PROJECT MANUAL

37702 – Lower Hillside (High Park) Fieldhouse Washroom Improvements

Toronto, Ontario

SOCA Project Number: 2222

Work Assignment Number: 24-PFR-CAP-GC-001

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END OF SECTION

Part 1 General

1.1 COMPLEMENTARY DOCUMENTS

.1 Drawings, specifications, and schedules are complementary each to the other and what is called for by one to be binding as if called for by all. Should any discrepancy appear between documents which leave doubt as to the intent or meaning, abide by Precedence of Documents article below or obtain direction from the Consultant.

.2 Drawings indicate general location and route of conduit and wire/conductors. Install conduit or wiring/conductors and plumbing piping not shown or indicated diagrammatically in schematic or riser diagrams to provide an operational assembly or system.

.3 Install components to physically conserve headroom, to minimize furring spaces, or obstructions.

.4 Locate devices with primary regard for convenience of operation and usage.

.5 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional work beyond work described to be brought to attention of Consultant.

1.2 DESCRIPTION OF THE WORK

.1 Work of this Bid Package comprises renovations and related sitework to Lower Hillside (High Park) Fieldhouse Washroom Improvements located in Toronto, Ontario. Work of this package includes renovations to the building and related sitework.

.2 Work specified in Specifications is divided into Divisions and Sections for reference purposes only. Division of the Work among Subcontractors, Sub-subcontractors and suppliers/vendors is solely the Contractor's responsibility. Neither the Owner nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.

.3 Contract Documents were prepared by the Consultant for the Owner. Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. The Consultant and/or the Owner accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions based on the Contract Documents.

.4 For purposes of reference in these Contract Documents, the term "Contractor" shall mean the party in contract with the Owner.

1.3 COMMUNICATION METHOD

.1 Work of this contract will be recorded and administered through email.

1.4 CONTRACT METHOD

.1 Construct Work under single, stipulated price contract.

1.5 PERFORMANCE OF THE WORK

.1 State in Bid Form, time required to complete work. Completion date in Agreement must be this completion time added to commencement date.

.2 Owner requires that work of this contract be completed as quickly as possible and consideration will be given to time of completion when reviewing Bids submitted.

.3 Initiate work of this project 10 days after award of contract.

1.6 CONTRACTOR USE OF PREMISES

.1 Limit use of premises for Work, for storage, and for access, to allow:

.1 Public usage of remainder of the site.

.2 Co-ordinate use of premises under direction of Consultant.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

.7 If construction timeline includes the month between May – October coordinate with Owner and Turtle Protectors for additional requirements.

1.7 DOCUMENTS REQUIRED AT JOB SITE

.1 Maintain at job site, one copy each of the following documents:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Site Instructions.
.8 Other Modifications to the Contract.
.9 Field Test Reports.
.10 Copy of Approved Work Schedule.
.11 Health and Safety Plan and Other Safety Related Documents.
.12 All Permits for Work.
.13 Other documents as specified.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

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

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Consultant to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to public and normal use of premises. Arrange with Consultant to facilitate execution of work.

1.4 EXISTING SERVICES

.1 Notify Consultant and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Consultant, 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to operations.

.3 Provide alternative routes for personnel, pedestrian, and vehicular traffic.

.4 Establish location and extent of service lines in area of work before starting Work. Notify Consultant of findings.

.5 Submit schedule to and obtain approval from Consultant for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services, when directed by Consultant, to maintain critical building and tenant systems.

.7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

.8 Where unknown services are encountered, immediately advise Consultant and confirm findings in writing.

.9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.10 Record locations of maintained, re-routed and abandoned service lines

.11 Construct barriers in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.

1.5 SPECIAL REQUIREMENTS

.1 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.2 Keep within limits of work and avenues of ingress and egress.

.3 All material to be brought in and out from the south of the site to avoid conflicting with turtle nesting sites to the north of the existing building. Coordinate delivery and removal of materials with Owner and Turtle Protectors at pre-construction meeting.

.4 Existing curbs set on site to restrict the movement of turtles are not to be relocated with written approval of the Owner and Turtle Protectors.

.5 Vehicles should enter and exit the site from Parkside Drive. Gates are closed to public traffic on weekends and holidays (Friday nights 23:00 – Monday 6:00). Coordinate weekend and holiday access with Owner as required.

.6 Roads leading to existing washroom building are not to have any public access. All contractor vehicles required to drive on non-public roadways to be in marked vehicles or have authorized passes. Coordinate requirements with Owner.

1.6 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not allowed anywhere on the property.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Requirements for inspection and testing to be carried out by testing laboratory, designated by the Consultant, are specified under various sections.

1.2 ARRANGEMENT AND PAYMENT

.1 Engage, coordinate and pay for independent testing and inspection services from Owner approved agencies.

.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 Consultant to verify acceptability of corrected work.

1.3 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 Consultant 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 Consultant.

.5 Include all testing reports in Operation and Maintenance Manuals as specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Schedule and administer Project meetings throughout the progress of the Work and at the call of Consultant.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Consultant.

.4 Provide physical space and make arrangements for meetings and provide arrangements for virtual attendance (audio and video) when required by Owner or Consultant.

.5 Preside at meetings.

.6 Record meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and affected parties not in attendance.

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

1.2 PRECONSTRUCTION MEETING

.1 Prior to signing the Contract, request a meeting of parties in contract to discuss and resolve administrative procedures, responsibilities, construction strategies and procedures.

.2 Representatives of the Owner, Consultant, Contractor, major Subcontractors, suppliers listed in bid form, field inspectors and supervisors are to be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum five days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 Agenda to include the following:

.1 Appointment of official representative of participants in Work.

.2 Schedule of Work, progress scheduling as specified in Section 01 32 16 – Construction Schedule.

.3 Schedule of submission of shop drawings, samples, colour chips.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences as specified in Section 01 52 00 – Construction Facilities.

.5 Delivery schedule of specified equipment.

.6 Site security as specified in Section 01 56 00 – Temporary Barriers and Enclosures.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.

.8 Record drawings as specified in Section 01 78 00 – Closeout Submittals.

.9 Maintenance Manuals as specified in Section 01 78 00 – Closeout Submittals.

.10 Take-over procedures, acceptance, and warranties as specified Section 01 78 00 – Closeout Submittals.

.11 Monthly progress claims, administrative procedures, photographs, and holdbacks.

.12 Appointment of inspection and testing agencies or firms.

.13 Insurances and transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work, schedule progress meetings every two weeks at times and location mutually agreed to with Owner and Consultant.

.2 Contractor, Consultant and Owner are to be in attendance. Major subcontractors or suppliers involved in Work may be requested to attend specific meetings.

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

.3 Notify parties minimum five days prior to meetings.

.4 Record minutes of meetings including significant proceedings and decisions. Identify action by the parties and circulate to attending parties and affected parties not in attendance within three days after meeting.

.5 Include updated Construction Schedule, Site Instruction, Contemplated Change Notice, Change Order, Submittal and Request for Information logs with meeting minutes at each progress meeting.

.6 Agenda to include following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revisions to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules and log: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Review Request for Information log.

.13 Review site security issues.

.14 Review utility status updates.

.15 Other business.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Consultant to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately ten working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence for this contract.

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

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

.2 Submit to Consultant within ten working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

1.4 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilizations.
.5 Removal of demolition work.
.6 Site clearing.
.7 Excavation.
.8 Backfill.
.9 Site utilities.
.10 Foundation work.
.11 Slab on grade.
.12 Structural framing.
.13 Exterior Finishing.
.14 Cladding and Roofing.
.15 Interior Architecture.
.16 Millwork.
.17 Landscaping and Exterior Improvements.
.18 Plumbing.
.19 Electrical.
.20 Piping.
.21 Controls.
.22 Heating, Ventilating and Air Conditioning.
.23 Fire Systems.
.24 Testing, Start-Up and Adjusting.
.25 Supplied equipment long delivery items.

1.5 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule every two weeks reflecting activity changes and completions, as well as activities in progress.

.2 Submit revised progress schedule with each application for payment.

.3 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 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.

1.7 SCHEDULE OF SHOP DRAWINGS

.1 Coordinate sub-trades, suppliers and manufacturers to ensure that all required shop drawings, samples, product data and other items required for review are scheduled so as to provide sufficient time for review by Consultant.

.2 Contact necessary sub-trades, suppliers and manufacturers to inform them when submissions are required.

.3 Shop drawing schedule is not required for submission as part of Construction Schedule.

.4 Shop drawing schedule will be discussed at regular progress meetings.

.5 Shop drawings may be combined between different sites if using the same subtrade or supplier for the Work.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Shop Drawings and Product Data.

.2 Samples.

.3 Photographs.

.4 Certificates and transcripts.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.1 Submittals may be combined between different sites if using the same subtrade or supplier for the Work.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

.6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

.7 Include with submission a copy of the originating subtrade’s submission transmittal with date affixed, as backup to submission.

.8 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.9 Verify field measurements and affected adjacent Work are coordinated.

.10 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

.11 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.12 Keep one reviewed copy of each submission on site.

1.3 PROGRESS PHOTOGRAPHS

.1 Digital Photography:

.1 Submit electronic copy of colour digital photography in *.jpg format.

.2 Sizes: minimum 2 mega pixel image file size, jpeg image file.

.3 Identification: Name and number of project and date of exposure indicated.

.2 Number of Viewpoints:

.1 Minimum of two exterior viewpoints until building is closed in.

.2 Minimum of four once building is closed in. Two exterior viewpoints and two interior viewpoints.

.3 Locations of viewpoints as discussed with Owner and Consultant.

.3 Frequency: Every two weeks prior to scheduled construction meetings.

.4 Capture photographs at completion of excavation, underslab services and vapour barriers, foundations, framing and services before concealment.

.5 In addition, capture any special operation, phase of construction or special detail of unusual interest for record purposes.

.6 Take photos of primary entrance at substantial completion.

.7 On completion of project, provide photograph of the completed project, taken from the best possible viewpoint to show the project to its best advantage.

.8 All photographs will become the Owner’s property, to be used for whatever purposes the Owner may desire.

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of the Work as required. The Professional Engineer shall be responsible for reviewing the method attachment to the structure with the Consultant prior to installation. The Professional Engineer shall also provide field and certification of installation at Sub-contractor’s cost.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications

.4 Allow ten full working days for Consultant's review of each submission.

.5 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price or Time. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work. If work proceeds without notice, Contractor acknowledges no additional cost or time will be given.

.6 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.7 Accompany submissions with transmittal letter, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification of each shop drawing, product data and sample.

.5 Other pertinent data.

.8 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to other parts of the Work.

.9 After Consultant's review, Contractor shall 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 Consultant may reasonably request.

.11 Submit electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Consultant 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 Consultant.

.13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.

.14 Submit electronic copies of manufacturer’s instructions for requirements requested in specification Sections and as requested by Consultant.

.15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.

.16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

.17 Delete information not applicable to project.

.18 Supplement standard information to provide details applicable to project.

.19 If upon review by Consultant, 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 copies will be returned and re-submission 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 Consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

.21 After final review, the Contractor, at his expense, reproduce the number of prints required for performance of the Work and for completion of the Operation and Maintenance Manuals.

1.5 SAMPLES

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

.2 Deliver samples prepaid to Consultant's business address.

.3 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Consultant are not intended to change Contract Price or Time. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work. If work proceeds without notice, Contractor acknowledges no additional cost or time will be given.

.6 Make changes in samples which Consultant may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.6 MOCK-UP

.1 Erect mock-ups for review in accordance with Section 01 45 00 – Quality Control.

1.7 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, obtain and submit, to the Owner, Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 INTENT

.1 The intent of Delegated Design Submittals required by this Section is to account for professional engineering responsibility for design, review and acceptance of components of Work forming a part of permanent Work in accordance with Building Code, and that has been assigned to a design entity other than Consultant including, but not limited to, the following:

.1 Design requiring structural analysis of load bearing components and connections and seismic requirements.

.2 Design requiring compliance with fire safety regulations.

.3 Design requiring compliance with life or health safety regulations.

.4 Materials and systems located in sections as indicated below.

.2 Delegated Design Submittals are not required for components of Work requiring engineering for temporary Work (i.e.: crane hoisting, engineered lifts, false Work, shoring, concrete formwork) that would normally form a part of Contractor's scope of Work.

.3 The requirements of this Section are in general conformance with recommended Responsibilities for Engineering Services for Building Projects published by Ontario Society of Professional Engineers (OSPE), with regards to duties of specialty professionals appointed during construction period.

.4 The requirements of this Section do not diminish responsibilities of Consultant's role as Registered Professional of Record; submittals will be used by Consultant to establish that Work is substantially performed in accordance with Building Code.

1.2 RELATED REQUIREMENTS

.1 Section 07 21 13 – Board Insulation

.2 Section 07 61 00 – Sheet Metal Roofing

.3 Section 07 84 00 – Fire Stopping and Smokeseals

.4 Section 09 22 00 – Non-Structural Metal Framing

.5 Coordinate additional items with disciplines for items requiring delegated design submittals.

1.3 DELEGATED DESIGN

.1 Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated where professional design services or certifications by a design professional are specifically required of Contractor by Contract Documents.

.2 If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Consultant.

.3 Delegated design will be required for elements designed by a specialty professional, which may include:

.1 Elements normally fabricated off-site

.2 Elements that require specialized fabrication equipment or a proprietary fabrication process not usually available at job site (i.e.: guardrails, handrails, open web steel joists, wood trusses, combination wood and metal or plywood joists, prefabricated wood or metal buildings, noise and vibration isolation devices, elevators).

.3 Elements requiring civil engineering, not normally a part of scope of services performed by architectural; structural; mechanical; electrical; or geotechnical disciplines of Consultant.

Part 2 Products

2.1 LETTERS OF COMMITMENT/COMPLIANCE

.1 Submit a signed and sealed Letter of Commitment on company letterhead addressed to Consultant, in a format acceptable to the Consultant, prior to starting Work requiring design and seal of a professional engineer.

.2 Submit a signed and sealed Letter of Compliance on company letterhead addressed to Consultant, in a format acceptable to the Consultant, on completion of Work requiring design and seal of a professional engineer.

Part 3 Execution

3.1 IMPLEMENTATION

.1 Include summary of Work described in technical specification Section as a part of the required Letter of Commitment.

.2 Prepare required submittals and present to Consultant within sufficient time to allow for Consultant’s detailed review and acceptance.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety and Data Sheets (SDS).

.3 Province of Ontario:

.1 Ontario Occupational Health and Safety Act and Regulations, most current edition

1.2 CONSTRUCTOR

.1 Responsibility for Work Site Safety - This Contractor Is "Constructor":

.1 The Contractor shall, for the purposes of the Occupational Health and Safety Act, and for the duration of the Work of this Contract:

.1 Be the " Constructor" for the "Work Site", and

.2 Meet all requirements of the Occupational Health and Safety Act and Regulations, Workers Compensation Board legislation, the Fire Code legislation and all other applicable laws that govern work place safety.

.2 The Contractor shall direct all Subcontractors, sub-subcontractors, Other Contractors, employees, suppliers, workers and any other persons at the “Work Site” on safety related matters, to the extent required to fulfill its “Constructor” responsibilities pursuant to the Act, regardless of:

.1 Whether or not any contractual relationship exists between the Contractor and any of these entities, and

.2 Whether or not such entities have been specifically identified in this Contract.

.3 Safety Certification: Safety certification is a condition of contract award; Contractor is required to maintain a valid Clearance Certificate (CC) for the duration of the Work of this Contract.

1.3 ACTIVE SUBMITTALS / INFORMATIONAL SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan within seven days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit duplicate copies of Contractor's authorized representative's work site health and safety inspection reports to authority having jurisdiction as required.

.4 Submit copies of reports or directions issued by Federal, Provincial health and safety inspectors as required.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets.

.7 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel as required.

.8 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

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

1.5 SAFETY ACTIVITIES

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

.2 Contractor shall verify that emergency procedures including appropriate First Aid facilities and First Aid personnel are in place at the Work Site.

.3 Maintain on site sufficient quantities of PPE, including but not limited to: hard hats, safety glasses, hearing protection and other items of clothing or special equipment as necessary to verify that visitors to the site, the Consultant and the Owner’s representative are adequately protected.

.4 Verify that all Contractor’s employees, Subcontractors, sub-subcontractors, suppliers and others working on the site, meet clothing requirements in accordance with OH & S requirements.

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Consultant and Owner prior to commencement of Work.

1.7 REGULATORY REQUIREMENTS

.1 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements and this section.

1.8 SAFETY PLAN

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

.1 The " Constructor" according to applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection

of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act of Ontario.

1.11 UNFORESEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of the Province having jurisdiction. Advise Consultant verbally and in writing.

1.12 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 completing required training are not permitted to enter site to perform Work.

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

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

1.13 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices, substantial completion certificate and orders are posted in conspicuous location in accordance with Acts and Regulations of the Province having jurisdiction, and in consultation with Consultant.

1.14 CORRECTION OF NON-COMPLIANCE

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

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

.3 Authority Having Jurisdiction or Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 HAZARDOUS WORK

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Authority Having Jurisdiction.

.2 Use powder actuated devices only after receipt of written permission from the Consultant.

1.16 WORK STOPPAGE

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to 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 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prior to commencing construction activities or delivery of materials to site, submit an Environmental Protection Plan for review and approval by Consultant. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Environmental protection plan, to include:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.6 Drawings showing locations of material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures

for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.

.9 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.

.12 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean- up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.3 FIRES

.1 Fires and burning of rubbish and construction materials on site is not permitted.

1.4 DRAINAGE

.1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

.2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sedimentations control plan.

.3 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.4 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.5 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 and adjacent properties where indicated.

.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 areas indicated, or as designated by Consultant.

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.

.4 Design and construct temporary crossings to minimize erosion to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.7 Do not blast under water or within 100 m of indicated spawning beds.

1.7 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authorities emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.8 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.9 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for review by Consultant.

.3 Consultant will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Regulatory requirements means laws, by-laws, ordinances, rules, regulations, codes, orders of authorities having jurisdiction, and other legally enforceable requirements applicable to the Work and which are or become in force during the performance of the Work.

1.2 REFERENCE AND CODES

.1 Perform Work in accordance with 2012 Ontario Building Code, including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 In addition, comply with the following:

.1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended.

.3 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.3 MUNICIPALITIES

.1 Perform Work in accordance with the by-laws and ordinances of the Municipality in the jurisdiction of the Work and to the direction of the Authorities Having Jurisdiction.

1.4 PERMITS

.1 Building permits have been applied for, obtained and paid for by the Owner. Permits will be provided to the awarded Contractor.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 All references to codes, standards and standard specifications referred to in these specifications or used on drawings shall mean and intend to be the currently adopted edition, amendment and revision of such reference standards in effect at the time of Bid closing.

.2 In the event that the most current version of a code, standard or standard specification differs from the version indicated in these specifications:

.1 Report the discrepancy to the Consultant immediately.

.2 The most current standard at the time of Tender will be used to establish the quality of the work or material being referenced.

.3 Referenced standards and code requirements shall be considered minimum requirements only. The specifications may indicate additional requirements in excess of those established by referenced codes and standards.

.4 Applicable portions of standards used that are not in conflict with the Contract Documents are hereby made a part of the specifications.

.5 Modifications or exceptions to standards shall be considered as amendments, and unmodified portions shall remain in full effect.

.6 In cases of discrepancies between the Specifications and Standards, the requirements of the Specifications shall govern.

.7 In cases of discrepancies between Codes and the Specifications, the Code requirements shall govern.

.8 Where references to Codes or Standards are used in these specifications, the Contractor and subcontractors must familiarize themselves with the applicable portions and shall be governed by the requirements affecting the project.

