2014) Pruning.
 - .2 ANSI A300 (Part 2) - 2011 Soil Management: a. Modification, b. Fertilization, and c. Drainage.
 - .3 ANSI A300 (Part 3) -2013 Supplemental Support Systems (includes Cabling, Bracing, Guying, and Propping).
 - .4 ANSI A300 (Part 5)-2012: Management of Trees and Shrubs During Site Planning, Site Development, and Construction.
 - .5 ANSI A300 (Part 6)-2012 Planting and Transplanting.
 - .6 ANSI A300 (Part 7)-2012 Integrated Vegetation Management (IVM).
 - .7 ANSI A300 (Part 9) - 2011 Tree Risk Assessment.
 - .8 ANSI A300 (Part 10)-2016: IPM.
 - .2 Canadian Nursery Landscape Association (CNLA)
 - .3 International Society of Arboriculture (ISA)

1.3 DEFINITIONS

- .1 Crown Cleaning: consists of selective removal of one or more of following items: dead, dying or diseased branches, weak branches and water sprouts.
- .2 Crown Thinning: consists of selective removal of branches to increase light penetration, air movement and reduce weight.
- .3 Crown Raising: consists of removal of lower tree branches to provide clearance.
- .4 Crown Reduction or Crown Shaping: decreases tree height and/or spread.
- .5 Vista Pruning: is selective thinning of framework limbs or specific crown areas to improve views.
- .6 Crown Restoration: improves structure, form and appearance of trees that have been severely headed or vandalized.

1.4 QUALITY ASSURANCE

- .1 Certification: provide International Society of Arboriculture or Canadian Nursery Landscape Association certification.
- .2 Regulatory requirements: provide safety certificate as approved by local hydro utility.

- .3 Field Samples: do sample pruning in manner to enable Departmental Representative to identify:
 - .1 Knowledge of target areas including branch bark ridge and branch collars.
 - .2 Technique for selection process and pruning used to establish desired form and shape for each species.
- .4 Acceptance of Work will be determined by Departmental Representative from field sample.
- .5 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29_06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Dispose of unused disinfectant at official hazardous material collections site approved by Departmental Representative.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Divert wood materials from landfill to facility for recycling or composting as directed by Departmental Representative.

1.6 TOOL MAINTENANCE

- .1 Ensure that tools are clean and sharp throughout pruning operation: do not use tools that crush or tear bark.
- .2 Disinfect tools before each tree is pruned.
- .3 On diseased plant material disinfect tools before each cut.

2 Products

2.1 DISINFECTANT

- .1 20% solution of sodium hypochlorite or 70% solution of ethyl alcohol.

3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Prune in accordance with ANSI A300 National Tree Care Standards, and as directed by Departmental Representative. Where discrepancies occur between standard and specifications, specifications govern.
- .2 Notify immediately Departmental Representative conditions detrimental to health of plant material or operations.
- .3 Prune during plant dormant period or after leaves have matured. Avoid pruning during leaf formation, at time of leaf fall, or when seasonal temperature drops below minus 10 degrees C.
- .4 Prune each species when in full leaf.
- .5 Retain natural form and shape of plant species.
- .6 Do not:
 - .1 Flush cut branches.
 - .2 Crush or tear bark.
 - .3 Cut behind branch bark ridge.
 - .4 Damage branch collars.
 - .5 Damage branches to remain.

3.3 PRUNING

- .1 Remove dead, dying, diseased and weak growth from plant material to provide crown cleaning, crown thinning, crown raising, crown reduction, vista pruning and/or crown restoration as designated by Departmental Representative in order to promote healthy growth.
- .2 Remove live branches that:
 - .1 Interfere with healthy development and structural strength including branches crossed or rubbing more important branches.
 - .2 Are of weak structure including narrow crotches.
 - .3 Obstruct development of more important branches.
 - .4 Are broken.
- .3 Remove live branches to re-establish natural species form including:
 - .1 One or more developing leaders.
 - .2 Multiple growth due to previous topping.
 - .3 Branches extending outward from natural form.
 - .4 Undesirable sucker growth.
- .4 Remove loose branches, twigs and other debris lodged in tree. Remove vines.
- .5 For branches under 50 mm in diameter:
 - .1 Locate branch bark ridge and make cuts smooth and flush with outer edge of branch collar to ensure retention of branch collar. Cut target area to bottom of branch collar at angle equal to that formed by line opposite to branch bark ridge.
 - .2 Make cuts on dead branches smooth and flush with swollen callus collar. Do not injure or remove callus collar.
 - .3 Do not cut lead branches unless directed by Departmental Representative.