.9 The Contractor shall furnish an affidavit, when requested by the Consultant, from manufacturers certifying that materials or products delivered to the project meet the requirements specified. Such certifications, however, shall not relieve the Contractor or their subcontractors from the responsibility of complying with any added requirements specified in the Contract Documents.

.10 If there is a question as to whether product or system is in conformance with applicable standards, Consultant reserves the right to have such products or systems tested to prove conformance.

.1 Cost of such testing will be borne by Owner in the event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 STANDARDS EQUIVALENCY

.1 Documents were prepared in the United States of America and in Canada. Reference standards used to establish performance requirements listed in the technical specifications for Work of the Project were prepared using mixed

reference standards from the United States and Canada, whereby Canadian will take precedence.

.1 National Standards of Canada: Standards Referenced within the National Building Code are National Standards of Canada as accepted by the Standards Council of Canada and enforced by the Authority Having Jurisdiction.

.2 Technical Specification Content: The Consultant has modified and referenced the correct listings of Referenced Standards within the technical specifications where they reference National Standards of Canada applicable to work governed by the Ontario Building Code. Coordinate referenced standards with the applicable codes.

.3 Names of Standards Organizations: Bilateral standards published in the United States of America and containing the word “American” when referenced as National Standards of Canada have the same weight as a standard containing the word “Canadian”:

.1 Country of testing origin does not prejudge the acceptability of the listed standards.

.2 All standards listed in the technical specifications are listed alphabetically, with no preference for country of origin.

.2 Materials, assemblies or systems that are tested in the United States using reference standards acceptable to Standards Council of Canada, with no equivalent Canadian reference standards are acceptable for use in Work of the Project using manufacturers’ standard product data and testing meeting the listed reference standards.

.3 Provide materials, assemblies or systems meeting Canadian reference standards acceptable to Standards Council of Canada where manufacturers conduct testing concurrently with reference standards published in the United States; and that are different than Canadian reference standards.

.4 Submit product data indicating Canadian equivalent performance to specified United States reference standards as follows:

.1 Submit product data listing CSA, CGSB, ULC or similar reference standard indicating testing acceptable to the Authority Having Jurisdiction.

.2 Use same material, assembly or system as would be required for a tested material, assembly or system specified for the project; substitutions will not be permitted unless evidence of equivalency is confirmed.

.3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.

1.3 STANDARDS PRODUCING INDUSTRY ORGANIZATIONS

.1 The following list of standards organizations indicate the most common standards that may be referenced within the technical specifications. Acronym and names are as follows:

.2 Canadian Organizations:

.1 AWMAC - Architectural Woodwork Manufacturers Association of Canada.

.2 CCA - Canadian Construction Association.

.3 CCDC - Canadian Construction Documents Committee.

.4 CGA - Canadian Gas Association

.5 CGSB - Canadian General Standards Board

.6 CSA - Canadian Standards Association (CSA Group)

.7 ULC - Underwriters Laboratories of Canada

.3 USA Organizations:

.1 ANSI - American National Standards Institute

.2 ASTM - American Society for Testing and Materials

.3 NFPA - National Fire Protection Agency

.4 UL - Underwriters Laboratories

.5 WHI - Warnock Hersey | Intertek Testing Services

.4 The following limitations on marks issued by standards organizations will apply to the standards issued by the organizations listed above.

.1 **Underwriters Laboratories Inc.:** Only systems designated by "$_{c}$UL" or "$_{c}$UL$_{us}$" will be acceptable for use on this project. Systems indicating "UL" or "UL$_{us}$" will only be considered where local authorities having jurisdiction have reviewed and accepted the systems in writing.

.2 **Warnock Hersey / Intertek:** Only materials designated by "$_{c}$WHI" or "$_{c}$WHI$_{us}$" will be acceptable for use on this project: Materials being a "WH", "WHI" or "WHI$_{us}$" mark will only be considered where local authorities having jurisdiction have reviewed and accepted the materials in writing.

.3 Contractor and subcontractor will be responsible for obtaining written acceptance of materials and submitting them to the Consultant prior to installation.

1.4 ABBREVIATIONS

.1 Additional Technical Societies, Associations, or Standards may be referenced in these Specifications in addition to the following abbreviations:

Name of Association	Abbreviation
Acoustical Materials Association	AMA
Air Movement & Control Association	AMCA
Aluminum Association	AA
American Concrete Institute	ACI
American Iron & Steel Institute	AISI
American Society of Heating, Refrigerating and Airconditioning Engineers	ASHRAE
American Society of Mechanical Engineers	ASME
American Standards Association	ASA
American Wood Preservers' Association	AWPA
Canadian Institute of Steel Construction	CISC
Ceilings and Interior Systems Construction Association	CISCA
Canadian Sheet Steel Building Institute	CSSBI
Canadian Steel Door Manufacturers Association	CSDMA
Canadian Welding Bureau	CWB
Construction Specifications Canada	CSC

Name of Association	Abbreviation
Factory Mutual	FM
Fenestration & Glazing Industry Alliance	FGIA
Heating, Refrigerating and Airconditioning Institute of Canada	HRAI
Hydronics Institute	HI
Industrial Fabric Association International	IFAI
Insulated Glass Manufacturers Association	IGMA
Master Painters Institute	MPI
National Association of Architectural Metal Manufacturers	NAAMM
National Building Code	NBC
National Lumber Grades Authority	NLGA
National Research Council	NRC
North American Architectural Woodwork Standards	NAAWS
Northwest Wall and Ceiling Bureau	NWCB
Ontario Building Code 2020	OBC
Terrazzo, Tile & Marble Association of Canada	TTMAC
The Society for Protective Coatings	SSPC

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 INSPECTION BY AUTHORITY

.1 Allow Authorities Having Jurisdiction 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 whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the 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.

1.2 REVIEW BY CONSULTANT

.1 Allow Consultant 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 Consultant 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 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.

.1 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.

.2 If such Work is found in accordance with Contract Documents, Consultant Owner will pay cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

.1 Contractor shall provide inspections, tests and other quality control services, unless otherwise indicated as the responsibility of the Owner, specified in the Contract Documents and required by the authorities having jurisdiction. Employ and pay for a qualified independent inspection/testing agency to perform quality control services. Costs for these services are not to be included in the Contract Sum.

.2 Provide equipment required for executing inspection and testing by appointed agencies.

.3 Employment of inspection and 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 testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to Owner. Pay costs for retesting and re-inspection.

1.4 ACCESS TO WORK

.1 Allow inspection and testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Cooperate to provide reasonable access and facilities for such access.

1.5 PROCEDURES

.1 Notify appropriate agency, Consultant and Owner in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples. Provide transport of samples as required by testing agency.

1.6 DEFECTIVE 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 Consultant 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 Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner 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 Consultant.

1.7 REPORTS

.1 Submit electronic copy of signed inspection and test reports to Consultant and Owner.

.2 Provide copies to Subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

.3 Prepare reports and include in Operation and Maintenance Manuals as specified in Section 01 78 00 – Closeout Submittals.

1.8 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Consultant and may be authorized as recoverable.

1.9 MOCK-UP

.1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Consultant or as specified in specific Section.

.3 Prepare mock-ups for Consultant review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.

1.10 MILL TESTS

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

1.11 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

.2 Submit integrated systems testing reports and verification letter to confirm integrated systems testing for fire protection and life safety systems has been successfully completed in accordance with ULC-1001.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.2 DEWATERING

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

1.3 WATER SUPPLY

.1 Owner will allow use of existing water supply at no cost to the Contractor for renovation Projects.

.2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.

1.4 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be 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 Celsius in areas where construction is in progress.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters, replace bearings and thoroughly clean permanent equipment used during construction.

.8 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 Consultant.

.9 Pay costs for maintaining temporary heat, when using permanent heating system.

.10 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.

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.5 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, electric cranes and other equipment.

.2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

.3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors is not less than 162 lx.

.4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of the Owner 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 three months.

1.6 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, data and internet hook up, line/lines and equipment as required.

1.7 TEMPORARY FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment and fire watch provisions, as necessary, during performance of Work required by insurance companies, authority having jurisdiction and governing codes, regulations and bylaws.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA S269.2-16 (R2021), Access Scaffolding for Construction Purposes.

1.2 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

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

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Indicate on grass parking areas as required.

.5 Provide construction facilities in order to execute work expeditiously.

.6 Remove from site all such work after use.

1.4 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs and any other means for Work.

1.5 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists and cranes shall be operated by qualified operator.

1.6 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with Products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.7 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work. Coordinate parking areas with Owner.

.1 No parking will be permitted in the tree protection zone.

.2 Coordinate turtle nesting sites with Owner and Turtle Protectors if construction procedures will take place during nesting or hatching season.

.3 Parking should be on existing paved surfaces to greatest extent as possible.

.2 Provide and maintain adequate access to project site.

.3 Maintain roadways in area of Work and provide snow removal during period of Work.

.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

.5 Clean roadways and parking areas where used by Contractor's equipment.

1.8 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Consultant.

.3 Provide measures for protection and diversion of traffic, including provision of watchpersons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing public and private roads and allowable load limit on these roads. Contractor is responsible for repair of damage to roads caused by construction operations.

.7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.8 Provide dust control that is adequate to ensure safe operation at all times.

.9 Provide snow removal as required during period of Work.

1.9 SECURITY

.1 Provide and pay for responsible security measures to protect the premises and contents of site during the course of Work up to the date of Substantial Performance of Work.

.2 Provide fencing and additional security as deemed necessary.

1.10 OFFICES

.1 Provide and maintain, in clean condition, office heated to 22 degrees C, adequately lighted and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.

.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

.4 Site offices shall not be located in tree protection zones or in areas near turtle nesting sites. Coordinate locations with Owner.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

.3 Provide and pay for all off site storage as may be required during the duration of this project.

.4 No storage shall be in tree protection zones or in areas near turtle nesting sites. Coordinate locations with Owner.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities.

.3 Except where connected to municipal sewer system, periodically remove wastes from Site.

.4 Keep sanitary facilities clean and fully stocked with the necessary supplies.

1.13 CONSTRUCTION SIGNAGE

.1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Consultant.

.2 Project sign to include a building perspective, provided by the Consultant, project name, name of Owner, Consultant and Contractor, of design style established by Consultant.

.3 Signs or advertisements other than project, warning and safety signs, are permitted on site only at the discretion and approval of the Owner.

.4 Locate signs where directed by the Owner.

.5 Maintain approved signs and notices in good condition for duration of project and dispose of off-site or return for reuse on completion of project or earlier if directed by the Owner.

1.14 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 Stack stored new or salvaged material not in construction facilities.

.4 Remove all temporary construction facilities at end of project and make good all Work. Restore site to pre-existing condition any surfaces, landscaping, products or equipment damaged as result of this contract.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.2 SITE ENCLOSURE

.1 Erect temporary site enclosure using purpose made, prefabricated interlocking metal fence panels minimum 1.8 m in height as approved by the Owner.

.2 Provide at least one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.3 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.4 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 GUARD RAILS AND BARRIERS

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide as required by governing authorities.

1.4 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 in accordance with climate data published in the Building Code for the geographic location of this project.

.4 During cold weather and freezing temperatures, take precautions to protect building and construction materials and maintain temperatures at specified levels.

1.5 DUST TIGHT BARRIERS

.1 Provide dust tight barriers and 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.

1.6 SECURITY

.1 As soon as building construction is sufficiently advanced, enclose and protect openings in envelope with temporary doors, barriers and screens.

.2 Provide temporary doors with necessary hardware to secure building against illegal entry during none-working hours.

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF APPLIED FINISHES

.1 Provide protection for finished and partially finished surfaces and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Do not leave air/vapour barriers or insulation exposed for more than they are intended as per manufacturer’s instructions.

.4 Confirm with Consultant locations and installation schedule 3 days prior to installation.

.5 Be responsible for damage incurred due to lack of or improper protection.

1.11 PROTECTION OF SURROUNDING WORK

.1 Provide protection for finished and partially finished Work from damage.

.2 Provide necessary cover and protection.

.3 Be responsible for damage incurred due to lack of or improper or inappropriate protection.

1.12 FIRE ROUTES

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

1.13 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 – Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Within text of each specifications Section, reference may be made to reference standards.

.2 Conform to 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, Consultant reserves right to have such products or systems tested or to receive test data.

.4 The cost for such testing will be borne by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY ASSURANCE

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.

.5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.

.1 If delays in supply of Products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

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

1.4 STORAGE, HANDLING AND PROTECTION

.1 Store, handle and protect products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's written 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 sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 For exterior storage of fabricated Products, place on sloped supports above ground.

.6 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

.7 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

.8 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.

.9 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.10 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.

.11 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

.12 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

.13 Remove and replace damaged products at own expense and to satisfaction of Consultant.

.14 Touch-up damaged factory finished surfaces to Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name or fire rating plates.

1.5 TRANSPORTATION AND HANDLING

.1 Transport and handle Products in accordance with manufacturer's written instructions.

.2 Pay costs of transportation of Products required in performance of Work.

.3 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

.4 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.6 PRODUCT CHANGES

.1 Change in Product/Products: Submit request for substitution or alternative in accordance with Section 01 62 00 – Product Options and Substitutions.

1.7 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, pedestrians and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.8 MANUFACTURER'S WRITTEN INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Owner or Consultant reserves right to require dismissal from site any workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.10 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.

1.11 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Consultant if there is interference. Install as directed by Consultant.

1.12 REMEDIAL WORK

.1 Refer to Section 01 73 00 - Execution.

.2 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

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

1.13 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.14 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.15 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16 PROTECTION OF WORK IN PROGRESS

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant, at no increase in Contract Price.

.2 Prevent overloading of any part of the Project.

.3 Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Consultant.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 INTENT

.1 This section indicates the criteria for use of optional products listed in the specification and provision for proposing changes to acceptable materials listed during the Bid Period and during the course of construction.

1.2 DEFINITIONS

.1 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 Consultant's determination that materials meet specified requirements and opinion of applicability to the project requirements.

.2 Acceptable Materials listings are deemed to establish the standard of acceptance that Consultant will consider appropriate for the Work.

.3 Any product listed in the Acceptable Materials listing may be used to establish the Bid Price.

.2 Basis-of-Design Materials: The term Basis-of-Design Materials 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 Consultant's preference for a single source product listing based on performance, appearance or configuration.

.2 Use the Basis-of-Design Material to establish the Bid Price, unless an Addendum is issued adding additional Acceptable Materials.

.3 Basis-of-Design Materials designation does not limit the Contractor's ability to submit Proposed Substitutions in accordance with Substitutions requirements of this Section and specific performance requirements listed in Technical Specification Sections.

.3 Non-proprietary specification means a specification which 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 Consultant and Owner.

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 When requested by Consultant, 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 Written verification that the substitute products can be obtained, meet the performance required for the project, and meet requirements of the Building Code.

.3 Manufacturer's literature providing product description, applicable reference standards, and performance and test data.

.4 Samples, as applicable.

.5 Name and address of projects on which product has been used and date of each installation.

.6 For substitutions and requests for changes to accepted products, include in addition to the above, the following:

.1 Itemized comparison of substitution with named product(s). List significant variations.

.2 Designation of availability of maintenance services and sources of replacement materials.

.3 Identify reason for substitution request.

1.4 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.

.3 Basis-of-Design Materials: Use the named product contained in the Basis-of-Design Material listing, unless an addendum is issued indicating acceptance of additional Acceptable Materials.

1.5 SUBSTITUTIONS

.1 Contractor will assemble requests for substitutions requested by subcontractors and submit to Consultant for review.

.2 Consultant will review proposed substitute products for acceptability only when submitted by Contractor; Consultant will not review requests submitted independently by subcontractors.

.3 No substitutions will be permitted without Consultant'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 Consultant's discretion where substitutions are found in the Work that have not been formally accepted by Consultant and Owner.

.4 Consultant 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 will be accepted by the Owner and Consultant, 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 will be accepted by the Owner and Consultant, 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 substitution Contractor represents that:

.1 They have personally investigated the proposal product or manufacturer, or both (unless the proposal explicitly states otherwise), and has determined that it performs in a similar way or is superior to the product or method specified.

.2 The same guaranty will be furnished as for the originally specified product or construction method.

.3 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 They will bear costs and waives claims for additional compensation for costs and time that subsequently become apparent arising out of the substitution.

.5 They will reimburse Owner and Consultant for review or redesign services associated with reapproval by authorities.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit name and address of Surveyor to Consultant.

.2 On request of Consultant, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.2 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practise in the Place of the Work, acceptable to the Consultant and Owner.

1.3 SURVEY REQUIREMENTS

.1 Establish lines and levels, locate and lay out, by instrumentation.

.2 Stake for grading, fill and topsoil placement and landscaping features.

.3 Stake slopes and berms.

.4 Establish pipe invert elevations.

.5 Stake batter boards for foundations.

.6 Establish foundation column locations and floor elevations.

.7 Establish lines and levels for mechanical and electrical Work.

1.4 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by the Consultant.

1.5 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 Consultant 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 Consultant.

1.6 SURVEY RECORD

.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 Locations of maintained, re-routed and abandoned service lines to be completely and properly documented within ‘as-built’ markups submitted by Contractor at project close-out.

1.7 SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if discovered surface or 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 Consultant determine that conditions do differ materially, instructions will be issued for changes in Work by Change Order.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:

.1 Structural integrity of any element of Project.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Visual qualities of sight-exposed elements.

.5 Work of Owner or separate contractor.

.3 Include in request:

.1 Identification of Project.

.2 Location and description of affected Work.

.3 Statement on necessity for cutting or alteration.

.4 Description of proposed Work, and products to be used.

.5 Alternatives to cutting and patching.

.6 Effect on Work of Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

.2 Change in Materials: Submit request for substitution in accordance with Section 01 62 00 – Product Options and Substitutions.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective or non-conforming Work.

.5 Remove samples of installed Work for testing, if not designated in the respective Section as remaining as part of the Work.

.6 Provide openings in non-structural elements of Work for penetrations of associated, electrical and mechanical Work. Limit opening dimensions to minimal sizes required and performed in a neat and clean fashion.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 If possible, 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 or concrete work without prior approval.

.10 Restore work with new products in accordance with requirements of Contract Documents.

.11 Fit Work reasonably close to opening size 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 in accordance with Section 07 84 00 – Firestopping and Smokeseals, for full thickness of the constructed element.

.13 Re-finish surfaces to match adjacent finishes: For continuous surfaces re-finish to nearest intersection; for an assembly, re-finish entire unit.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Cleaning prior to acceptance.

.3 Final product cleaning.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

Part 2 Products

2.1 CLEANING MATERIALS

.1 Cleaning Agents and Materials: Low VOC content.

Part 3 Execution

3.1 PROGRESSIVE CLEANING

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.

.3 Clear snow and ice from area of construction, bank or pile snow in designated areas only as directed by the Owner.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Containers:

.1 Provide on-site containers for collection of waste materials and debris.

.2 Provide and use clearly marked, separate bins for recycling. Refer to Section 01 74 21 - Waste Management and Disposal.

.6 Dispose of waste materials and debris off site.

.7 Clean interior areas prior to start of finish work and maintain areas free of dust and other contaminants during finishing operations.

.8 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

.10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

.12 Lower waste material in a controlled manner. Do not drop or throw materials from heights.

3.2 CLEANING PRIOR TO ACCEPTANCE

.1 Prior to applying for Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Prior to final review, remove surplus products, tools, construction machinery and equipment.

.3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

.5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures.

.7 Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors, structural elements.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Clean and polish surface finishes, as recommended by manufacturer.

.13 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.14 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.15 Remove dirt and other disfiguration from exterior surfaces.

.16 Clean and sweep roofs, gutters, downspouts, and drainage components, areaways, and sunken wells.

.17 Sweep and wash clean paved areas.

.18 Clean equipment and fixtures to a sanitary condition; replace filters of mechanical equipment.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to facilities.

3.3 FINAL CLEANING

.1 Execute final cleaning prior to final project assessment.

.2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

.3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

.4 Replace filters of operating equipment.

.5 Clean site; sweep paved areas, rake clean landscaped surfaces.

.6 Remove waste and surplus materials, rubbish, and construction facilities from the site.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.

.2 Construction and Demolition Waste: Solid wastes typically including but not limited to, building materials, packaging, trash, debris, and rubble resulting from construction, re-modelling, repair and demolition operations.

.3 Hazardous: Exhibiting the characteristics of hazardous substances including, but not limited to, ignitability, corrosiveness, toxicity or reactivity.

.4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including, but not limited to, ignitability, corrosiveness, toxicity, or reactivity.

.5 Non-toxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

.6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.8 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.

.9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.11 Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

.12 Separate Condition: refers to waste sorted into individual types.

.13 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

.15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

.16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing.

.17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

.18 Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.2 WASTE MANAGEMENT GOALS

.1 Waste Management Goal is to divert construction and demolition materials considered recyclable from landfill sites.

.2 Accomplish maximum control of solid construction and demolition waste.

.3 Preserve environment and prevent pollution and environment damage.

1.3 ADMINISTRATIVE REQIUREMENTS

.1 Prior to start of Work conduct meeting with Consultant to review and discuss Waste Management Plan and Goals.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Consultant.

.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 Consultant.

.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.

1.5 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 PREPARATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 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.

.6 Transport waste material to licensed disposal and recycling facilities.

3.3 CLEANING

.1 Remove tools and waste materials on completion of work, leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

Part 1 General

1.1 INTENT

.1 A facility start-up process shall be used to bring the facility to a fully operational state, free of deficiencies, in the most efficient and timely manner achievable.

.2 Contractor shall be responsible for testing, adjusting and balancing of all:

.1 Piped, ducted, wired and wireless services and systems, including all components and equipment forming part thereof, and

.2 Manually and mechanically operated systems including all components and equipment forming part thereof.

.3 Perform starting of each system and each item of equipment in accordance with the general requirements specified in this Section and is specific to facility start-up and commissioning of the facility.

.4 This Section specifies additional requirements to those required for normal Contractor's start-up of equipment and systems as contained in the General Requirements of the Contract, and as follows:

.1 Perform and record tests to confirm proper performance and compliance with requirements of Contract Documents; take corrective action as necessary.

.2 Perform adjustments to ensure proper, efficient and safe operation.

.3 Perform balancing to ensure that the various parts of system are in a proper state of equilibrium.

.5 Performance Testing will begin two weeks prior to declaration of Substantial Performance as described in Section 01 77 00 – Closeout Procedures and will lead to Fine Tuning of equipment and systems.

.6 Fine Tuning will occur prior to declaration of Substantial Performance as described in Section 01 77 00 – Closeout Procedures and will lead to Final Acceptance of the Work.

.7 Owner's representative will oversee the starting, testing, adjusting and balancing operations, and verify that equipment and systems are working as specified and within manufacturer's operating tolerances.

1.2 QUALITY ASSURANCE

.1 Contractor shall perform testing, adjusting and balancing with Contractor's qualified personnel, or employ and pay for a qualified organization to perform such services.

.2 Perform testing, adjusting and balancing after starting of equipment and systems.

.3 Provide personnel, operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

.4 Report to Consultant any deficiencies or defects noted during testing, adjusting and balancing, which cannot be promptly corrected.

Part 2 Products

2.1 MANUFACTURER'S SITE SERVICES

.1 Provide manufacturers authorized representative when specified, or when requested by the Owner at site to do the following:

.1 Inspect, check and approve equipment and systems installation before starting.

.2 Supervise placing equipment and systems in operation.

.2 Manufacturers' authorized representative shall provide a written report verifying that equipment:

.1 Is properly installed and lubricated;

.2 Is in accurate alignment;

.3 Is free from any undue stress imposed by connecting lines or anchor bolts; and,

.4 Is being satisfactorily operated under load conditions.

Part 3 Execution

3.1 PREPARATION

.1 Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during starting process.

.2 Coordinate sequence for starting of various equipment and systems.

.3 Prepare each system and item of equipment for testing, adjusting and balancing.

.4 Verify that each systems and equipment installation is complete and in continuous operation.

.5 Verify ambient conditions.

3.2 FIELD QUALITY CONTROL

.1 Testing, Adjusting and Balancing

.1 Testing: Perform tests to confirm compliance with requirements of Contract Documents. Take corrective action as necessary.

.2 Adjusting: Perform adjustments to ensure proper, efficient and safe operation.

.3 Balancing: Perform balancing to ensure that the various parts of system are in a proper state of equilibrium.

.4 Provide testing, adjusting and balancing of all:

.1 Piped, ducted, wired and wireless services and systems, including all components and equipment forming part thereof as identified in technical Sections, and

.2 Manually and mechanically operated systems including all components and equipment forming part thereof.

.3 Comply with the requirements of all CSA, ASTM, ASHRAE, IEEE and other standards affecting their portion of the work to ensure that systems installed will meet the Owner's testing criteria.

.5 Perform testing, adjusting and balancing after starting of equipment and systems.

.2 Fine Tuning

.1 Fine tuning shall include, but not be limited to, the following:

.1 Air Balancing: final balancing.

.2 Water Balancing: final balancing.

.3 Fire Protection Systems: Verification of fire alarm system and sprinkler system.

.4 Electrical Equipment and Systems: Testing of safety systems and devices.

.5 Other systems and equipment as identified in the technical Sections.

.2 Fine tuning shall commence upon Owner's acceptance of Performance Testing results.

.3 Coordinate and cooperate with the Owner's Representative.

.4 Make necessary adjustments to comply with standards established by the Specifications ready for Owner's formalized verification and commissioning process.

.5 Contractor shall do the following during Fine Tuning:

.1 Correct all Contract Deficiencies previously outstanding and those identified during Fine Tuning.

.2 Execute Change Orders issued by Owner.

.3 Perform all other work and activities required for fulfillment of prerequisites to Final Acceptance of the Work as specified in Section 01 77 00 – Closeout Procedures.

.6 Owner will do the following during Fine Tuning:

.1 Conduct user surveys and take environmental measurements as necessary to identify existing and potential problems.

.2 Initiate Change Orders as required.

.3 Perform other activities related to Final Acceptance of the Work as specified in Section 01 77 00 - Closeout Procedures.

3.3 FACILITY START-UP

.1 Contractor shall do the following during Facility Start-Up, not necessarily in order listed:

.1 Start equipment and systems as specified below.

.2 Test, adjust and balance equipment and systems as specified below.

.3 Demonstrate equipment and systems as specified in Section 01 79 00 – Demonstration and Training.

.4 Complete and submit Facility Start-Up report forms including:

.1 Contractor's system and equipment start-up reports.

.2 Testing, adjusting and balancing reports.

.3 Manufacturers' equipment start-up reports.

.5 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with requirements of Contract Documents.

.6 Correct Contract Deficiencies identified as a result of the foregoing and as may be identified by the Owner.

.7 Execute Change Orders issued by the Owner.

.8 Perform all other work and activities required for fulfillment of prerequisites to Substantial Performance of the Work as specified in Section 01 77 00 - Closeout Procedures.

3.4 STARTING

.1 Verify that each item of equipment has been checked for proper lubrication; drive rotation, belt tension, control sequence, and other conditions affecting starting and operation; take corrective action as necessary.

.2 Execute starting under supervision of Contractor’s personnel and, when specified or requested by Owner, manufacturer's authorized representative.

.3 Place equipment and systems in operation in proper sequence and in accordance with approved Contractor’s Start-Up sub-schedule.

.4 Take corrective action as necessary.

3.5 SEASONAL CONSTRAINTS

.1 Notwithstanding all-inclusive requirements specified in this Section, additional separate cycles of Facility Start-Up, Performance Testing and Fine Tuning may be necessitated at a later time on equipment and systems whose full operation is dependent on seasonal conditions.

.2 Contractor’s responsibilities with respect to such later Facility Start-Up activities shall be as specified in this Section.

3.6 PARTIAL UTILIZATION OF WORK

.1 Applicable requirements specified in this Section shall apply to the parts of the Work being utilized when partial utilization of the Work is required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Underwriters' Laboratories of Canada (ULC):

.1 ULC1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems (CAN/ULC S1001-11)

1.2 CONTRACTOR'S INSPECTION FOR SUBSTANTIAL PERFORMANCE

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Contractor shall prepare a list of deficiencies and issued to appropriate sub-contractors and a copy will be forwarded to the Consultant.

.2 When Contractor is satisfied that Substantial Performance has achieved; make application to Consultant. Include copy of deficiencies complete with date of scheduled completion.

.3 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.4 Request Consultant's Review.

.5 Consultant's Field Review: Consultant 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 Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.

.4 Certificates required by authorities having jurisdiction have been submitted.

.5 Verification letter required to confirm integrated systems testing for fire protection and life safety systems has been successfully completed in accordance with ULC-1001.

.6 Operation of systems have been demonstrated to Owner's personnel.

.7 Work is complete and ready for final inspection.

1.3 OWNER AND CONSULTANT REVIEW

.1 Upon receipt of application of Substantial Performance and associated documents, the Consultant will arrange for a review. Representatives of the Consultant, Sub-Consultants and Owner will be present at the review.

.2 Contractor shall arrange for all major subcontractors to have representatives available to attend this review.

.3 The Consultant will verify that Substantial Performance has been attained and that the list of deficiencies provided by the Contractor reflects the completeness of the project. Any additional items identified during the inspection will be appended to the Contractor's deficiency list. Correct defective and deficient Work accordingly.

.4 The date of Ready for Takeover will be verified at this review and the Consultant will confirm a date for final review.

1.4 FINAL REVIEW AND DECLARATIONS

.1 Final Review: When items noted above are completed, request final review of Work by Owner, Consultant and Contractor. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request review.

.2 Declaration of Substantial Performance: When the Consultant considers the requirements of the Contract are substantially performed in accordance with the Construction Act, make application for Certificate of Substantial Performance.

.3 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period as required by Construction Act.

.4 Final Payment:

.1 Complete outstanding items and request re-inspection by the Consultant.

.2 When Consultant considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.5 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement. Holdback will be paid in accordance with the Construction Act.

1.5 REINSPECTION FEES

.1 Should it become evident that Substantial Performance has not been achieved at time of Consultant review, the Contractor will be responsible for expenses incurred for any subsequent reviews required due to lack of completeness of project.

1.6 CLEANING

.1 Complete cleaning in accordance with Section 01 74 11 - Cleaning.

.2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 CLOSEOUT SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, one electronic copy of operating and maintenance manuals in Canadian English.

.4 Copy will be returned after final inspection, with Consultant's comments.

.5 Revise content of documents as required prior to final submittal.

.6 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.

.7 If requested, furnish evidence as to type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous reviews. Replace products at own expense.

.9 Pay costs of transportation.

.10 Submit `redline` marked up as built construction drawings to the Consultant within 30 days of Substantial Performance and prior to Ready for Takeover.

.11 Provide one final hard copy and one electronic copy, on USB stick drive, to the Owner.

.1 Electronic copy of Operation and Maintenance Manual in same format as noted in this Section. Provide one complete PDF with clickable links. All disciplines and scanned as-builts shall be on one USB stick.

.2 Submit electronic copy all progress photos taken during duration of construction with final submission of Operation and Maintenance Manuals. No hard copy of photographs to be included.

1.2 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.

.3 Use multiple binders, when required, and correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover and Spine: 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 fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings:

.1 Provide printed 279 x 432 mm as built site drawings with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.2 Provide electronic copy of scanned full size As-Builts on each USB stick.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: Provide:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.4 Schedule of products and systems indexed to content of volume.

.2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions. Include original manufactures brochures and written information on products and equipment installed on this project.

.4 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions. Include original manufactures brochures and written information on products and equipment installed on this project.

.5 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.6 Parts Diagrams: Provide complete component descriptions; exploded parts diagrams for each piece of equipment and/or product provided.

.7 Inventory directory relating to information on installed systems, equipment and components.

.8 Inventory and location of spare parts, special tools and maintenance materials.

.9 Approved project shop-drawings, product and maintenance data.

.10 Product WHIMS sheets.

.11 Manufacturer's data and recommendations relating manufacturing process, installation, commissioning, start-up, Operation and Maintenance, shutdown and training materials.

.12 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.13 Warranty Management Plan.

.14 Maintenance program supporting information including:

.1 Recommended maintenance procedures and schedule.

.2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

.15 Training: refer to Section 01 79 00 - Demonstration and Training.

.16 Copy of Final Survey (Real Property Report).

.17 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction.

1.4 SUPPORTING DOCUMENTATION

.1 Provide supporting documentation relating to installed equipment and system, including:

.1 General:

.1 WHMIS information manual.

.2 Approved "as-built" drawings and specifications.

.3 Procedures used during commissioning.

.4 Cross-Reference to specification sections

.2 Architectural and Structural:

.1 Inspection certificates, construction permits.

.1 Copy of Building Permit and Occupancy Permit

.3 Mechanical:

.1 Installation permits, inspection certificates.

.1 Piping pressure test certificates.

.2 Ducting leakage test reports.

.3 TAB and PV reports.

.4 Copies of posted instructions.

.4 Electrical:

.1 Installation permits, inspection certificates.

.1 TAB and PV reports.

.2 Electrical work logbook.

.3 Charts and schedules.

.4 Locations of cables and components.

.5 Copies of posted instructions.

1.5 AS-BUILT DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label as-built 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 as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.

.5 Keep as-built documents and samples available for viewing by Consultant.

.6 Provide a scan copy of record documents for inclusion into the O&M manuals.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of drawings, and in copy of Project Manual.

.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed 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, field test records, required by individual specifications Sections and completed during course of Work.

1.7 FINAL SURVEY

.1 Submit Grading Certificate to authority having jurisdiction requirements.

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

1.8 REAL PROPERTY CERTIFICATE

.1 Supply to the Consultant, as soon as construction of foundations and basic ground floor levels are completed, a survey plan from a registered Ontario Land Surveyor.

.2 Plan shall show dimensioned building plan at ground level, distance from property lines, and elevation of the floor used as datum.

.3 This includes all buildings in Contract.

1.9 EQUIPMENT AND SYSTEMS

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

.2 Panelboard Circuit Directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

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

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

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

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide a list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports and integrated systems testing reports as specified in Section 01 45 00 – Quality Control.

.15 Additional Requirements: As specified in individual specification sections or as noted on drawings.

1.10 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalog number, size, composition, and colour and texture designations. Provide information for reordering 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 recommend schedule for cleaning and maintenance.

.4 Additional Requirements: As specified in individual specification sections or as noted on drawings.

1.11 SPARE PARTS AND MAINTENANCE MATERIALS

.1 Provide spare parts, 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 as directed.

.4 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Operating and Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.12 EXITING SIGNAGE

.1 Provide computer generated signage for emergency passage exiting of building. Provide minimum 305 x 305 mm size signs to include at locations as required by Authority having Jurisdiction for building exiting.

.2 Prepare fire safety plan in accordance with Fire Code and local fire bylaw unless specified otherwise by the Owner. Locate in Fire Safety Plan Box. Provide fire key cylinder at location on exterior of building for Entrance by Fire Station Personnel. Provide and coordinate type of storage and location with local Fire Station and authority having jurisdiction.

1.13 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section or as noted on drawings.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site, location as directed, place and store as directed by the Owner.

.4 Receive and catalogue items. Submit inventory listing to Consultant. Include approved listings in Operating and Maintenance Manual.

1.14 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.15 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 Owner and Consultant.

.3 Warranty management plan to include required actions and documents to assure that Owner 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 Consultant 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 (10) days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.8 Conduct joint eleven month warranty inspection, measured from time of acceptance, by Consultant.

.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, HVAC balancing, pumps, motors, transformers, and systems such as fire protection, alarm systems, sprinkler systems, and lightning protection systems.

.3 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.4 Contractor's plan for attendance eleven 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 Consultant to proceed with action against Contractor.

1.16 PRE-WARRANTY CONFERENCE

.1 Meet with Consultant and Owner to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by Contractor.

.2 Consultant 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.

1.17 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Consultant.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Administrative and procedural requirements for demonstration and instruction of Products, equipment and systems to Owner's personnel.

1.2 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of Substantial Performance.

.2 Owner will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.4 COMPONENT DEMONSTRATION

.1 When requested by Consultant, manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

.2 Instruct Owner's personnel and provide written report that demonstration and instructions have been completed.

1.5 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Consultant's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Give time and date of each demonstration, with list of persons present.

1.6 CONDITIONS FOR DEMONSTRATIONS

.1 Testing, adjusting, and balancing has been performed in accordance with Mechanical and Electrical conditions of the Work and equipment and systems are fully operational.

.2 Provide copies of completed Operation and Maintenance manuals for use in demonstrations and instructions.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 PREPARATION

.1 Verify that suitable conditions for demonstration and instructions are available.

.2 Verify that designated personnel are present.

.3 Prepare agendas and outlines.

.4 Establish seminar organization.

.5 Explain component design and operational philosophy and strategy.

.6 Develop equipment presentations.

.7 Present system demonstrations.

.8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.

.2 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.

.4 Review contents of manual in detail to explain all aspects of operation and maintenance.

.5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

3.3 TIME ALLOCATED FOR INSTRUCTION

.1 Ensure adequate amount of time required for instruction of each item of equipment or system is allotted for.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Removal of existing construction necessary to permit installation or performance of other Work and fitting and repairing work required to restore surfaces to original conditions after installation of other Work.

1.2 RELATED REQUIREMENTS

.1 Individual Product Specification Sections:

.1 Cutting and patching incidental to work of the section.

.2 Advance notification to other sections of openings required in Work of those sections.

.3 Limitations on cutting structural members.

1.1 DEFINITIONS

.1 Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

.2 Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

.1 Extent: Describe cutting and patching, show how they will be performed.

.2 Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

.3 Products: List products to be used and firms or entities that will perform the Work.

.4 Dates: Indicate when cutting and patching will be performed.

.5 Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

.6 Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering

calculations showing integration of reinforcement with original structure to the Consultant prior to making cuts or modifications.

.7 Consultant's Acceptance: Obtain acceptance of cutting and patching proposal before cutting and patching. Review and acceptance of cutting and patching proposal does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

.1 Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load deflection ratio.

.2 Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety, including primary operational systems and equipment, air or smoke barriers, fire protection systems, control systems, communications systems or electrical wiring systems.

.3 Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Consultant's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner. If possible, retain original Installer or fabricator to cut and patch exposed Work. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm. Work may include, but is not limited to, concrete finishes, firestopping and smokeseals, flooring, wall coverings and HVAC enclosures, cabinets or covers.

.4 Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety, including but not limited to, water, moisture or vapour barriers, membranes or flashings, piping, ductwork, vessels and equipment, or noise and vibration control elements and systems.

1.5 SITE CONDITIONS

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this Section.

.2 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous as defined in the Hazardous Product Act be encountered, stop work, take preventative measures, and notify Consultant and Owner immediately.

1.6 WARRANTY

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

Part 2 Products

2.1 MATERIALS

.1 General: Comply with requirements specified in other Sections of these Specifications.

.2 Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible:

.1 If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

.2 Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 62 00 – Product Options and Substitutions.

Part 3 Execution

3.1 EXAMINATION

.1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

.1 Provide X-ray or other approved methods to determine locations of existing services and reinforcing in existing concrete slabs and block walls before cutting and renovations. Advise Consultant of findings before proceeding with the Work and revise penetration locations as required and directed by Consultant. Existing concrete slab thickness is to be confirmed by Contractor.