- .6 For branches greater than 50 mm in diameter:
 - .1 Make first cut on lower side of branch 300 mm from trunk, one third diameter of branch.
 - .2 Make second cut on upper side of branch 500 mm from trunk until branch falls off.
 - .3 Make final cut adjacent to and outside branch collar.
- .7 Ensure that trunk bark and branch collar are not damaged or torn during limb removal.
 - .1 Repair areas which are damaged, or remove damaged area back to next branch collar.
- .8 Remove additional growth designated by Departmental Representative.

3.4 ROOT GIRDLING

- .1 For girdling roots one-quarter size of trunk diameter or larger, V-cut girdling root one-half way through at point where root is crossing.
- .2 Remove exposed portion of girdling root as directed by Departmental Representative after cleanly cutting root flush with grade on each side of parent root. Do not injure bark or parent root.

3.5 CARE OF WOUNDS

- .1 Shape bark around wound to oblong configuration ensuring minimal increase in wound size. Retain peninsulas of existing live bark.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 - General Requirements: Cleaning. 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 11 00 - General Requirements: Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 - General Requirements: Waste Management and Disposal. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 - General Requirements: Cleaning. Leave Work area clean at end of each day.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS
- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A48/A48M-03(2016), Standard Specification for Grey Iron Castings.
 - .2 ASTM C478M-15a, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
 - .3 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for maintenance holes and catch basin structures and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
- 1.3 QUALITY ASSURANCE
- .1 Certifications:
 - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.4 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
-

1.4 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .2 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect infiltration manholes and structures from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Precast infiltration manhole units: to ASTM C478M, circular or oval.
 - .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
 - .2 Monolithic bases to be approved by Parks Canada Representative and set on concrete slabs cast in place.
 - .2 Adjustment rings: to ASTM C478M.
 - .3 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames.
 - .1 Frame with grating or cover to constitute one unit.
 - .2 Assemble and mark unit components before shipment.
 - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
 - .3 Castings: sand blasted or cleaned and ground to eliminate surface imperfections.
 - .4 Maintenance hole frames and covers: light duty for landscape service.
 - .1 Cover cast without perforations and complete with two 25 mm square lifting holes.
 - .5 Size: 762 mm clear diameter.
 - .4 Gravel bedding and clear stone backfill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
-

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 maintenance holes and catch basin structures installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Parks Canada Representative.
 - .2 Inform Parks Canada 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 Parks Canada Representative.
- 3.2 EXCAVATION AND BACKFILL
- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
 - .2 Obtain approval of Parks Canada Representative before installing infiltration manhole.
- 3.3 INSTALLATION
- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
 - .2 Complete units as pipe laying progresses.
 - .1 Maximum of 3 units behind point of pipe laying will be allowed.
 - .3 Dewater excavation to approval of Parks Canada Representative and remove soft and foreign material before placing concrete base.
 - .4 Cast bottom slabs directly on undisturbed ground.
 - .5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% maximum density to ASTM D698.
 - .6 Compact clear stone backfill.
 - .7 Place frame and cover on top section to elevation as indicated.
-