.2 Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

.3 Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

.2 After uncovering existing Work, assess conditions affecting performance of work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

.1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

.2 Protection:

.1 Protect existing construction during cutting and patching to prevent damage.

.2 Provide protection from elements for areas which may be exposed by uncovering work.

.3 Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

.4 Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 CUTTING AND PATCHING

.1 Employ skilled and experienced workers to perform cutting and patching.

.1 Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

.2 Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations:

.1 In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

.2 Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

.3 Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond core drill.

.4 Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

.5 Proceed with patching after construction operations requiring cutting are complete.

.3 Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications:

.1 Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

.2 Floors and Walls: Where walls or partitions that are removed extend from one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, colour, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.3 Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over

entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

.4 Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

.5 Maintain existing fire ratings as required.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section requires the selective removal and subsequent offsite disposal of the following:

.1 Portions of existing building indicated on drawings and as required to accommodate new construction.

.2 Removal of doors and frames as indicated.

.3 Removal and protection of existing fixtures, materials, and equipment items indicated to remain.

1.2 RELATED REQUIREMENTS

.1 Cutting nonstructural concrete floors and masonry walls for piping, ducts, and conduits is included with the work of the respective mechanical and electrical specifications.

.2 Cutting holes in roof deck for installation of new rooftop mechanical equipment is specified in Mechanical drawings.

.3 Remodeling construction work and patching are included within the respective Sections of specifications, including removal of materials for reuse and incorporation into remodeling or new construction.

.4 Relocation of pipes, conduits, ducts, and other mechanical and electrical work is specified in other Divisions.

.5 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division Specification Sections, apply to this Section.

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

.3 Making Good: making good (make good) shall include repairing, filling or refinishing operations performed on existing floors, walls, ceilings or any other exposed surfaces. It is intended that finished surfaces match and align with existing adjoining surfaces.

.4 Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.

.5 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.6 Remove and Salvage: Detach items from existing construction and deliver them to Owner.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

.2 Schedule indicating proposed sequence of operations for Selective Demolition Work to Consultant for review prior to start of Work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

.1 Provide detailed sequence of demolition and removal Work to ensure uninterrupted progress of Owner's on-site operations.

.3 Shoring Submittal: Include structural analysis data and drawings signed, dated and sealed by the qualified professional engineer responsible for their preparation. The Engineer shall be licensed in the state where the Work resides. The submittal to the Consultant is for their “records”.

.4 Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Consultant prior to start of Work.

1.5 SITE CONDITIONS

.1 Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

.1 Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of Selective Demolition Work.

.2 Partial Demolition and Removal: Owner maintains first right of salvage. Items indicated to be removed but of salvageable value to Contractor, and not required to be salvaged for Owner, may be removed from structure as Work progresses. Transport salvaged items from site as they are removed.

.1 Storage or sale of removed items on site will not be permitted.

.3 Protections: Provide temporary barricades and other forms of protection to protect general public from injury due to Selective Demolition Work.

.1 Erect temporary covered passageways as required by authorities having jurisdiction.

.2 Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or Work to remain. Responsibility for all aspects of shoring, in concept and in execution, shall reside with the Contractor doing the Work.

.3 Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

.4 Protect floors with suitable coverings when necessary.

.5 Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.

.6 Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

.7 Remove protections at completion of Work.

.4 Damages: Promptly repair damages caused to adjacent facilities by Selective Demolition Work.

.5 Traffic: Conduct Selective Demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

.1 Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

.6 Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

.7 Explosives: Use of explosives will not be permitted.

.8 Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

.1 Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

.9 Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

.1 Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 PREPARATION

.1 General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

.1 Cease operations and notify Consultant immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

.2 Cover and protect equipment, and fixtures from soilage or damage when Selective Demolition Work is performed in areas where such items have not been removed.

.3 Provide weatherproof closures for exterior openings resulting from Selective Demolition Work.

.4 Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

3.2 DEMOLITION

.1 General: Perform Selective Demolition Work in a systematic manner. Use such methods as required to complete Work indicated on Drawings in accordance with demolition schedule and governing regulations. Do not proceed with Selective Demolition Work where shoring is required, until engineering analysis, drawings and reports have been completed and submitted to Consultant.

.1 Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.

.2 Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

.3 Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

.4 Demolish foundation walls to a depth of not less than 12 inches below existing ground surface. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs.

.5 For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

.2 If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Consultant in written, accurate detail. Pending receipt of directive from Consultant, rearrange Selective Demolition schedule as necessary to continue overall job progress without undue delay.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

.1 Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

.1 If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

.2 Burning of removed materials is not permitted on project site.

3.4 CLEANING AND REPAIR

.1 General: Upon completion of Selective Demolition Work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.

.1 Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by Selective Demolition Work.

.2 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights-of-way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.

END OF SECTION

Part 1 General

1.1 INTENT

.1 This Section includes, but not limited to, the following:

.1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris.

.2 Selective demolition to allow new construction materials to meet existing construction as indicated.

.3 Repair procedures for selective demolition operations.

.2 This Section does not include the following:

.1 Removal of hazardous materials or asbestos abatement.

.2 Demolition of exterior building components or structural elements.

.3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):

.1 ANSI A10.8-2019, Safety Requirements for Scaffolding.

.2 American Society for Testing and Materials International, (ASTM):

.1 ASTM C475/C475M-17(2022), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.3 Canadian Standards Association (CSA):

.1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures (withdrawn).

.4 Department of Justice Canada (Jus):

.1 Motor Vehicle Safety Act (MVSA), 1993, c.16.

.2 Hazardous Products Act (R.S.C), 1985, c.H-3

.3 Hazardous Materials Information Review Act, 1985, c.24.

.5 National Fire Protection Association (NFPA):

.1 NFPA 241-22, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

.6 Provincial Legislation:

.1 Legislation specific to Authority Having Jurisdiction for work governed by this Section.

.7 Definitions:

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

.3 Making Good: making good (make good) shall include repairing, filling or refinishing operations performed on existing floors, walls, ceilings or any other exposed surfaces. It is intended that finished surfaces match and align with existing adjoining surfaces.

.4 Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.

.5 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.6 Remove and Salvage: Detach items from existing construction and deliver them to Owner.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

.2 Coordination for shutoff, capping, and continuation of utility services.

1.4 ACTION SUBMITTALS / INFORMATION SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Qualification Data: For firms and persons specified below to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses and other information specified.

.3 Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Owner reserves the right to make modifications where proposed methods interfere with the Owner’s ongoing operations.

.4 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.

.5 Pre-demolition Digital Photographs or Video: Submit photographs or video indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:

.1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.

.2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.

.2 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:

.1 Conform to the Workers Compensation Act and the Occupational Health and Safety Regulations under the Act.

.2 Conform to local bylaws and regulations governing this type of work.

1.6 SALVAGEABLE AND RECYCLABLE MATERIALS

.1 Except where otherwise specified, all materials indicated or specified to be permanently removed from the Place of the Work shall become Construction Manager's property. Maximize to the fullest extent possible, salvage, and recycling of such materials, consistent with proper economy and expeditious performance of the Work.

.2 To reduce the quantity of material otherwise destined for disposal at a landfill, the Contractor is encouraged to consider utilizing the services of businesses and non-profit organizations that specialize in salvage and recycling of used building materials, but does so at his own option and risk.

.3 A current listing of recyclers specializing in specific categories of materials may be obtained during normal office hours from:

Ministry of Environment
Public Information Centre
Phone: (416) 325-4000 or 1-800-565-4923
or by viewing
Ontario Environment Business Directory (OEBD)
Website: www.ontario.ca/page/ontario-environment-business-directory

.4 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.7 EXISTING CONDITIONS

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this Section.

.2 Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous as defined in the Hazardous Product Act be encountered, stop work, take preventative measures, and notify Consultant and Owner immediately.

Part 2 Products

2.1 TEMPORARY SUPPORT STRUCTURES

.1 Design temporary support structures required for demolition work and underpinning and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in province of the Work.

2.2 DEBRIS

.1 Make all arrangements for transport and disposal of all demolished materials from the site.

2.3 EQUIPMENT

.1 Provide all equipment required for safe and proper demolition work as described in this Section and as the Drawings.

2.4 MATERIALS

.1 Use repair materials identical to existing materials:

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

.2 Use material whose installed performance equals or surpasses that of existing materials.

.3 Comply with material and installation requirements specified in individual Specification Sections.

.2 Floor Patching and Levelling Compounds: Cement based, trowelable, self-levelling compounds compatible with specified floor finishes. Gypsum based products are not acceptable for work of this Section.

.3 Concrete Unit Masonry: Lightweight concrete masonry units and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.

.4 Gypsum Board Patching Compounds: Joint compound to ASTM C475, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 – Gypsum Board Assemblies.

.5 Hoarding and Dust Screens: Refer to Section 01 56 00 –Temporary Facilities and Controls for stud framing and gypsum board sheathing materials.

Part 3 Execution

3.1 EXAMINATION

.1 Inspect building with Consultant and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Verify that utilities have been disconnected and capped as required.

.3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

.4 Notify the Consultant where existing mechanical, electrical, or structural elements conflict with intended function or design:

.1 Investigate and measure the nature and extent of conflict and submit a written report to Consultant.

.2 Consultant will issue additional instructions or revise drawings as required to correct conflict.

.5 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 PREPARATION

.1 Identify and mark all equipment and materials identified to be retained by Owner or to be re-used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.

.2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.

.3 Confirm that all electrical and telephone service lines entering building are not disconnected.

.4 Do not disrupt active or energized utilities crossing the demolition site.

.5 Provide and maintain barricades, warning signs, protection for workmen during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.

.6 Mark all materials required to be re-used, store in a safe place until ready for re-installation.

.7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.

.8 Protection of In-Place Conditions

.1 Take precautions to guard against damage to adjacent work. Be liable for any damage or injury caused.

.2 Cease operations and notify the Consultant if safety or any adjacent work appears to be endangered. Do not resume operations until reviewed with the Consultant.

.3 Ensure safe passage of building occupants around and through area of demolition.

.4 Cease operations and notify the Owner and Consultant immediately for special protective and disposal instructions when asbestos materials or other hazardous materials are suspected or uncovered during the work of this project.

.5 Protect temporarily suspended work that is without continuous supervision to prevent access by unauthorized persons.

.6 Protect building systems, services and equipment.

.7 Keep noise, dust, and inconvenience to occupants to minimum.

.8 Protect building systems, services and equipment.

.9 Provide temporary dust screens, covers, railings, supports and other protection as required.

.10 Provide and maintain fire prevention equipment and alarms accessible during demolition.

.11 Do Work in accordance with Section 01 35 29 – Health and Safety Requirements.

.9 Utility Services

.1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.

.2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

.1 Arrange to shut off affected utilities with utility companies.

.2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

.3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

.4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound.

.3 Coordinate with mechanical and electrical sections for shutting off, disconnecting, removing, and sealing or capping utilities.

.4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 CONCRETE SLAB REINFORCING

.1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non-destructive, non-ionizing radio frequency locators.

.2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Engineer where slab features interfere with core drilling.

.3 Notify the Engineer immediately for further instructions where coring or cutting will damage existing slab features.

3.4 DEMOLITION

.1 Unless otherwise specified, carry out demolition in accordance with CSA S350.

.2 Completely demolish the items scheduled and immediately remove materials from the premises.

.3 Carry out demolition in an orderly and careful manner and in strict accordance with all regulations.

.4 Lower waste materials in a controlled manner; do not drop or throw materials from heights.

.5 Demolish in a manner to minimize dusting and to prevent migration of dust.

.6 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.

.7 Selling or burning of materials on the site is not permitted.

.8 Remove concrete bases by cutting and chipping, take precautions against slab cracking and degradation. Grind edges smooth, fill and make level with self levelling grout.

.9 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.

.1 Provide bond beams in new openings cut into existing concrete masonry unit walls.

.2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.

.10 Fill all openings in gypsum board walls and ceilings with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.

.11 Demolish existing flooring and adhesive remnants as follows:

.1 Vacuum existing flooring thoroughly, prior to removal, using vacuum equipped with power head/sweeper.

.2 Apply fine mist water spray to floors to minimize dust generation during removal. Avoid spraying near electrical outlets.

.3 Demolish existing residual floor finishes, remove and dispose of off site.

.4 Remove adhesive to the greatest extent possible using scrapping tools and as follows:

.1 Do not use solvent based cleaners to remove adhesive remnants.

.2 Lightly shot blast or grind floor using machine designed for purpose to remove adhesive remnants.

.3 Vacuum floor ready for application of skim coating.

.4 Repair all slab depressions and damage with cementitious patching compound.

.5 Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.

.5 Floor substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through flooring materials.

.12 Demolish existing tile finishes. Remove setting bed or adhesive to the greatest extent possible using mechanical scrapping tools and as follows:

.1 Saw cut edge of tile for clean and even transition joint between existing tile to remain and new flooring materials.

.2 Lightly shot blast or grind floor to remove remnants of setting materials.

.3 Vacuum floor ready for application of skim coating.

.4 Repair all slab depressions and damage with cementitious patching compound. Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.

.13 Demolish ceiling finishes as indicated on drawings.

.14 Remove all wall coverings scheduled for demolition. Patch and repair wall surfaces with skim coat of gypsum board joint compound leaving wall surfaces smooth and even ready for new wall finishes.

.15 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.16 Patch and repair all mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.5 RESTORATION

.1 Make good any demolition to the existing work beyond that necessary for carrying out new work, at no expense to the Owner.

3.6 CORING, DRILLING AND SAW-CUTTING CONCRETE

.1 Complete an x-ray or ultrasound inspection of affected concrete area before coring. Employ the services of an experienced inspector in accordance with Delegated Design requirements. Confirm with Owner before coring or drilling, location of reinforcing steel and raceways that may be present.

.2 Perform coring and drilling after normal working hours, unless specified otherwise. Confirm coring and drilling times with Owner.

.3 Wet or dry core drilling and saw-cutting are acceptable. Reduce amount of cooling water used to minimum required and collect water used in suitable containers, or use a suitable vacuum system that will collect water.

.4 Do not core structural beams or cut conduits or reinforcing steel without written permission from Owner.

3.7 PATCHING AND REPAIRING

.1 Floors and Walls:

.1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.

.2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.

.3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Patch with durable seams that are as invisible as possible.

.5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

.6 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire

unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

.7 When requested, test and inspect patched areas after completion to demonstrate integrity of installation.

.8 Maintain fire rating of existing and new construction.

.2 Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.8 CLEANUP

.1 Remove all tools and equipment from site.

.2 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.

.3 Maintain access to exits clean and free of obstruction during removal of debris.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 The Work in this Section is concrete finishing and shall include all labor, materials and equipment to complete the installation.

.1 Preparation Work, including sub-grade preparation, compaction, finish grading, construction of formwork, placement of screeds, and installation of reinforcement, when required, shall be done by a qualified Contractor(s).

.2 Provide, place and finish concrete as specified elsewhere.

.3 Provide all necessary or required special concrete preparation as specified elsewhere.

.4 Provide all necessary repair and patch Work.

1.2 RELATED SECTIONS

.1 Structural Drawings – Cast-in-place Concrete.

.2 Section 09 05 23 – Common Work Results for Flooring Preparation

.3 Section 09 67 23 – Resinous Flooring.

.4 Section 32 13 15 – Concrete Sidewalks and Curbs.

1.3 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 C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.2 ASTM C881/C881M-20a, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

.3 ASTM D1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.4 ASTM D3575-20, Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers.

.3 Canadian Standards Association (CSA):

.1 CSA-A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Testing Methods and Standard Practices for Concrete

.4 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule #1113-16, Architectural Coatings.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with concrete floor placement and concrete floor curing, and other work having a direct bearing on work of this section.

1.5 ACTION SUBMITTALS / INFORMATION SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and data sheet for each product specified.

.2 Submit WHMIS SDS - Safety Data Sheets. WHMIS SDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.

.3 Include application instructions for concrete floor treatments.

1.6 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 in accordance with Section 01 78 00 – Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Performance Requirements

.1 Product quality and quality of work in accordance with Section 01 61 00 – Common Product Requirements.

.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in manufacturer's packaging including application instructions.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Temporary Lighting: Minimum 1200 W light source, placed 2.5 m above the 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 degree C from seven 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 product 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 and in accordance with OH & S Regulations.

.3 Provide continuous ventilation during and after coating application.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

.1 Refer to Structural Drawings for Slab Cambers as these numbers will rule over the items below.

.2 Exterior Slabs: Floors having a straightedge value of ±8 mm over 3050 mm, similar to CSA A23.1 Class A Slab Finishing.

.3 Interior Slabs: Floors having a straightedge value of ±5 mm over 3050 mm; similar to CSA A23.1 Class C Slab Finishing.

2.2 LEVELLING MATERIALS

.1 Overlayment: Cementitious, self levelling, single component, polymer modified overlayment, for application thicknesses as recommended by the manufacturer.

.1 Acceptable Materials:

.1 NXT Level SP, Laticrete.

.2 Ultraplan 1 Plus, MAPEI Inc.

.3 Sikafloor Level 25, Sika Canada Ltd.

.2 Underlayment: as specified in Section 09 05 23 – Common Work Results for Flooring Preparation.

.3 Patching and Flash Patching Materials: Section 09 05 23 – Common Work Results for Flooring Preparation.

.4 Fine Finish Flash Patching Materials: Section 09 05 23 – Common Work Results for Flooring Preparation.

2.3 CRACK REPAIR MATERIALS

.1 Crack repair and filler: two-component, nonshrink, 100% solids, moisture-insensitive, VOC free, and meeting the requirements of ASTM C881.

.1 Basis-of-Design Materials:

.1 Mapefloor Patch, MAPEI Canada Inc.

2.4 HARDENERS

.1 Type: Sodium silicate, permanent penetrating sealer and hardener.

.1 Liquid applied, water based, chemically reactive.

.2 Non-toxic, non-flammable, and anti-dusting have low or no VOC.

.3 Colour: colourless.

.4 Acceptable Materials:

.1 Protech III, Cornerstone Coatings.

.2 Ashford Formula, Curecrete.

.3 Pentra-Hard, Dayton Superior

.4 Euco Diamond Hard, Euclid Chemical Company.

.5 L & M Seal Hard, Laticrete International, Inc.

.6 Mapecrete Hard SI, Mapei Inc.

.7 Sikafloor 3S, Sika Canada.

.8 Liqui-Hard, W.R. Meadows Inc.

.2 Water: potable.

2.5 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.

2.6 MIXES

.1 Mixing, ratios and application in accordance with manufacturers instructions.

2.7 ACCESSORIES

.1 Expansion Joint Filler: flexible, lightweight, non-staining closed cell polyethylene. Chemical resistant Ultraviolet stable and low density compressible foam having the following properties:

.1 Density: 32.04 kg/cu.m to ASTM D1751

.2 Compression, ASTM D3575

.1 10% Deflection: 69 KPa maximum

.2 80% Deflection: 862.49 KPa maximum

.3 Tensile Strength: 379.5 KPa to ASTM D3575

.4 Water Absorption: 0.5% volume maximum to ASTM D3575

.5 Basis-of-Design Materials:

.1 Deck-O-Foam, W.R. Meadows

.2 Edge Joint Filler: ASTM D1751, bituminous impregnated fibreboard, 13 mm thick minimum.

.3 Control Joint Filler: as indicated in Section 07 92 00 – Sealants.

.4 Waterstop Gasket and Waterstop Sealant: ribbed PVC waterstop with centerbulb, type to suit application.

.1 Basis-of-Design Materials:

.1 Ribbed PVC Waterstops, Durajoint Concrete Accessories.

Part 3 Execution

3.1 EXAMINATION

.1 Prepare floor surface in accordance with CSA A23.1.

.2 Verify that slab surfaces are ready to receive the work of this section.

3.2 REPAIRS

.1 Inspect surfaces for defects immediately after removal of forms. Repair or patch defects within 48 hours of removal of forms with cure repairs same as new concrete with Consultants permission.

.2 Defective Areas: where patches are allowed, repair and patch areas to match surrounding areas in texture and colour.

3.3 PREPARATION OF EXISTING SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

.2 Bring to an even, level or sloping surface as indicated on the drawings the tops of all floor slabs, including slabs on grade, ready to receive the specified finish.

.3 Provide minimum floor flatness (F_F) required to CSA-A23.1/A23.2, Table 16, as indicated above.

.4 Finish interior floors indicated as exposed concrete 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 Use strong solvent or mechanical stripping to remove chlorinated rubber or existing surface coatings.

.6 Use protective clothing, eye protection, and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.4 FINISHING FORMED SURFACES

.1 Requirements listed below apply to normal structural concrete; refer to Structural Drawings – Cast-in-Place Concrete for additional requirements for formed exposed architectural concrete.

.2 Unspecified Finish: Provide following finishes as applicable when finish of formed surfaces is not specifically indicated:

.1 Unexposed Surfaces:

.1 Rough form finish for concrete not exposed to view.

.2 Smooth form finish for concrete to receive membrane waterproofing.

.2 Exposed Surfaces:

.1 Smooth form finish for concrete surfaces exposed to view.

.3 Rough Form Finish: Leave surfaces with texture imparted by forms; patch tie holes and defects; remove fins longer than 6 mm high.

.4 Smooth Form Finish: Coordinate as necessary to secure form construction using smooth, hard, uniform surfaces with number of seams kept to a minimum, uniformly spaced in an orderly pattern; patch tie holes and defects; completely remove fins.

.5 Related Unformed Finish: Strike-off concrete smooth and finish with using texture matching adjacent formed surfaces at tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces; continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces.

.6 Penetrating Sealer Finish: Apply penetrating sealer to vertical surfaces after any patching, joint sealing or caulking is completed in accordance with manufacturer's written instructions.

3.5 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.

.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 power-driven trowel (only use hand trowel where power-driven trowel cannot be used) 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 to be covered with resinous flooring system.

.4 Finish surfaces to the tolerances indicated above.

.4 Broom Finishing:

.1 Apply a broom finishing to exterior concrete sidewalks, platforms, steps, and ramps, and elsewhere as indicated.

.2 Slightly roughen trafficked surface by brooming with fibre bristle broom perpendicular to main traffic route immediately after float finishing.

.3 Coordinate required final finishing with Consultant and Section 32 13 15 – Concrete Sidewalks and Curbs before application.

3.6 APPLICATION: GENERAL

.1 Seal control joints and joints at junction with vertical surfaces with sealant after floor treatment is dry.

.2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.3 Clean overspray. Clean sealant from adjacent surfaces.

.4 Cure concrete in accordance with manufacturers recommended procedures.

3.7 APPLICATION: LIQUID APPLIED FLOOR HARDENER

.1 Provide hardener on all exposed concrete floors unless noted otherwise.

.2 Apply liquid floor hardener in accordance with manufacturer's written instructions after initial floating.

.3 Cure concrete in accordance with manufacturer’s recommended instructions.

.4 Apply hardener to horizontal and vertical exposed concrete to remain unfinished.

3.8 APPLICATION: WATERSTOPS

.1 Install in accordance with manufacturer's written instructions at exterior construction joints.

.2 Ensure concrete is free of voids, honeycombing, segregation of the mix, or any conditions which leads to concrete permeability.

.3 Install in all applicable exterior vertical and horizontal cast-in-place concrete constructions joints, around applicable penetration and structural members. Leaving a minimum of 75mm of concrete cover to the exterior.

.4 Tightly butt ends together to form continuous waterstop.

3.9 PROTECTION

.1 Protect finished installation in accordance with manufacturer's instructions.

3.10 MAINTENANCE

.1 Provide training to Owner’s representative based on written manufacturers instructions as indicated in Section 01 78 00 – Closeout Submittals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section includes unit masonry assemblies consisting of the following:

- .1 Concrete masonry units (CMU).
- .2 Mortar and grout.
- .3 Steel reinforcing bars.
- .4 Masonry joint reinforcement.
- .5 Ties and anchors.
- .6 Embedded flashing.
- .7 Miscellaneous masonry accessories.

1.2 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 07 21 13 – Board Insulation

.3 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier

.4 Section 07 62 00 – Sheet Metal Flashing and Trim

.5 Section 07 84 00 – Firestopping and Smokeseals

.6 Section 07 92 00 – Sealants

.7 Section 09 91 00 – Painting

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

- .1 ASTM A116-22, Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric.
- .2 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .3 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .4 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- .5 ASTM A496/A496M-07, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement. (Withdrawn 2013)
- .6 ASTM A563/A563M-21ae1, Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).
- .7 ASTM A653/A653M-22 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .8 ASTM B633-19, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

.9 ASTM C140/C140M-22c, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

.10 ASTM C207-18, Standard Specification for Hydrated Lime for Masonry Purposes.

.11 ASTM E488/E488M-22, Standard Test Methods for Strength of *Anchors in Concrete Elements.

.12 ASTM F593-17, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.13 ASTM F594-09(2020), Standard Specification for Stainless Steel Nuts.

.14 ASTM F738M-02(2008), Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs. (Withdrawn 2015)

.15 ASTM F836M-20, Standard Specification for Style 1 Stainless Steel Metric Nuts (Metric).

.16 ASTM F3125/F3125M22, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength.

.2 Canadian Standards Association (CSA International):

.1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CSA A123.3-05 (R2015), Asphalt Saturated Organic Roofing Felt (Reaffirmed 2010).

.3 CSA-A165 Series-14 (R2019), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2, and A165.3).

.4 CSA A179-14 (R2019), Mortar and Grout for Unit Masonry.

.5 CSA A370-14 (R2018), Connectors for Masonry.

.6 CAN/CSA A371-14 (R2019), Masonry Construction for Buildings.

.7 CSA-A3000-18, Cementitious Materials Compendium, Includes Update No. 1 and Errata (2021)

.8 CSA S304-14 (R2019), Design of Masonry Structures, include Update No. 1 (2015).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate lines, levels and coursing with work of other Sections.

.2 Obtain built-in items prior to start of this work.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor, Subcontractor, material supplier and Consultant in accordance with Section 01 31 19 – Project Meetings to:

.1 Verify project requirements including specification and details for project.

.2 Confirm required mortar, grout and concrete testing; review batch control and grouting procedures.

.3 Co-ordination with related Work including, but not limited to, air/vapour membranes and insulation.

.4 Review cavity drainage requirements and methods for keeping mortar out of cavity spaces.

.5 Coordinate crack control measures.

.6 Review requirements for reinforcement at corners and wall intersections.

.7 Review membranes and membrane flashing materials and details used for construction.

.8 Confirm trowelled or tooled joints to concealed and exposed masonry faces.

.9 Review methods for controlling efflorescence during construction.

.10 Review hot and cold weather requirements.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Provide manufacturer's printed product literature, specifications and data sheet. Indicate masonry types, shapes, sizes, and textures.

.2 Cementitious Materials:

.1 Include brand, type, and name of manufacturer for site mixed mortar materials.

.2 Submit proposed design mix proportions and sand analysis reports and compressive strength reports on the proposed mortar mix(es).

.2 Shop Drawings: Submit shop drawings indicating the following:

.1 Indicate sizes, profiles, coursing, and locations of special shapes for concrete masonry units.

.2 Detail bending and placement of unit masonry reinforcing bars, including elevations of reinforced walls if required.

.3 Detail corner units, end dam units, and other special applications for fabricated flashings.

.3 Submit samples in accordance with Section 01 33 00 – Submittals Procedures.

.1 Provide three concrete masonry units (face only) to show texture and colour variance of interior finish only.

.2 Provide three concrete masonry units (face only) to show texture and colour variance of exterior finish only.

.3 Provide sample of masonry connector, joint reinforcement and flashings.

.4 Obtain review comments from Consultant prior to ordering.

1.6 QUALITY ASSURANCE

.1 Conform to CAN/CSA A371, except as modified by this specification.

.2 The masonry Subcontractor shall be a member in good standing with the Ontario Masonry Contractors' Association.

.3 The masonry Subcontractor shall have a minimum of five years of experience on projects of similar size and magnitude and shall provide continuous active supervision by a journeyman mason while masonry work is in progress.

.4 Masonry work shall be performed by experienced, qualified journeyman masons under the direct and continual full-time supervision of certified masons.

.5 Do not lay masonry units with chipped edges or corners, surface indentations, surface cracks where exposed to view.

.6 Mortar specimens shall be sampled and tested for compressive strength and slump to CSA A179.

.7 Connectors and joint reinforcement shall conform to CSA A370.

.8 Miscellaneous masonry accessories, and their use where not otherwise specified but shown or required for proper completion of the Work, shall conform to CSA A371.

.9 Mock-Ups:

.1 Construct mock-up in accordance with Section 01 45 00 – Quality Control.

.2 Construct a minimum 1.2 m x 1.2 m of one wall in location agreed upon by Consultant to establish a standard of construction, workmanship, and appearance. Show reinforcement, masonry connectors, flashing, jointing, coursing, mortar, and masonry pattern, unit face alignment, texture, and colour.

.3 Do not continue with work of this Section until Consultant has reviewed mock-up.

.4 Mock-up may form a part of the completed work when written acceptance is provided by the Consultant.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver masonry materials in the manufacturer's unopened packaging with manufacturer's identification and labels intact until ready for installation.

.2 Store materials to prevent damage due to moisture, contamination, breakage, chipping or other causes.

.3 Store materials on dry, level area without contact to ground to reduce contamination and soiling. Cover with a non-staining waterproof covering allowing for airflow around units while protecting it from airborne contaminants and wind-borne dirt.

.4 Deliver cement, lime, and mortar in dry condition with manufacturer's labels intact and store under waterproof cover and protect from the elements.

.5 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Maintain materials and surrounding air temperature to minimum 5 degrees C, and a maximum of 32 degrees C, prior to, during, and 48 hours after completion of masonry work.

.2 Cold and Hot Weather Requirements: CAN/CSA-A371.

.3 Provide adequate bracing for masonry during construction and until permanent lateral supports are in place.

Part 2 Products

2.1 CONCRETE MASONRY UNITS

.1 Architectural Concrete Masonry Units (CMU-1): to CSA A165.1 and as follows:

.1 Classification: H/15/B/M.

.2 Size (Nominal): As indicated on Drawings.

.3 Special shapes: provide solid corner stone as required. Provide additional special shapes as indicated.

.4 Finish: suave finish.

.5 Colour: Iceland White.

.6 Basis of Design Materials:

.1 Profile Series, Brampton Brick.

.2 Standard Concrete Masonry Units (CMU-2): to CSA A165.1 and as follows:

.1 Classification: H/15/A/M.

.2 Size (Nominal): As indicated on Drawings.

.3 Special shapes: provide plain end units for exposed corners as indicated on Drawings. Lintels and bond beams are constructed using knock-out lintel units. Provide additional special shapes as indicated.

.4 Finish: all exposed CMU-1 to be painted in accordance with Section 09 91 00 – Painting.

.5 Basis of Design Materials:

.1 CarboClave Block, Brampton Brick.

2.2 MORTAR AND GROUT MATERIALS

.1 Use same brands of materials and source aggregate for entire project.

.2 Cementitious Material:

.1 Portland Cement: to CSA A3000, Type GU – General use hydraulic cement (Type 10), white colour.

.2 Masonry Cement: to CSA A3000 and CSA A179, Type N.

.3 Quick Lime: to CSA A179.

.4 Hydrated Lime: to CSA A179, Type S.

.3 Mortar Aggregate: to CSA A179, fine aggregate.

.4 Water: clean and potable.

.5 Colour Additives:

.1 Use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample. Admixtures to be approved prior to use. Use in accordance with the specific manufacturer's recommendations.

.1 Colour: selected from manufacturer’s complete range.

.6 Mortar Mixes:

.1 Mortar for exterior masonry above grade:

.1 Loadbearing: type S based on proportion specifications.

.2 Non-Loadbearing: type S based on proportion specifications.

.2 Mortar for interior masonry:

.1 Loadbearing: type S based on proportion specifications.

.2 Non-Loadbearing: type N based on proportion specifications.

.3 Following applies regardless of mortar types and uses specified above:

.1 Mortar for grouted reinforced masonry: type S based on proportion specifications.

.7 Mortar Mixing

.1 Mix mortar ingredients in accordance with CSA A179 in quantities needed for immediate use.

.2 Maintain sand uniformly damp immediately before mixing process.

.3 Add mortar colour in accordance with manufacturer's instructions. Provide uniformity of mix and colouration.

.4 Do not use admixtures unless approved in writing by the Consultant.

.5 Do not use antifreeze liquids, calcium chloride, frost inhibitors based on calcium chloride, salts or other substances used for lowering the freezing point or accelerating setting time.

.6 Use a batch type mixer in accordance with CSA A179.

.7 If moisture is lost by evaporation, retemper within two hours of mixing as directed by the manufacturer.

.8 Use mortar withing two hours after mixing as specified in CSA A179.

.8 Grout Mixes:

.1 Bond Beams: grout mix 20 MPa strength at 28 days; 200-275 mm slump; mixed in accordance with CSA A179 coarse grout.

.2 Lintels: grout mix 20 MPa strength at 28 days; 200-250 mm slump; mixed in accordance with CSA A179 coarse grout.

.3 Grout: Minimum compressive strength of 20 MPa at 28 days. Maximum aggregate size and grout slump: CSA A179.

.9 Grout Mixing:

.1 Mix grout ingredients in quantities needed for immediate use in accordance with CSA A179 coarse grout.

.2 Add admixtures in accordance with manufacturer's instructions; mix uniformly.

.3 Do not use calcium chloride or chloride based admixtures.

.10 Mix Tests:

.1 Testing Mortar Mix:

.1 Test mortar to requirements of Section 01 45 00 - Quality Control, and in accordance with CSA A179, for mortar based on proportion specification. Test prior to construction and during construction for:

.1 Compressive strength.

.2 Consistency.

.3 Mortar aggregate ratio.

.4 Sand/cement ratio.

.5 Water content and water/cement ratio.

.6 Air content.

.7 Splitting tensile strength

.2 Testing Grout Mix:

.1 Test grout to requirements of Section 01 45 00 - Quality Control, and in accordance with CSA A179, for grout based on proportion specification. Test prior to construction and during construction for:

.1 Compressive strength.

.2 Sand/cement ratio.

.3 Water content and water/cement ratio.

.4 Slump.

2.3 GALVANIZING

.1 The following galvanizing requirements apply to steel anchors, reinforcing and accessories where requirements are not otherwise specifically listed:

.1 Ties and Reinforcing:

.1 Mill Galvanized (Interior Use): In accordance with ASTM A116, Class 3

.2 Hot Dip Galvanized (Exterior, including inner wythe of exterior wall construction and High Humidity Use): In accordance with ASTM A153/A153M, Class B-2.

.2 Hot Dip Hardware and Bolts: In accordance with ASTM A153/A153M, Class B-2 regardless of location.

.3 Hot Dip Sheet Steel: In accordance with ASTM A653/653M, Coating Designation Z600, regardless of location.

.4 Structural Shapes and Pipes: In accordance with ASTM A123/A123M, Grade 85, regardless of location.

2.4 REINFORCEMENT

.1 As specified on Structural Drawings.

2.5 TIES AND ANCHORS

.1 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:

.1 Deflection: Maximum 2 mm, including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.

.2 Positive restraint at position of maximum adjustment.

.3 Free play of multi-component ties maximum 1.2 mm when assembled in all possible configurations.

.4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.

.2 Lateral Partition Supports (Top of Wall Anchors):

.1 Angle Support: Fabricated from 2.657 mm core metal thickness angled steel plate having 75 mm long legs fastened to deck structure to allow vertical movement of masonry assembly; hot dip galvanized; coordinate with Section 07 84 00 - Firestopping and Smokeseals for firestopping insulation and smoke seals.

.1 Basis-of-Design Materials:

.1 PTA 422, Blok Lok.

.2 Plate Support: Fabricated from 2.657 mm core metal thickness steel plate with 10 mm diameter metal 150 mm long welded to plate having closed end plastic tube fitted over rod that allows rod to move in and out of tube; hot dip galvanized after fabrication.

.1 Basis-of-Design Materials:

.1 PTA 420, Blok Lok.

.3 Rigid T-Intersection Anchors: Fabricate from steel bars 38 mm wide x 6 mm thick x 600 mm long with ends turned up 50 mm or with cross pins at installers option; hot dip galvanized.

.4 Anchor Bolts: Headed or L-shaped steel bolts in accordance with ASTM A307, Grade A; with ASTM A563/A563M hex nuts and, where indicated, flat washers; hot-dip galvanized in accordance with ASTM A153/A153M, Class C.

.5 Post Installed Anchors: Provide chemical or torque controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete when tested in accordance with ASTM E488/E488M conducted by a qualified independent testing agency, and as follows:

.1 Indoor Locations: Carbon-steel components zinc-plated in accordance with ASTM B633, Class Fe/Zn 5.

.2 Outdoor and High Humidity Locations: Alloy Group 1 or 2 stainless steel bolts complying with ASTM F593/F738M and nuts complying with ASTM F594/ASTM F836M.

2.6 FLASHING

.1 Metal Flashing: Provide metal flashing materials in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim.

.2 Coordinate supply and installation of flexible flashing materials with Section 07 27 13 - Modified Bituminous Air and Vapour Barrier, provide only materials that are compatible with acceptable materials listed in Section 07 27 13 - Modified Bituminous Air and Vapour Barrier and that form the basis of the contract.

.3 Butyl Rubber Base Flashing: minimum 1.2 mm thick butyl sheet rubber strips.

.4 Sheet Steel Base Flashing: minimum 0.60 mm thick, to ASTM A653/A653M, formed as detailed, galvanized with Z275 zinc coating.

.5 Modified Bitumen Base Flashing: SBS modified sheet membrane, minimum 1.0 mm thick self-adhering type or minimum 3.0 mm thick torch-applied type.

.6 Through Wall and Flexible Flashings: Install flexible membranes where required to maintain flow direction to divert water away from face of building envelope.

.1 Basis-of-Design Materials:

.1 Bakor Blueskin TWF, Henry Company.

.2 Mighty Flash, Hohmann & Banard Inc.

2.7 ACCESSORIES

.1 Firestopping: As specified under Section 07 84 00 - Firestopping and Smokeseals.

.2 Sealants: As specified under Section 07 92 00 – Sealants; colour as directed by Consultant.

.3 Anti-Graffiti Coatings: Non-sacrificial, fully breathable water based sealer:

.1 Acceptable Materials:

.1 505 Special Coatings Stripper, Diedrich Technologies

.2 Protectosil Antigraffiti, Evonik Industries

.3 Fabrishield PR Series, Fabrikem.

.4 Acryli-Master, Graffiti Master.

.5 Blok-Guard & Graffiti Control Ultra 15, ProSoCo.

.4 Joint Filler: Control Joint Fillers: Preformed rubber, neoprene or polyvinylchloride, size and profile to suit intended application.

.5 Bond Breaker Strips: #15 asphalt saturated, organic roofing felt in accordance with CSA A123.3.

.6 Cavity wall insulation in accordance with Section 07 21 13 - Board Insulation.

.7 Air and vapour barrier membrane in accordance with Section 07 27 13 - Modified Bituminous Air and Vapour Barrier. Coordinate through wall flashings listed in this section with products that form the basis of the contract.

.8 Masonry Cleaners: in accordance with masonry manufacturer's recommendations for type of units supplied. Muriatic acid is not permitted.