- 3.3 INSTALLATION .7 (Cont'd)
- (Cont'd) .1 If adjustment required use concrete ring.
- .8 Clean units of debris and foreign materials.
- .1 Remove fins and sharp projections.
- .2 Prevent debris from entering system.
-
- 3.4 CLEANING .1 Progress Cleaning:
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Materials and installation for water mains and valves, including service connections.
- 1.2 RELATED SECTIONS
- .1 Division 01 - General Requirements.
 - .2 Section 03 20 00 - Concrete Reinforcing.
 - .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- 1.3 REFERENCES
- .1 Canadian Standards Association (CSA)
 - .1 CSA B137 Series - 17 Thermoplastic Pressure Piping Compendium.
 - .2 ASTM International
 - .1 ASTM D1784-11 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - .2 ASTM D1785-15e1 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - .3 ASTM D2241-15 Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - .4 ASTM F438-17 Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
 - .5 ASTM F442-13e1 Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
 - .6 ASTM F1970-12e1 Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems.
 - .3 National Sanitation Foundation (NSF) International
 - .1 NSF 61-2017 Drinking Water System Components - Health Effects.
 - .2 NSF 372-2016 Drinking Water System Components - Lead Content
 - .4 Department of Justice Canada (Jus)
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1.3 REFERENCES
(Cont'd)

- .4 (Cont'd)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .5 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Division 01 for each size/type of water main pipe, fitting, valve, and accessory.
- .2 Submit samples in accordance with Division 01.
- .3 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .4 Pipe certification to be on pipe.

1.5 CLOSEOUT
SUBMITTALS

- .1 Provide data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Division 01.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

PART 2 - PRODUCTS

2.1 PIPE, JOINTS
AND FITTINGS

- .1 All pipes will be the size and type as shown on the drawings.
 - .2 Polyvinyl chloride pressure pipe: to ASTM 2241 and CSA B137.3, pressure class 160, DR 26 and shall be colour coded white.
-

2.1 PIPE, JOINTS
AND FITTINGS
(Cont'd)

- .3 Joints: bell and spigot type with rubber gasket meeting the requirements of CSA B137.3 and ASTM D2241. This is a push-on joint and must be watertight. The bell will be an integral and homogeneous part of the pipe barrel with no reduction in the wall thickness.
- .4 Fittings: PVC pressure fittings Class 160 (DR26) meeting the requirements of ASTM 2241 and CSA B137.3 and to be push-on bell and spigot type.
- .5 Alternate Pipe Fittings:
 - .1 PVC Schedule 40 fittings meeting the requirements of ASTM D-2466.

2.2 TRACER TAPE

- .1 Installation of the water main pipe shall be accompanied by a 50 mm wide metal marker tape located 600 mm above the top of the pipe. Service pipes shall carry the message - WATER MAIN BURIED

2.3 VALVES &
EXISTING VALVE
CHAMBERS

- .1 Modify existing Valve Pit No. 1 to accomodate new potable ewater feed from Utility Building and potable water feed to future building 'E'.
 - .2 New piping and fittings in existing valve chamber:to be PVC Schedule 40 meeting the requirements of ASTM D-2466.
 - .3 Valves:
 - .1 Body: PVC.
 - .2 Ball: PVC.
 - .3 Working Pressure: 1,035 kPa (150 psig)
 - .4 PVC compound shall have an ASTM cell classification 12454-A with a minimum suffix per ASTM D1784.
 - .5 PVC valves with EPDM or FKM (Viton®) seals shall be certified under NSF/ANSI Standard 61 for contact with drinking water.
 - .6 All valves will be CRN (Canadian Registration Number).
 - .7 Socket ends in PVC shall be Schedule 80.
 - .8 Standard of acceptance: Chemline Type 21.
-

2.4 PIPE BEDDING AND SURROUND MATERIAL .1 25 mm crushed gravel to: Section 31 05 16 - Aggregate Materials as indicated.

2.5 BACKFILL MATERIAL .1 Selected excavated material in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.6 PIPE INSULATION .1 Insulation for water pipe to be 50 mm thick HI-40 styrofoam insulation installed as indicated on drawing.

PART 3 - EXECUTION

3.1 PREPARATION .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
 .1 Inspect materials for defects to approval of Parks Canada Representative.
 .2 Remove defective materials from site as directed by Parks Canada Representative.