Part 3 Execution

3.1 EXAMINATION

.1 Verify surfaces and conditions are ready to accept work of this Section.

.2 Examine all site conditions and surfaces affecting the installation of masonry including structural steel, heating, plumbing and electrical work and report deficiencies to the Consultant in writing. Commencement of installation constitutes acceptance of existing conditions.

.3 Perform work with minimal cutting and patching.

3.2 PREPARATION

.1 Protect adjacent finished materials from damage due to masonry work.

.2 Establish all coursing lines and plumb levels for masonry work and protect from disturbance.

3.3 APPLICATION

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

3.4 INSTALLATION

.1 Construct masonry work in accordance with requirements and tolerances of CSA-A371, including variation from mean plane, plumb, level and position as well as variation of wall opening sizes.

.2 Where mortar has started to harden at units requiring repositioning, remove and replace with fresh mortar.

.3 Lay masonry units in bond pattern indicated on Drawings with accurately spaced courses, true to lines and levels and plumb throughout with exterior and interior corners and intersections masonry bonded. Maintain bond pattern below and above openings.

.4 Masonry horizontal and vertical joints to be 10 mm thick except where adjustments are necessary to maintain the bond pattern or to adjust coursing.

.5 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.

.6 Install hollow masonry units using face shell bedding with full head and bed joints. Minimize mortar protruding or dropping into core spaces.

.7 Tap units firmly into place.

.8 Closure units must receive "double buttering" to ensure full head joints.

.9 Install units as may be required to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond pattern or module.

.10 Special Shapes:

.1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.

.2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.3 End bearing: not less than 200 mm.

.4 Install special shaped units.

.5 Factory cut shapes only, site cut shapes require Owner approval.

.11 Cull out masonry units, in accordance with CSA A165 and reviewed range of colour samples, with chips, cracks, broken corners, excessive colour and texture variation.

.12 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.

.13 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.

.14 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.

.15 Install movement joints and keep free of mortar where indicated.

.16 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.

.17 After mortar has initially "set up", tool all joints, wipe wall surfaces with a suitable brush or burlap to remove mortar protrusions and re-tool the joints.

.18 Fill all holes and cracks, remove loose mortar, and repair defective work.

.19 Exposed joints shall be tooled to concave joint, firmly pointed and compacted with round tooling bar. Use flush joints only where masonry units are not exposed to view. Provide raked joints at expansion joints and where masonry abuts other materials.

.20 Do not reset masonry units after laying. Where resetting of masonry is required, remove and clean units and reset in new mortar.

3.5 CONNECTORS AND REINFORCEMENT

.1 Supply and install masonry connectors and reinforcement in accordance with CSA A370, CAN/CSA A371, CSA-A23.1 and CSA-S304.1 unless indicated otherwise.

.2 Prior to placing mortar or grout, obtain Consultant's approval of placement of reinforcement and connectors.

3.6 BONDING AND TYING

.1 Install unit, adjustable, single wythe joint reinforcement where indicated and in accordance with CSA A370, CAN/CSA A371, Structural Drawings and manufacturer's instructions.

3.7 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry beams, masonry lintels and bond beams as indicated.

3.8 GROUTING

.1 Grout masonry in accordance with CSA S304.1, CAN/CSA A371 and CSA A179 and as indicated.

3.9 ANCHORS

.1 Supply and install metal anchors in accordance with CSA A370 and CAN/CSA A371 as indicated.

3.10 LATERAL SUPPORT AND ANCHORAGE

.1 Supply and install lateral support and anchorage in accordance with CSA A370 and as indicated.

3.11 CONTROL AND EXPANSION JOINTS

.1 Install control and expansion joint materials in unit masonry as masonry progresses; do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

.2 Form control joints in concrete masonry consisting of a complete vertical break free from mortar using one of the following methods:

.1 Break joint reinforcement at control joints, but extend bond beam reinforcing 400 mm into wall across control joint and wrap with 0.15 mm polyethylene bond breaker.

.2 Fit bond breaker strips into hollow contour in ends of concrete masonry units on one side of control joint; fill resultant core with grout and rake out joints in exposed faces for application of sealant.

.3 Install preformed control joint gaskets designed to fit standard sash block.

.4 Install interlocking units designed for control joints; install bond breaker strips at joint; keep head joints free and clear of mortar or rake out joint for application of sealant.

.5 Install temporary foam plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

.6 Refer to Drawings for control and expansion joint locations, and vertical reinforcing requirements; confirm location with Consultant before installation; confirm with Consultant where not shown on Drawings.

.3 Install a minimum 10 mm high horizontal, pressure relieving joints by either leaving an air space or inserting a compressible filler, sealant and backer rod specified in Section 07 92 00 - Sealants; locate horizontal, pressure relieving joints beneath shelf angles supporting masonry.

3.12 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant.

3.13 INSTALLATION: FLASHINGS

.1 Build in flashings in masonry in accordance with CAN/CSA A371.

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings, and at base of cavity wall and where cavity is interrupted by horizontal members or supports and as shown on drawings. Install flashings under weep hole courses and as indicated.

.2 In cavity walls, carry flashings from front edge of exterior cladding, then up backing not less than 150 mm, and as follows:

.1 For masonry backing embed or bond flashing 25 mm in joint.

.2 For concrete backing, insert or bond flashing into reglets.

.3 For wood frame backing, staple flashing to walls behind water resistive paper, and lap joints.

.4 For gypsum board and glass fibre faced sheathing backing, bond to wall using manufacturer's recommended adhesive.

.3 Lap joints 150 mm and seal with adhesive.

.2 Form flashing (end dams) at lintels, sills and wall ends to prevent water from travelling horizontally past flashing ends.

3.14 MASONRY COATINGS

.1 Anti-Graffiti Coatings: Apply in accordance with manufacturer’s written instructions.

.2 Place safety devices and signs near work areas as indicated and directed; seal or repair openings and joints where there is potential risk of water or chemical infiltration through the wall assembly.

.3 Cover surfaces not scheduled for masonry coatings; cover and protect surfaces and non-masonry finishes with in areas scheduled for coatings.

.4 Rinse off masonry until no indications of chemicals are present; rinse from bottom to top and from top to bottom; cleanup work area as work progresses; remove debris and waste from site at end of each work day.

3.15 REPAIR/RESTORATION

.1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.

3.16 CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.

.2 Keep adjacent surfaces clean, dry, and free of mortar droppings and stains during laying using suitable protection.

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

.4 Prior to full scale cleaning, confirm suitability of materials and methods by cleaning an inconspicuous test area.

.5 Unless otherwise required by cleaning agent manufacturer, wet wall with clean water and flush off all loose dirt and mortar prior to cleaning.

.6 Clean masonry using specified cleaning agents in strict accordance with cleaning agent and masonry manufacturer's requirements.

.7 When pressure washing, do not leave wand streaks.

.8 Protect adjacent surfaces and work from damage and staining during cleaning process.

.9 Unless otherwise required by cleaning agent manufacturer, rinse all areas thoroughly with clean water to remove all cleaning solutions and residue.

.10 Repeat cleaning process as often as necessary to remove mortar and other stains.

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section specifies the requirements for shop-applied powder coatings for metal fabrications as indicated on Drawings.

1.2 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

1.3 REFERENCES

.1 Reference Standards:

.1 American Architectural Manufacturers Association (AAMA)/Fenestration & Glazing Industry Alliance (FGIA):

.1 AAMA 2604-22, Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.

.2 American Society for Testing and Materials International (ASTM):

.1 ASTM B117-19, Standard Practice for Operating Salt Spray (Fog) Apparatus.

.2 ASTM D1654-08 (2016)e1, Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

.3 ASTM D2244-22, Standard Practice for Calculation of Colour Tolerances and Colour Differences from Instrumentally Measured Colour Coordinates.

.4 ASTM D2247-15(2020), Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity.

.5 ASTM D3363-22, Standard Test Method for Film Hardness by Pencil Test.

.6 ASTM D4214-07 (2015), Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

.7 ASTM D7091-22, Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.

.8 ASTM D7803 – 19, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating

.9 ASTM E1980-11(2019), Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

.3 Canadian Institute of Steel Construction (CISC):

.1 CISC Code of Standard Practice for Structural Steel, 8th Edition, 2015.

.2 CISC Code of Standard Practice, Appendix I, Architecturally Exposed Structural Steel (AESS).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate submittal and selection procedures for items to receive shop-applied coatings.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit powder coat cured physical properties for each type of application indicated.

.2 Submit transportation, storage, and handling requirements pertaining to powder coated Products.

.3 Submit coating maintenance and touch-up guidelines.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Product List: Submit for each substrate indicated, cross-reference products to powder coating finish colour and gloss, and locations of application. Use same designations indicated on Drawings and in schedules.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit Samples for Initial Selection: for each type of powder coat application indicated.

.2 Submit Samples for Verification: For each type of powder coating application and in each colour and gloss indicated.

.1 Submit Samples on substrate materials specified, 200 mm square.

.2 Label each sample with Contract number and title, colour name and number, sheen name and gloss values, date, and name of manufacturer.

.3 Label each Sample for location and application area.

.4 Source Quality Control Submittals:

.1 Certificates of Compliance: manufacturer's certification that finishes applied on Project components comply with referenced AAMA standards.

.5 Qualifications: Submit qualifications for shop-applied coatings applicator.

1.6 QUALITY ASSURANCE

.1 Applicator Qualifications: Coating manufacturer's approved and certified applicator who is equipped, trained and approved for application of coatings required for this project, and is approved to provide the warranty specified in this Section.

.2 Comply with the following:

.1 Powder coating manufacturer's guidelines and data sheets.

.2 AAMA 2604 guidelines.

.3 Applicable sections of CISC Code of Standard Practice.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Transport products in accordance with the manufacturer's printed guidelines.

.2 Verify accuracy of components, quantities, and sizes prior to application of finishes.

.2 Storage and Handling Requirements:

.1 Transport, handle, store, and protect products in accordance with the manufacturer's printed guidelines.

.2 Store products off ground, and protected from direct sunlight.

.3 Protect products from exposure to harmful weather conditions. Store at temperature and humidity conditions recommended by supplier.

.4 Remove damaged or deteriorated Products from site.

.3 Packaging Waste Management:

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Ambient Conditions: Maintain area where Products are being installed at a uniform temperature and humidity for 24 hours prior to, during, and after installation in accordance with supplier's guidelines; provide additional lighting to maintain a minimum of 430 lx on surfaces and areas where work is being installed.

1.9 WARRANTY

.1 Coating Warranty: coating applicator's warranty in which applicator agrees to repair finish or replace coated items that demonstrate deterioration of shop-applied finishes within warranty period indicated.

.1 Exposed coating: deterioration includes but is not limited to:

.1 Colour fading in excess of 5 Delta E Hunter units per ASTM D2244.

.2 Peeling, checking, or cracking of coating adhesion to metal.

.3 Chalking in excess of a No. 8 per ASTM D4214, when tested per Method D659.

.4 Corrosion of substrate in excess of a No. 6 on cut edges and a No. 8 on field surfaces, when measured per ASTM D1654.

.2 Warranty period: five years from date of Substantial Performance.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Perform Work in accordance with AAMA 2604.

2.2 MATERIALS

.1 Powder Coating Materials:

.1 Super durable or modified polyester based coating (TGIC-Free), to AAMA 2604, three-coat system (primer, intermediate coat, and topcoat), colour and gloss to be selected from manufacturer's full range.

.1 Acceptable Materials:

.1 POWDURA® 4000 powder coating system, Sherwin-Williams.

.2 Drylac® Series 58 Super Durable Polyester powder coating system, TIGER.

.2 Primer: as recommended by powder coating system manufacturer, suitable for substrates and exposures.

.3 Touch-up coating materials: as recommended by powder coating manufacturer for post-installation repairs and touch-ups.

.2 Finishes:

.1 Pre-treatment: mechanically clean and chemically pre-treat fabricated items in accordance with coating manufacturer's requirements and AAMA 2604 requirements for finish indicated.

.2 Application: apply primer and finish coats in accordance with coating manufacturer's requirements for finish indicated.

.3 Concealed / backer finish: pre-treat substrate and apply coating applicator's standard polyester or epoxy finish in accordance with manufacturers' requirements.

Part 3 Execution

3.1 EXAMINATION

.1 Verify site conditions.

.2 Examine substrates and conditions for compliance with requirements for conditions affecting performance of work.

.3 Verify compatibility and suitability of substrates.

.4 Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

.5 Coating application indicates acceptance of surfaces and conditions.

3.2 PREPARATION

.1 Architecturally exposed metal shall be fabricated to CISC Code of Standard Practice, AESS 3: Feature Elements in Close View.

.2 Comply with manufacturer's written instructions and recommendations applicable to substrates indicated.

.3 Remove plates, machined surfaces, and similar items already in place that are not to be powder coated.

.1 After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

.4 Clean substrates of substances that could impair bond of powder coating, including dirt, oil, grease, and incompatible paints, primers, and encapsulants.

.5 Prepare substrates to provide required finished appearance prior to powder coating and in accordance with the powder coating manufacturer's requirements.

3.3 APPLICATION

.1 Shop-apply powder coating to achieve required finishes and performance criteria.

.1 Use powder coat formula and method suitable to substrate, location, and finish indicated.

.2 Powder coat thickness to be as required to meet powder formula cured physical properties from manufacturer's printed data sheets.

.2 Apply powder coatings to produce a uniform and consistent surface coverage with no seams, layers, lines or other surface imperfections. Produce sharp lines and colour breaks.

.3 To the extent practical, powder-coat fabrications, otherwise, fabricate using powder coated materials, to Section 05 50 00 – Metal Fabrications, drawings, and as required to meet the design intent.

3.4 INSTALLATION

.1 Prime and paint cut-outs, uncoated edges, ends, faces, undersides, and back sides with compatible coating system in accordance with powder coating manufacturer's guidelines.

.2 Install products in accordance with the drawings. Refer to individual specification sections for installation requirements for items receiving shop-applied coatings.

3.5 REPAIR

.1 At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces using touch-up materials recommended by powder coating manufacturer.

3.6 CLEANING

.1 Remove protective wrap (if used) from coated items at time of installation

.2 Clean finished surfaces after installation in accordance with finish manufacturer's instructions.

3.7 PROTECTION

.1 Protect finished Work.

.2 Protect work of other trades against damage from Product installation and related site coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Consultant, and leave in an undamaged condition.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Shop fabricated miscellaneous metal items as indicated on drawings.

1.2 RELATED REQUIREMENTS

.1 Section 04 22 00 – Unit Masonry

.2 Section 06 10 00 – Rough Carpentry

.3 Section 06 20 00 – Finish Carpentry

.4 Section 09 21 16 – Gypsum Board Assemblies

.5 Section 09 91 00 – Painting

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM):

.1 ASTM A53/A53M-22, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.3 ASTM A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.

.4 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.

.5 ASTM A500/A500M -21a: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

.6 ASTM A501/A501M -21: Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

.7 ASTM F593-22, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.8 ASTM F3125/F3125M-22, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

.2 Canadian Standards Association (CSA International):

.1 CSA G40.20-13/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel. Includes Update No. 1 (2014)

.2 CSA S16:19, Design of Steel Structures, Includes Errata (2019).

.3 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel.

.4 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.

.5 CSA W55.3-08(R2018), Certification of companies for resistance welding of steel and aluminum.

.6 CSA W59-18, Welded Steel Construction, Includes Errata (2020).

.7 CSA W178.1-18, Certification of Welding Inspection Organizations.

.8 CSA W178.2-18, Certification of Welding Inspectors.

.3 National Association of Architectural Metal Manufacturers (NAAMM):

.1 NAAMM AMP 500-06, Metal Finishes Manual.

.2 NAAMM AMP 555-92, Code of Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).

.4 The Society for Protective Coatings (SSPC)/National Association of Corrosion Engineers (NACE International):

.1 Surface Preparation Guidelines:

.1 SSPC SP3, Power Tool Cleaning (2018).

.2 SSPC-SP5/NACE No. 1, White Metal Blast Cleaning (2006).

.3 SSPC-SP6/NACE No. 3, Commercial Blast Cleaning (2006).

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and data sheets.

.2 Provide one electronic copy of WHMIS SDS - Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada and indicate VOC content for:

.1 Finishes, coatings, primers and paints.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate materials, core thicknesses, profiles, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Submit evidence of welder qualifications specified in this Section.

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.

.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 W178.1 and W178.2.

.4 Resistance welding: to CSA W55.3.

.5 Fusion welding: to CSA W59.

1.6 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 Consultant deems damage irreparable, replace the affected items at no additional expense to the Consultant or Owner.

.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.

.5 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.7 SITE 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 blots, and other members that are built in to 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 and Plates: to CSA-G40.20/G40.21, Grade 300W.

.2 Hollow Structural Sections: In accordance with CSA G40.20/G40.21, Grade 350W, Class C.

.3 Steel Pipe: to ASTM A53/A53M, Schedule 40, standard weight, unless another weight is indicated or required by structural loads, galvanized finish.

.4 Steel Tubing: to ASTM A500/A500M, Grade B or ASTM A501/A501M.

.5 Welding materials: to CSA W59.

.6 Welding electrodes: to CSA W48 Series.

.7 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 CSA-G164.

.8 Structural bolts: to ASTM F3125/F3125M.

.9 Stainless steel fasteners, washers and nuts: to ASTM F593, 18-8 austenitic stainless steel (Grade 8 - B8/B8A), sized as required for purpose intended, or as otherwise indicated. Cold finished: Condition B, cold worked, per ASTM A276/A276M.

.10 Aluminum sheet: round perforated pattern as indicated on the drawings; 6 mm minimum thickness, powder coated finish; colour as selected by Consultant.

2.2 FABRICATION

.1 Fit and shop assemble items in largest practical sections, for delivery to site.

.2 Fabricate work square, true, straight and accurate to required size, free from warpage and other defects, with joints closely fitted and properly secured. Accurately cut, machine, file and fit joints, corners, copes and mitres.

.3 Use self-tapping shake-proof flat, round, or oval headed screws on items requiring assembly by screws or as indicated.

.4 Where possible, fit and shop assemble work, ready for erection.

.5 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications to provide corrosion protection in accordance with CSA-S16.

.6 Welding is to conform to CSA W59 and the fabricator certified to CSA W47.1. Include for welding inspection in the Contract.

.7 Continuously seal joined members by continuous welds. File or grind all exposed welds smooth and flush. Repair or fill all pits, cracks and holes. Grind and polish

all handrails to a smooth, even surface. Smooth all inside corners, returns. Seal exterior steel fabrications to provide corrosion protection.

.8 Use welded connections for exterior metal work unless otherwise approved by Consultant.

.9 Insulate when necessary to prevent electrolysis due to metal to metal contact or metal to masonry or concrete contact. Use bituminous paint or other approved method.

.10 Provide fastenings, including anchor bolts, bolts, lag screws, expansion bolts, straps, brackets, etc. required for the fabrication and erection of work of this Section.

.11 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FINISHES

.1 Prior to priming steel, prepare all surfaces in conformance with SSPC SP-3 – Power Tool Cleaning for non-exposed locations and any overhead steel not subject to contact and SSPC SP-5 – White-metal Blast Cleaning for exposed architectural finished locations. Adjust blast grit to suit primer coat thickness specified in Section 09 91 00 – Painting.

.2 Shop Primers: Provide primers that are compatible with paint systems specified.

.3 Isolation Coating: Apply an isolation coating to contact surfaces in contact with cementitious materials, wood materials and dissimilar metals.

.4 Paint: Prepare the Work and paint in accordance with CSA-S16, primed ready for site finish as specified in Section 09 91 00 – Painting. Leave surfaces to be welded unpainted.

.5 Powder Coating: in accordance with Section 05 05 13 – Shop-Applied Coatings for Metal.

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 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.

.2 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.

.3 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.

.4 Miscellaneous Steel 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 BENCHES BRACKETS

.1 Provide premanufactured bracket or manufacture on site as indicated.

.2 Provide 100 mm wide x 12 mm thick steel flat bar brackets with welded corners; mounted to walls indicated.

.3 Finish: prime coat painted.

.1 Finish colour: black.

2.7 TRANSOM AND GABLE PANELS

.1 Aluminum panels fabricated from 6 mm thick perforated pattern plate. Include fasteners to secure to wall.

.2 Finish: powder coat after fabrication, colour as directed by Consultant.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that field conditions are acceptable and are ready to receive work.

.2 Verify dimensions, tolerances, and method of attachment with other work.

3.2 INSTALLATION – GENERAL

.1 Install Work in accordance with manufacturer's/fabricator's written instructions and Contract Documents.

.2 Install items plumb and level, accurately fitted, free from distortion or defects. Ensure Work is accurate to profile, properly aligned, accurately fitted with tight joints and intersections.

.3 Supply finished items to be built-in to those trades along with instructions for proper installation.

.4 Apply architectural metal work using hidden mechanical fasteners. Installation shall be by skilled Architectural metal workers experienced in highest quality work.

.5 Fasteners to draw adjoining sections together in proper, true alignment, and are capable of field adjustment.

.6 All fasteners, mountings to be non-loosening and installed so that they will be hidden at completion.

.7 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

.8 Field weld components indicated on Shop Drawings. Grind welds smooth.

.9 Conceal bolts and screws wherever possible. Where not concealed, use flush countersunk fastenings.

.10 Perform field welding to CSA requirements.

.11 Isolate dissimilar metals to prevent electrolytic action or corrosion.

.12 Install finish hardware supplied under other Sections required for completion of components of this Section.

.13 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.14 Make field connections with high tensile bolts to CSA-S16 and weld to prevent loosening.

.15 Obtain approval prior to site cutting or making adjustments not scheduled.

.16 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.17 After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

.18 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

3.3 MISCELLANEOUS ITEMS

.1 Provide steel angle frame, hanging rods and bracing for supporting bulkheads and shelving.

.2 Custom bench brackets as indicated and detailed, anchored to wall.

.3 Perforated aluminum sheets to walls and gables as indicated.

.4 Supply and install miscellaneous metal items as indicated or specified, or as otherwise required for a complete job, in accordance with the design intent of the project.

3.4 PROTECTION

.1 Protect completed Work from damage during and after installation.

.2 Architectural metal work of this Section damaged or having finish marred or discoloured in any way shall be rejected and shall be removed from the site immediately and replaced with new at no cost.

.3 Field repair or refinishing of damaged, marred or discoloured finishes will not be accepted.

3.5 CLEANING

.1 At completion of Work, and progressively as Work proceeds, clean all installations and assemblies.

.2 At completion, remove protective cover and clean metal work using only cleaning solutions and methods to suit the metal and its finish.

.3 Protect adjacent materials, finishes from damage or discolouration during cleaning.

.4 At completion, remove all equipment, tools, surplus materials and debris from job site.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Miscellaneous rough carpentry.

.2 Accessories.

1.2 RELATED SECTIONS

.1 Section 09 21 16 – Gypsum Board Assemblies.

.2 Section 10 28 10 – Toilet and Bath Accessories.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B18.2.1-2012 (R2021), Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series), Includes Errata (2013).

.2 ASME B18.6.1-1981 (R2016), Wood Screws (Inch Series).

.2 American Society for Testing and Materials International (ASTM):

.1 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.2 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

.3 ASTM A563/A563M-21 ae1, Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

.4 ASTM F1667/F1667M-21a, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.3 American Wood Preservers Association (AWPA):

.1 AWPA Book of Standards, 2020.

.2 AWPA M2 Standard for the Care of Preservative-Treated Wood Products.

.4 Canadian Standards Association (CSA International):

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.2 CSA-G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles, Includes Update No 1 (2020).

.3 CAN/CSA O80 Series:21 – Wood Preservation, Includes Administrative Update (2022) and Errata (2022).

.4 CSA O112 Series-M1977 (R2006), CSA Standards for Wood Adhesives (Withdrawn).

.5 CSA O121-17, Douglas Fir Plywood.

.6 CSA O141-05 (R2019), Softwood Lumber.

.7 CSA O151-17 (R2022), Canadian Softwood Plywood.

.8 CSA-O325:21, Construction Sheathing (Adopted NIST PS 2-18, with Canadian deviations). Includes Administrative Update (2021).

.5 National Lumber Grades Authority (NLGA):

.1 NLGA SPS 2-2019, Special Products Standards on Machine Graded Lumber.

.2 Standard Grading Rules for Canadian Lumber 2017.

.6 South Coast Air Quality Management District (SCAQMD), California State. (SCAQMD)

.1 SCAQMD Rule 1113-16, Architectural Coatings.

.2 SCAQMD Rule 1168-22, Adhesive and Sealant Applications.

.7 Underwriters' Laboratories of Canada (ULC)

.1 ULC 102-18, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. (ULC S102)

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer’s printed product literature, specifications and data sheets.

.2 Submit SDS sheets or official manufacturer literature stating no urea-formaldehyde was used in the manufacturing of composite wood.

.3 Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

.2 Site Quality Control Submittals: Prior to covering exterior sheathing and shear walls, request structural engineer to review nailing patterns and provide confirmation report to Consultant.

1.5 QUALITY ASSURANCE

.1 Lumber shall be graded and stamped by an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.6 DELIVERY, STORAGE, AND PROTECTION

.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 panels from sunlight, water or excessive humidity.

.4 Protect sheet materials to prevent breaking of corners and damage to surfaces.

.5 Packaging Waste Management

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Waste Management and Disposal.

Part 2 Products

2.1 PANEL MATERIALS

.1 Plywood: Douglas Fir (DFP) or Canadian Softwood (CSP), Sheathing Grade, to CSA O121 or O151, thickness as indicated on drawings, meeting the requirements of CSA-O325.

.2 Fire Rated Plywood Panels to CSA O325, Class A fire retardant produced under Performance Standard PS-1, certified by the American Plywood Association.

.3 Exterior applications: marine-grade Douglas fir sheathing, Grade B-B; exposure durability rating shall be 'EXTERIOR', and the glue used shall be a fully waterproof structural adhesive.

.4 Pressure Preservative Treated Plywood:

.1 Plywood Grade: exterior grade sheathing.

.2 Treatment: In accordance with CAN/CSA O80 Series.

.3 Product: amine copper quat (ACQ) or copper Azole (CA).

.4 Retention:

.1 Above ground application: minimum of 4.0 kg/m3.

.2 Ground Contact Application: minimum of 6.4 kg/m3

.5 Water-borne preservative treated wood shall have maximum moisture content of 19% after treatment.

2.2 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 Select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work for blocking and nailers.

.3 Fabricate miscellaneous lumber from dimension lumber of sizes indicated, and into shapes shown on drawings.

.4 Moisture Content: 19% maximum for lumber items not specified to receive wood preservative treatment.

.5 Grade: for dimension lumber sizes provide No. 2 or Standard grade lumber per NLGA. For board-sized lumber, provide sheathing grade, S2S.

.6 Kiln dry lumber materials to 8% moisture content or less.

2.3 ACCESSORIES

.1 Sealants: in accordance with Section 07 92 00 – Sealants.

.2 General purpose adhesive: to CSA O112 Series.

.3 Rough Hardware (bolts, nuts, washers, etc.): Hot dip galvanized in conformity to CSA G164 or Grade A low carbon steel, conforming to ASTM A307.

.4 Surface Applied Wood Preservative: Containing minimum 19.6% Disodium octaborate tetrahydrate and 1.0% dodecyl dimethyl ammonium chloride in propylene glycol and water in accordance with CAN/CSA-O80.

2.4 FASTENERS

.1 Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Where rough carpentry is exposed to weather (during or after construction), in ground contact, pressure preservative treated, or in area of high relative humidity, provide fasteners with hot dip zinc coating complying with ASTM A153 or of Type 304 stainless steel.

.2 Nails, spikes and staples: to CSA B111, hot dipped galvanized for exterior work and pressure preservative and fire retardant treated materials.

.3 Power Driven Fasteners: Fasteners with a CCMC or ICC-ES evaluation report acceptable to authorities having jurisdiction.

.4 Through Bolts and Anchor Bolts: ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated flat washers, hot dip galvanized to ASTM A153.

.5 Wood Screws: ASME B18.6.1 or as specified on Drawings.

.6 Lag Screws: ASME B18.2.1

.1 All lag screws to be machined threaded, not cast threaded.

.2 Pre-drilled hole sized in wood members for lag screws to be in accordance with CSA O86.

.3 Lag screws are acceptable only where specifically indicated on the Drawings. Do not substitute lag screws for self-tapping wood screws.

2.5 FASTENER FINISHES

.1 Galvanizing: to CSA G164, use hot dipped galvanized fasteners for untreated and treated wood; exterior work and interior high humidity areas.

2.6 PRESERVATIVE TREATMENT

.1 Where lumber or plywood is indicated as preservative treated or is specified to be treated, treated in accordance with CAN/CSA O80 Series and AWPA.

.2 Wood preservatives containing arsenic or chromium are not permitted.

.3 Pressure treat above ground items with waterborne preservatives to minimum retention of 4.0 kg/m^3. 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.

.4 Fire retardant treatment (FRT): CAN/CSA-O80 Series, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of 25/75, to CAN/ULC-S102.

.5 Complete fabrication of treated items before treatment where possible. If cut after treatment apply field treatment to cut surfaces.

.6 Wood Preservatives: Maximum allowable VOC limit 350 g/L in accordance with SCAQMD Rule #1113 - Architectural Coatings.

Part 3 Execution

3.1 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

.2 Construct continuous members from pieces of longest practical length.

.3 Install spanning members with "crown-edge" up.

.4 Select exposed lumber and panel material for appearance. Install materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.5 Install blocking, plates and backing for all components mounted on gypsum board walls, ceilings, and bulkheads requiring support.

.1 Components include, but not limited to: architectural woodworking components, door frames and hardware, mirrors, washroom accessories, manufactured specialties, mechanical and electrical devices, and items indicated as N.I.C. and requiring support.

.2 Center supporting members on fastening line of supported component.

.3 Supporting members to extend one stud spacing to each side of the supported component.

.6 Provide all wood furring, blocking, strapping, nailing strips where required, and as indicated on drawings.

.7 Install sleepers as indicated.

.8 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.9 Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

.10 Comply with AWPA M4 and revisions specified in CSA O80 Series, supplementary requirements to AWPA M2 for applying field treatment to cut surfaces of preservative-treated lumber.

3.2 SITE APPLIED WOOD TREATMENT

.1 Apply preservative treatment to manufacturer's written instructions.

.2 Brush apply two (2) coats of preservative treatment on wood requiring cutting or drilling after treatment and on wood in contact with cementitious materials.

.3 Allow preservative to dry prior to erecting members.

3.3 POWER, TELECOMMUNICATIONS AND DATA PANEL BOARDS

.1 Install 19 mm fire rated fir plywood boards on all walls receiving telephone and data wiring and equipment; minimum 1220 mm x 2440 mm panels on periphery walls over 300 mm wide, mounted 150 mm off of finished floor.

3.4 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 The work of this section includes the supply, fabrication, delivery to the job site, finishing, and installation of site manufactured finish carpentry indicated on the drawings and as specified.

.2 Finish carpentry work shall include all clear, kiln dried, dressed, or resawn material exposed to view in a finished building interior and exterior, including running and standing trim, wall bases, door frames, paneling, trim and other trim related products.

1.2 RELATED REQUIREMENTS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 09 91 00 – Painting

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM F1667-21a, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI):

.1 North American Architectural Woodwork Standards (NAAWS), Most Recent Edition.

.3 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate provision of blocking or supports.

.2 Ensure that back-priming of finish carpentry surfaces concealed after installation, has been performed as specified in Section 09 91 00 – Painting, prior to installation.

.3 Materials and installation shall be in Metric measurements as specified.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.2 Indicate materials, thicknesses, finishes and hardware.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit duplicate samples, 300 mm long or 300 mm square of each wood species to receive finish, to the Consultant for review.

.2 Reviewed samples shall become the standard for the work.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operations and maintenance data in accordance with Section 01 78 00 – Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Architectural Woodwork Standards (NAAWS) published by the Architectural Woodwork Manufacturers Association of Canada, together with authorized additions and amendments will be used as a reference standard and shall form part of this project specification. Where differences occur between the drawings and specifications requirements and the NAAWS, the more restrictive requirement shall prevail.

.2 Any reference to Custom or Premium grade in this specification shall be as defined in the NAAWS.

.3 Any item not given a specific quality grade shall be Custom grade as defined in the NAAWS.

.4 A copy of the NAAWS shall be made readily available for reference purposes on the job site.

.5 References in this specification to part and item numbers mean those parts and items contained within the NAAWS.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 The Architectural Woodwork Manufacturer and the Contractor shall be jointly responsible to make certain that architectural woodwork is not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content.

.2 Architectural woodwork delivery, storage and handling shall be in accordance with Section two Care and Storage of the NAAWS.

.3 Delivered materials which are damaged in any way or do not comply with these specifications will be rejected by the Consultant and shall be removed from the job site and replaced with acceptable materials.

.4 Packaging Waste Management.

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

1.9 SITE CONDITIONS

.1 Comply with the NAAWS Section 2 – Care & Storage for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized.

Part 2 Products

2.1 LUMBER MATERIAL

.1 Hardwood lumber: white maple species, S4S, average moisture content of 6% and maximum of 9% for interior work, in accordance with following standards:

.1 National Hardwood Lumber Association (NHLA).

.2 NAAWS custom grade, moisture content as specified.

.3 Provide eased edges for bench tops.

2.2 FABRICATION

.1 Fabricate items rigid, plumb and square, as detailed, with tight, bevelled, hairline joints. Sand work smooth, set all nails and screws.

.2 Countersink bolts and washers, fill holes with matching wood plugs.

2.3 ACCESSORIES

.1 Fasteners: to suit size and nature of components being fastened.

.2 Wood screws: stainless steel, type and size to suit application.

.3 Adhesive: as recommended by manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Ensure surfaces are ready to receive Work. All surfaces of other Work to be finished and painted before being built-over or covered in any way or millwork installed.

3.2 INSTALLATION

.1 Do finish carpentry to Quality Standards of the NAAWS, except where specified otherwise.

.2 Scribe and cut as required to fit abutting walls and surfaces, to fit properly into recesses and to accommodate intersecting or penetrating objects; secure materials and components in place, rigid, plumb and square, with tight, hairline joints to locations indicated on Drawings and in accordance with NAAWS, and as follows:

.1 Form joints to conceal shrinkage.

.2 Countersink screws in round cleanly cut hole and plug with wood plug matching material being secured.

.3 Fabricate in the longest practical length with the purpose of minimizing the field joints.

.4 Match wood pieces end to end for consistent colour and grain appearance; space and centre joints evenly in runs.

.3 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 Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.

.4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

.4 Benches:

.1 Install bench boards in sizes as indicated on Drawings with eased edges to custom welded brackets as specified in Section 05 50 00 – Metal Fabrications and as detailed on the Drawings.

.2 Finish: transparent maple hardwood lumber as indicated above in accordance with Section 09 91 00 – Painting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Self adhesive waterproofing system materials.

.2 Accessories.

1.2 RELATED SECTIONS

.1 Structural Drawings – Cast-In-Place Concrete.

.2 Section 07 21 13 – Board Insulation.

.3 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier

.4 Section 07 92 00 – Sealants.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D412-16(2021), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.2 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting

.3 ASTM E96/E96M-22a, Standard Test Method for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

.4 ASTM E154/E154M-08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-9MA (withdrawn), Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with other work having a direct bearing on work of this section.

.2 Convene pre-installation meeting one week prior to beginning waterproofing Work, with waterproofing contractor's representative, Engineer, Consultant, and Contractor in accordance with Section 01 31 19 – Project Meetings to:

.1 Verify project requirements.

.2 Co-ordination with other building subtrades.

.3 Review installation procedures, substrate requirements, quality control procedures and warranty requirements.

1.5 ACTION SUBMITTALS /INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.2 Provide most recent data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit membrane manufacturer’s standard details that will be utilized for this project, indicate changes that must be made to make the details project specific for review by the Consultant.

.4 Provide WHMIS SDS - Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada and indicate VOC content.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate flashing, control joints, insulation and penetration details.

.3 Manufacturer's Certificate: certify that products meet or exceed specified requirements.

.4 Manufacturer's Installation Instructions: submit manufacturers recommended installation instructions and procedures.

1.6 QUALITY ASSURANCE

.1 Installer qualifications: Engage experienced installer acceptable to the membrane manufacturer with a minimum of three years experience who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance.

.2 Obtain primary waterproofing materials from single manufacturer and/or ensure materials ordered and supplied are compatible with one another. Ensure waterproofing materials are compatible with air and vapour retarder specified under Section 07 27 13 – Modified Bituminous Air and Vapour Barrier.

.3 Compatibility between components of waterproofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

.4 Mock-ups

.1 Provide required Sample Installation in accordance with Section 01 45 00 – Quality Control.

.2 Apply waterproofing to wall to demonstrate surface preparation, joint treatment, corner treatment, thickness, texture, execution quality and tie in to adjacent membranes.

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

.5 Quality Control Submittal:

.1 At completion of installation and tie ins with adjacent membranes, prior to covering waterproofing, request Consultant review.

.2 Allow 48 hours for inspection of mock-up by Consultant before proceeding with air/vapour barrier work.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Provide and maintain dry, off-ground weatherproof storage.

.2 Store rolls of membrane in upright position.

.1 Store membrane rolls with salvage edge up.

.3 Remove only in quantities required for same day use.

.4 Handle waterproofing materials in accordance with manufacturer's written directives, to prevent damage or loss of performance.

.5 Store and manage hazardous materials in accordance with Section 01 35 29 – Health and Safety Requirements.

.6 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer.

.2 Minimum temperature for solvent-based adhesive in accordance with manufacturer’s recommendations.

.3 Install waterproofing on substrate, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into waterproofing system.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable manufacturers: Subject to compliance with requirements of this Section, products by the following manufacturers are acceptable. However, it is Contractor’s responsibility to provide only products compatible with adjacent materials in assembly.

.1 Henry Company.

.2 IKO.

.3 Siplast.

.4 Soprema.

.5 W.R. Meadows.

2.2 MATERIALS

.1 Waterproofing Membrane: SBS modified bitumen self-adhering sheet membrane with cross-laminated polyethylene film, covered by pull-off release sheets and as follows:

.1 Minimum total thickness: 1.5 mm.

.2 Tensile strength (membrane): minimum 2.24 MPa to ASTM D412.

.3 Tensile strength (film): minimum 34 MPa to ASTM D882

.4 Ultimate elongation: minimum 55% to ASTM D412.

.5 Flexibility at cold temperature: minimum -26°C.

.6 Water vapour transmission: ≤0.05 perms to ASTM E96.

.7 Puncture Resistance: minimum 0.22 kN to ASTM E154.

.8 Acceptable Materials:

.1 MiraDRI 860/861, Carlisle CCW.

.2 Blueskin WP200, Henry Company

.3 Aquabarrier FP, IKO

.4 Colphene 3000, Soprema

.5 Mel-Rol, W.R. Meadows

2.3 ACCESSORIES

.1 Primer: water based primer or elastomeric bitumen, solvent primer with adhesive enhancing resins to enhance adhesion of self-adhesive membranes as recommended by membrane manufacturer.

.2 Waterproofing Mastic: single component sealing compound to seal exterior, vertical and horizontal terminations as recommended by manufacturer.