3.2 TRENCHING .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
 .2 Trench depth to provide cover over pipe of not less than 1.50 m from finished grade or as indicated.
 .3 Trench alignment and depth require Parks Canada Representative's approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
 .2 Do not place material in frozen condition.
 .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

3.3 GRANULAR
BEDDING

(Cont'd)

- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% of corrected maximum dry density.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling with compacted bedding material.

3.4 PIPE LAYING

- .1 Install coupling necessary for connection to building plumbing.
 - .2 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
 - .3 Join pipes in accordance with manufacturer's recommendations.
 - .4 Bevel or taper ends of PVC pipe to match fittings.
 - .5 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
 - .6 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
 - .7 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
 - .8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
-

3.4 PIPE LAYING
(Cont'd)

- .9 (Cont'd)
- .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .11 Align pipes before jointing.
 - .12 Complete each joint before laying next length of pipe.
 - .13 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
 - .14 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Parks Canada Representative.
 - .15 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
 - .16 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
 - .17 Do not lay pipe on frozen bedding.
 - .18 Do hydrostatic and leakage test and have results approved by Parks Canada Representative before surrounding and covering joints and fittings with granular material.
 - .19 Backfill remainder of trench.

3.5 VALVE
INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.

3.6 TRACER TAPE

- .1 Install tracer tape in a single un-spliced length parallel to all non-metallic water mains and services.
-

3.6 TRACER TAPE
(Cont'd)

- .2 Tracer tape shall be looped up the outside of all valve boxes and extended into the valve box by 50mm through a saw cut 50 mm below the bottom of the cover bell.
- .3 Waterproof all connections.
- .4 Test and verify continuity of tracer tape to the satisfaction of the Parks Canada Representative prior to placing pipe surround and backfill.

3.7 PIPE SURROUND

- .1 Upon completion of pipe laying and after Parks Canada Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 0.5 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% SPMDD in accordance with ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% SPMDD in accordance with ASTM D698.
- .7 Install insulation as shown on detail where final cover over pipe will be less than the minimum required.

3.8 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.
 - .2 Do not place backfill in frozen condition.
 - .3 Under paving and walks, compact the upper 300 mm of backfill to at least 100% corrected maximum dry density.
-

3.8 BACKFILL
(Cont'd)

- .3 (Cont'd)
.1 In other areas, compact to at least 95% SPMD in accordance with ASTM D698.

3.9 HYDROSTATIC AND
LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Parks Canada Representative at least 24 hours in advance of proposed tests.
.1 Perform tests in presence of Parks Canada Representative.
- .4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Parks Canada Representative.
- .5 Upon completion of pipe laying and after Parks Canada Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
- .6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .7 Open valves.
- .8 Expel air from main by slowly filling main with potable water.
.1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
.2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .9 Thoroughly examine exposed parts and correct for leakage as necessary.
- .10 Apply hydrostatic test pressure of 1380 kPa (200 psi) based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.
- .11 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
-

3.9 HYDROSTATIC AND
LEAKAGE TESTING
(Cont'd)

- .12 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .13 Repeat hydrostatic test until defects have been corrected.
- .14 Apply leakage test pressure of 1380 kPa (200 psi) after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .15 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
- .16 Do not exceed allowable leakage of 0 L/mm of pipe, including lateral connections.
- .17 Locate and repair defects if leakage is greater than amount specified.
- .18 Repeat test until leakage is within specified allowance for full length of water main.

3.10 FLUSHING AND
DISINFECTING

- .1 Flushing and disinfecting operations: witnessed by Parks Canada Representative carried out by specialist contractor.
 - .1 Notify Parks Canada Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Provide connections and pumps for flushing as required.
- .4 Open and close valves and service connections to ensure thorough flushing.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Materials and installation for gravity sewers.
- 1.2 RELATED SECTIONS .1 Division 01 - General Requirements.
.2 Section 03 30 00 - Cast-in-Place Concrete.
.3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- 1.3 REFERENCES .1 American Society for Testing and Materials (ASTM International)
.1 ASTM D698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
.2 Canadian Standards Association (CSA International)
.1 CSA B1800-15, Plastic Non-pressure Pipe Compendium.
.1 CSA B182.1-15, Plastic Drain and Sewer Pipe and Pipe Fittings.
.2 CSA B182.2-15, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.
- 1.4 DEFINITIONS .1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.
- 1.5 SUBMITTALS .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
.2 Inform Parks Canada Representative at least 2 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
.3 Ensure certification is marked on pipe.
-

- 1.6 SCHEDULING
- .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
 - .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
 - .3 Notify Parks Canada Representative 24 hours minimum in advance of any interruption in service.

PART 2 - PRODUCTS

- 2.1 PLASTIC PIPE
- .1 Type PSM Polyvinyl Chloride (PVC): to CSA B182.2.
 - .1 Standard dimensional ratio (SDR): 28 for pipe less or equal 150 mm diameter, 35 for pipe greater than 150 mm diameter.
 - .2 Locked-in gasket and integral bell system.
 - .3 Nominal lengths: 6 m.

- 2.2 PIPE BEDDING AND SURROUND MATERIALS
- .1 Granular material: Type 1 gravel in accordance with Section 31 23 33.01 - Excavating, Trenching, and Backfilling.

- 2.3 BACKFILL MATERIAL
- .1 As indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

- 2.4 PIPE INSULATION
- .1 Expanded polystyrene insulation H140 CAN/CGSB-51-GP-20M, Type 4.

PART 3 - EXECUTION

- 3.1 PREPARATION
- .1 Clean and dry pipes and fittings before installation.
 - .2 Obtain Parks Canada Representative's approval of pipes and fittings prior to installation.
-

3.2 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth require approval of Parks Canada Representative prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding materials in uniform layer to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .1 Do not use blocks when bedding pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 98% Corrected Maximum Dry Density to ASTM D698.

3.4 INSTALLATION

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Parks Canada Representative.
 - .2 Handle pipe using methods approved by Parks Canada Representative.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
 - .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
 - .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
-

3.4 INSTALLATION
(Cont'd)

- .6 Do not allow water to flow through pipe during construction, except as may be permitted by Parks Canada Representative.
 - .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .8 Install plastic pipe and fittings in accordance with CSA B182.1.
 - .9 Pipe jointing:
 - .1 Install gaskets in accordance with manufacturer's recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 At rigid structures, install pipe joints not more than 1.20 m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
 - .10 When stoppage of Work occurs, block pipes as directed by Parks Canada Representative to prevent creep during down time.
 - .11 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .12 Where a minimum pipe cover of 1200 mm can not be achieved, sanitary pipe shall be insulated as indicated.
-

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Parks Canada Representative has inspected pipe joints, surround and cover pipes as indicated.
 - .1 Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 0.25 m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to depth as indicated at least 98% corrected maximum dry density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 98% Corrected Maximum Dry Density to ASTM D698.
- .7 When field test results are acceptable to Parks Canada Representative, place surround material at pipe joints.

3.6 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 98% Corrected Maximum Dry Density to ASTM D698.
 - .1 In other areas, compact to at least 95% Corrected Maximum Dry Density to ASTM D698.
- .4 Place unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.7 UNDERCROSSING

- .1 Excavate working pit outside right-of-way to be crossed.
 - .2 Excavate working pit to minimum of 0.5 m below lowest invert of encasing pit.
-

3.7 UNDERCROSSING
(Cont'd)

- .3 Dewater excavation.
- .4 Dewater area of undercrossing.
- .5 Provide shop drawings showing proposed method of installation for sanitary sewer in undercrossing.
- .6 Use approved blocking method to guide sanitary sewer pipe in true alignment.
- .7 Join sanitary sewer pipe one length at time outside encasement pipe. Push sanitary sewer pipe into position.

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS
- .1 ASTM International
 - .1 ASTM D698-12e2, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-34.22-94, Asbestos-Cement Drain Pipe.
 - .3 CSA Group (CSA)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA B1800-18, Thermoplastic Non-Pressure Pipe Compendium.
 - .1 CSA B182.2-18, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.
 - .3 CAN/CSA-G401-14, Corrugated Steel Pipe Products.
- 1.2 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Division 01.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for drainage material and include product characteristics, performance criteria, physical size, finish and limitations.
- 1.3 DELIVERY, STORAGE AND HANDLING
- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .2 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 material from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

- 1.4 SITE CONDITIONS .1 Known underground utility lines and buried objects are as indicated on plans.

PART 2 - PRODUCTS

- 2.1 BEDDING AND SURROUND MATERIALS .1 Coarse filter aggregate: to CSA A23.1/A23.2, Group 1, 20-5 mm, in accordance with Section 31 05 16 - Aggregate Materials.
- .2 Fine filter aggregate: to CSA A23.1/A23.2, in accordance with Section 31 05 16 - Aggregate Materials.
- .3 Rigid plastic pipe and fittings: to CSA B182.2.
- 2.2 BACKFILL MATERIAL .1 Type 2, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling, as indicated.
- .2 Excavated or graded material existing on site may be suitable to use if approved by Parks Canada

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 drainage materials installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Parks Canada Representative.
- .2 Inform Parks Canada 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 Parks Canada Representative.
- .2 Make sure graded subgrade conforms with required drainage pattern before placing bedding material.
-

3.1 EXAMINATION
(Cont'd)

- .3 Make sure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Parks Canada Representative.
- .4 Make sure foundation wall rigid insulation has been installed and approved by Parks Canada Representative before placing bedding material.

3.2 BEDDING
PREPARATION

- .1 Cut trenches in subgrade and place bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Shape bed true to grade and to provide continuous, uniform bearing surface.
- .3 Compact each layer full width of bed to at least 95% of corrected maximum dry density.
- .4 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.3 PIPE OR TUBING
INSTALLATION

- .1 Make sure pipe interior and coupling surfaces are clean before laying.
 - .2 Lay perforated pipe as indicated. For pipe, face perforations and coupling slots downward.
 - .3 Lay non-perforated pipe as indicated from perforated pipe to disposal area. Make joints watertight.
 - .4 Grade bedding to establish pipe slope.
 - .5 Install end plugs at ends of collector drains to protect pipe ends from damage and ingress of foreign material.
 - .6 Connect non-perforated pipe to infiltration dry well by appropriate adapters manufactured for this purpose.
 - .7 Provide cleanouts on non-perforated pipe at changes of pipe direction and in runs greater than 15 m.
 - .8 Provide flush cleanouts where directed by Parks Canada Representative.
-

3.3 PIPE OR TUBING INSTALLATION
(Cont'd)

- .9 Connect drainage system to building sewers, as indicated.

3.4 PIPE OR TUBING SURROUND MATERIAL

- .1 Upon completion of pipe laying and after Parks Canada Representative has inspected and approved Work in place, surround and cover pipe and install geotextile filter as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness, as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Compact each layer from pipe invert to mid-height of pipe to at least 95% of corrected maximum dry density.
- .5 Compact each layer from mid-height of pipe to underside of backfill to at least 90% of corrected maximum dry density.
- .6 Place low strength unshrinkable fill where compaction cannot be achieved using mechanical methods.

3.5 BACKFILL MATERIAL

- .1 Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Under concrete entrance pad, compact backfill to at least 95% corrected maximum dry density. In other areas, compact to at least 90% corrected maximum dry density.
- .3 Use appropriate compaction equipment.
.1 Conduct hand tamping around confined areas of pipe.
.2 Do not use water or other hydraulic means to place or consolidate backfill material.

3.6 FOUNDATION .1 Make penetrations through foundation structures only after receipt of written approval from Parks Canada Representative.

3.7 CLEANING .1 Progress Cleaning:
.1 Leave Work area clean at end of each day.
.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
.3 Waste Management: separate waste materials for reuse and recycling.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.