.3 Below Grade Insulation: as indicated in Section 07 21 13 - Board Insulation.

.4 Termination Bar: high strength plastic composite, ultraviolet resistant as recommended by membrane manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Do not proceed with work until conditions are in accordance with manufacturers instructions.

.2 Ensure surfaces are smooth, dry, clean and free of ice and debris as per manufacturer’s recommendations.

.3 Do not install materials in conditions of snow or rain.

.4 Cure concrete a minimum of 14 days, adhesion test is recommended before membrane application.

.5 Verify the compatibility of membrane components with curing compounds, coatings, or other materials which are already installed on the surfaces to be treated.

.6 Abrasive blast surface if required to promote adhesion.

.7 Report cracks over 3 mm wide to Consultant. Fill crack with waterproofing mastic. Apply 150 mm wide strip of membrane centered over crack.

3.2 METHOD OF EXECUTION

.1 Perform Work on a continuous basis as surface and weather conditions allow.

.2 Protect adjoining surfaces against damage that could result from the waterproofing installation.

3.3 PRIMER APPLICATION

.1 Apply primer coating as recommended by manufacturers printed instructions. If not covered the same day, primed surfaces must be re-primed.

3.4 WATERPROOFING MEMBRANE INSTALLATION

.1 Select waterproofing membrane according to temperatures during application. For membrane applications (not primer) at temperature below -10°C, contact membrane manufacturer.

.2 Install membrane in strict accordance with manufacturers written instructions or specification requirements whichever is more stringent.

.3 Apply pre-stripped membrane and seal with waterproofing mastic to all protrusions through waterproofing membrane.

.4 Align the first roll of membrane to a previously drawn chalk line.

.5 Pre-strip edges with a 150 mm wide strip of membrane centered on the corner. Membrane to be installed in direct contact with the substrate not leaving any voids under the membrane strip.

.6 Install membrane onto primed surface by peeling back the paper backing on the underside and adhering the membrane to the surface.

.7 Install subsequent rolls in the same manner and aligned with the preceding roll with a side lap of at least 75 mm. End laps must be overlapped at least 150 mm.

.8 Holes and tears in the membrane must be repaired with the appropriate membrane material. The repair must exceed the affected surface area by at least 75 mm. The membrane piece applied for the repair must be sealed around its edges with mastic.

.9 Use a roller approved by manufacturer to apply pressure over the entire surface of the membrane to ensure perfect adhesion.

.10 Contractor to verify meticulously the membrane installation at the end of each day of work and before application of membrane protection system and backfilling.

.11 Seal all inside corner overlaps with a bead of mastic after membrane installation.

.12 Uppermost edge of membrane is to be mechanically fastened to the concrete substrate using applicable fasteners and termination bars.

.13 Apply mastic on the top edge of membrane to prevent water infiltration.

.14 Any waterproofing membrane left exposed after backfilling shall be protected from ultra violet and mechanical damages.

3.5 CLEANING

.1 As the work proceeds and on completion clean up and remove from site all rubbish and surplus materials resulting from the foregoing work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Board insulation at perimeter foundation wall, underside of floor slabs and cavity wall applications.

1.2 RELATED SECTIONS

.1 Section 01 35 00 – Delegated Design

.2 Structural Drawings – Cast-in-Place Concrete.

.3 Section 04 22 00 – Unit Masonry

.4 Section 06 10 00 – Rough Carpentry

.5 Section 07 21 19 – Foam-in-Place Insulation.

.6 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier

.7 Section 07 27 19 – Sheet Membrane Vapour Barrier.

.8 Section 07 62 00 – Sheet Metal Flashing and Trim.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-20 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M-21a, Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.3 ASTM C518-21, Standard Test Method for Steady-State Heat Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.4 ASTM C612-14(2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.5 ASTM D638-22, Standard Test Method for Tensile Properties of Plastics.

.6 ASTM D695-15, Standard Test Method for Compressive Properties of Rigid Plastics.

.7 ASTM D732-17, Standard Test Method for Shear Strength of Plastics by Punch Tool.

.8 ASTM D1621-16, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.9 ASTM D2842-19, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.10 ASTM E84-22 Standard Test Method for Surface Burning Characteristics of Building Materials.

.11 ASTM E831-19, Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis.

.2 Canadian Gas Association (CGA):

.1 CSA B149.1:20 – Natural Gas and Propane Installation Code, Includes Errata (2020), Ontario Amendments (2021), and Administrative Update (2021).

.2 CSA B149.2:20 –Propane Storage and Handling Code.

.3 CSA B149.3:20 –Code for the Field Approval of Fuel-Burning Appliances and Equipment, Includes Ontario Amendments (2021).

.3 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M (Withdrawn), Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

.5 Underwriters Laboratories of Canada (ULC)

.1 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. (ULC S102) (2018).

.2 ULC 114, Standard Method of Test for Determination of Non-Combustibility in Building Materials (2018).

.3 ULC 604, Standard for Factory-Built Type A Chimneys. (2022).

.4 ULC 701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering. (CAN/ULC-S701-11) (Withdrawn).

.5 ULC 702.1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification. (ULC-S702.1) (2021).

.6 ULC 702.2, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines. (ULC-S702.2-15).

.7 ULC 770, Standard Test Method for Determination of Long-term Thermal Resistance of Closed-Cell Thermal Insulating Foams. (CAN/ULC S770-15).

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.2 Provide two copies of WHMIS SDS - Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions: Submit manufacturer's installation instructions.

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.

.3 Health and Safety Requirements: in accordance with Section 01 35 29 – Health and Safety Requirements.

1.6 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 plastic 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 plastic insulating materials to Project site before installation time.

.3 Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

.2 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

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 similar products that may be incorporated into the Work include the following:

.1 Beaver Plastics.

.2 DuPont Performance Building Solutions

.3 Johns Manville.

.4 Owens-Corning Canada.

.5 Plasti-Fab EPS Product Solutions.

.6 Rockwool Inc.

.7 Soprema

.8 T-Clear Corp.

.9 Tech-Crete Processors Ltd.

2.2 INSULATION MATERIALS

.1 Underslab Insulation: Mineral Wool Rigid Insulation: Non-combustible, rigid, water repellent, mineral wool insulation board to ASTM C612, Type IVB and CAN/ULC 702 Type one.

.1 Fire Performance:

.1 Non-combustibility: To CAN/ULC 114.

.2 Surface Burning Characteristics: To CAN/ULC 102.

.1 Flame spread: 0.

.2 Smoke developed: 0.

.2 Thermal Resistance: RSI 0.72/25 mm minimum.

.3 Thickness: as indicated on Drawings.

.4 Density: 128 kg/m^3.

.5 Basis of Design Materials:

.1 ComfortBoard 80, Rockwool Inc.

.2 Foundation Wall Insulation: Extruded polystyrene (XPS) to CAN/ULC S701 and as follows:

.1 Type: IV.

.2 Thermal Resistance: LTTR RSI 0.88/25 mm minimum.

.3 Edges: square.

.4 Size: 610 mm x 2440 mm x thickness as indicated on Drawings.

.5 Compressive Strength: minimum 200 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 Styrofoam SM, DuPont Performance Building Solutions.

.2 Foamular C-300, Owens-Corning Canada LP.

.3 Sopra-XPS 30, Soprema.

.3 Concrete Faced Insulation: Premanufactured concrete faced polystyrene, extruded type, in accordance with CAN/ULC S701 and CAN ULC S770 and as follows:

.1 Type: IV.

.2 Thermal Resistance: LTTR RSI 0.88/25 mm minimum.

.3 Edges: tongue and groove.

.4 Size: 610 mm x 1220 mm x thickness as indicated on Drawings with 8 mm concrete topping.

.5 Compressive Strength: minimum 200 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 WALLGuard, T-Clear Corp.

.2 CFI Wall Panels, Tech-Crete Processors Ltd.

.4 Semi-Rigid Mineral Wall Insulation: Unfaced, preformed semi-rigid fibrous mineral slag board insulation in accordance with CAN/ULC 702 and as follows:

.1 Type: 1VB to ASTM C612.

.2 Thermal Resistance: RSI 0.74/25 mm minimum.

.3 Combustion Characteristics: non-combustible in accordance with CAN/ULC 114.

.4 Flame spread and Smoke Development:

.1 Flame spread: 0/10 for black faced insulation in accordance with CAN/ULC 102.

.2 Smoke Development: 0/10 for black faced insulation in accordance with CAN/ULC 102.

.5 Edges: square.

.6 Size: 406 mm x 1220 mm x thickness or as indicated on Drawings.

.7 Basis of Design Materials:

.1 CavityRock, Rockwool Inc.

.2 CavityRock Black, Rockwool Inc for open-joint cladding systems.

2.3 ADHESIVE MATERIALS

.1 Adhesive (for polystyrene): trowel consistency, synthetic rubber based insulation adhesive compatible with polystyrene insulation to CGSB 71-GP-24; suitable for application in temperature down to -12°C.

.1 Basis-of-Design Materials:

.1 230-21 or Airbloc 21 Rigid Insulation Adhesive, Henry Company.

2.4 ACCESSORIES

.1 Thermally Broken Clip System:

.1 Low-conductivity thermal spacers confirm all clips with structural engineer and loads in accordance with Section 01 35 00 – Delegated Design and as follows:

.1 Sub-framing Thermal Spacer: 100 % Pultruded glass fibre and thermoset polyester resin insulation clip.

.1 Thermal Spacer thickness for top, base and web: 4.8 mm nominal.

.2 Thermal spacer depth: as indicated on Drawings.

.3 Depth tolerance: ± 0.127 mm.

.4 Spacing: as indicated on Drawings or as required by delegated design.

.5 Fasteners: hot dipped galvanized type as recommended by manufacturer in length to suit wall construction.

.6 Shims: as required to remove imperfections in sheathing/stud wall.

.7 Basis-of-Design Materials:

.1 Cascadia Clip, Cascadia Windows Ltd.

.2 Cladding Support System Sub-girts: fibreglass girt profiled to accept insulation, and exterior metal girt with structural attachment to building frame and the following performance values:

.1	Compressive Strength:	ASTM D638	40,000 psi.
.2	Compressive Modulus:	ASTM D695	673,400 psi.
.3	Shear Strength:	ASTM D732	16,000 psi.
.4	Thermal Conductivity:	ASTM C518	1.05 BTU in/ hr sf degree F.
.5	Coefficient of Thermal Expansion:	ASTM E831	2.2 x 10e-6 in/in/degree F.
.6	Thermal Resistance (R value):	ASTM C518	0.95 hr sf degreeF/BTU.
.7	Surface Burning Characteristics:	ASTM E84.	

.1 Flame Spread: 25 (class A).

.2 Smoke Developed: 50 (class A)

.8 Basis-of-Design Materials:

.1 Armatherm Girt.

.2 Girts: Structural quality steel to ASTM A653, with Galvalume AZM 150 coating, fabricated from minimum 1.27 mm thickness material, Z-profile for vertically oriented thermal clip and hat-profile for horizontally oriented thermal clips, and additionally as required by cladding manufacturer as indicated to accept panel.

.3 Screw Fasteners: 316 Stainless steel, of type to suit installation and to support all superimposed loads.

.4 Insulation Fasteners

.1 Mechanical Fasteners: High quality, impact resistant plastic fastener system specifically designed for installation of board insulation materials; 38 mm diameter, shaft length to suit insulation thickness and hot dipped galvanized fastener to suit substrate, and as follows:

.1 Acceptable Materials:

.1 Insulation Fasteners, Ucan Fastening Systems.

.2 Ramset Insulfast.

.2 Insulation Clips: Impale type, perforated 50 mm x 50 mm cold rolled carbon steel 0.912 mm core metal thickness, adhesive back; 2.657 mm diameter annealed steel wire spindle, length to suit insulation, 25 mm diameter self locking washers, and as follows:

.1 Basis-of-Design Materials:

.1 Gemco Insulation Fasteners, Insulation Hanger.

.3 Concrete Faced Insulation Fasteners: Concrete faced insulation manufacturer’s standard concealed fasteners with groove mounting plate and fastening spline.

.5 Protection Board: Pre-moulded, semi-rigid asphalt/fibre composition board, minimum 6 mm thick, formed under heat and pressure as recommended by board insulation manufacturer for below grade installations or cement board as indicated.

.6 Perimeter Insulation Flashings: Coordinate supply of end closures and flashings for perimeter insulation system with Section 07 62 00 - Sheet Metal Flashing and Trim.

Part 3 Execution

3.1 EXAMINATION

.1 Verify conditions before starting work.

.2 Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive. Immediately inform Consultant in writing of defects.

.3 Verify substrate surfaces are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.2 INSTALLATION – GENERAL

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Install insulation after building substrate materials are dry.

.3 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.4 Fit insulation tight (maximum 3 mm air gap) around electrical boxes, wires, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.5 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of ULC 604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 type B and L vents.

.6 Use only insulation boards free from chipped or broken edges that is dry, and unsoiled and that has not been left exposed at any time to ice and snow.

.7 Use largest possible dimensions to reduce number of joints.

.8 Offset both vertical and horizontal joints in multiple layer applications.

.9 Do not enclose insulation until it has been reviewed by Consultant.

.10 Install rigid insulation to maintain continuous thermal insulation, vapour barrier and air tightness for building spaces and elements.

.11 Saw-cut and trim insulation neatly to fit spaces. Butt edges and ends tight (maximum 3 mm air gap). Fit insulation tight against items protruding plane of insulation. Fill voids with foamed-in-place insulation compatible with installed insulation; refer to Section 07 21 19 – Foam-in-Place Insulation.

.12 Follow the instructions for use of materials of insulation and accessory manufacturers.

.13 Leave insulation joints unbonded over line of expansion and control joints; bond a continuous 150 mm wide strip of primary vapour membrane over expansion and control joints using compatible adhesive.

3.3 INSTALLATION – FOUNDATION PERIMETER INSULATION

.1 Install board insulation to vertical surfaces with adhesive applied in accordance with manufacturer's written instructions, and as follows:

.1 Exterior Application: Extend boards as indicated on Drawings.

.2 Apply adhesive to the substrate by the "dab" method not less than 10 mm x 20 mm size at 150 mm centres; bed the insulation in the adhesive before the adhesive loses its tack or skins over.

.3 Protect below grade insulation on vertical surfaces from damage during backfilling by applying protection board; set in adhesive according to insulation manufacturer's written instructions.

.2 Concrete Faced Perimeter Insulation: Install in accordance with manufacturer’s written instructions, and as follows:

.1 Fasten board insulation using manufacturer recommended fastening system.

.2 Cover exposed insulation at corners and top of perimeter insulation with prefinished flashing as specified in Section 07 62 00 - Sheet Metal Flashing and Trim.

.3 Install boards vertically in accordance with manufacturers written instructions.

3.4 INSTALLATION – UNDERSLAB INSULATION

.1 Extend boards as indicated on Drawings, and as follows:

.1 Place insulation level under slabs on grade after base for slab has been compacted.

.2 Protect top surface of horizontal insulation from damage during concrete work by applying protection board.

.2 Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

.3 Prevent insulation from being displaced or damaged while placing vapour retarder.

.4 Tape joints of underslab insulation and fill with 2 lb spray insulation.

3.5 INSTALLATION - CAVITY WALL INSULATION

.1 Cavity Wall Insulation: Fit courses of insulation between confining obstructions in cavity; butt edges tightly in vertical and horizontal directions and as follows:

.1 Apply insulation fasteners in accordance with manufacturer’s installation instructions. Apply additional fasteners where uneven substrates exist.

.2 Apply sheet membrane vapour retarder behind thermal clips or cladding support system sub-girts prior to installation of insulation between thermal clips supporting cladding.

.3 Install insulation clips to walls before sheet membrane vapour retarders are applied.

3.6 PROTECTION

.1 Protect installed board insulation from damage due to harmful weather exposures, physical abuse, and other causes.

.2 Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Batt insulation in exterior wall and roof construction indicated.

.2 Accessories.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 19 – Sheet Membrane Vapour Barrier

.3 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C167-22, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.

.2 ASTM C423-22 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.3 ASTM C1320-20, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.4 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.5 ASTM E413-22, Classification for Rating Sound Insulation.

.6 ASTM F1667/F1667M-21a, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.2 Canadian Gas Association (CGA)

.1 CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 CSA B149.2:20 – 2020, Propane Storage and Handling Code.

.3 CSA B149.3:20, Code for the Field Approval of Fuel-Burning Appliances and Equipment.

.3 Underwriters Laboratories of Canada (ULC)

.1 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies (ULC S102) (2018).

.2 ULC 114, Standard Method of Test for Determination of Non-Combustibility in Building Materials (2018).

.3 ULC 604, Standard for Factory-Built Type A Chimneys (2022).

.4 ULC 702.1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification. (ULC-S702.1) (2021).

.5 ULC 702.2, Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines. (ULC-S702.2-2015).

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.2 Submit WHMIS SDS - Safety Data Sheets. WHMIS SDS acceptable to Labour Canada and Health and Welfare Canada for sealants. Indicate VOC content.

.2 Manufacturer's Instructions: Submit manufacturer's installation instructions.

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 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and store insulation materials and accessories, undamaged in original packaging or cartons, in a suitable environment bearing manufacturer’s seals and labels.

.2 Store to protect materials from wind, moisture, sunlight and accidental ignition.

.3 Store insulation materials neatly on raised platforms and protect with waterproof covers. Keep dry at all times.

.4 Do not install insulation that has been damaged or wet. Remove it from jobsite.

.5 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

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 similar products that may be incorporated into the Work include the following:

.1 Owens-Corning Canada LP.

.2 Rockwool Inc.

2.2 BATT INSULATION

.1 Fibrous Mineral Wool Thermal Insulation: non-combustible, stone wool batt insulation to CAN/ULC S702 and as follows:

.1 Type: one.

.2 Fire performance:

.1 Combustion Characteristics: non combustible in accordance with CAN/ULC S114.

.2 Surface Burning Characteristics: To CAN/ULC S102.

.1 Flame spread: 0.

.2 Smoke developed: 0.

.3 Density: 32 kg/m^3 to ASTM C167.

.4 Thermal Resistance: nominal RSI of 0.71/25 mm.

.5 Thickness: as required to fill insulated spaces.

.6 Acceptable Materials:

.1 Thermafiber UltraBatt, Owens-Corning Canada LP.

.2 ComfortBatt, Rockwool Inc.

.2 Refer to Section 09 21 16 – Gypsum Board Assemblies for insulation in interior partitions.

2.3 ACCESSORIES

.1 Insulation clips:

.1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

.2 Attic Rafter Vents: extruded polystyrene foam vent, moisture and rot resistance and as follows:

.1 Size: 572 mm x 1220 mm.

.2 Air channel depth: 37.5 mm.

.3 Acceptable Materials:

.1 Durovent, ADO.

.2 Raft-R-Mate, Owens-Corning Canada LP.

.3 Eave Ventilation: Preformed, rigid fibreboard or plastic sheets designed and sized to fit between roof framing members, and to provide cross ventilation between insulated attic spaces and vented eaves.

.4 Nails: galvanized steel, length to suit insulation plus 25 mm, to ASTM F1667.

.5 Staples: 12 mm minimum leg.

.6 Tape: as recommended by manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 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 in spaces without gaps or voids. Friction fit insulation between framing members, structural components and other items snug and tight. Do not compress insulation to fit into spaces.

.2 Cut and trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids. Use batts free from ripped or damaged back and edges.

.3 Install batt insulation where indicated with continuous vapour retarder on the warm side of the insulation in accordance with ASTM C1320.

.4 Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

.5 Fit insulation closely around electrical boxes, wires, 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. Refer to manufacturer's recommendations for additional clearance requirements.

.7 Fill stud space of exterior framed walls with insulation full depth of stud only where no insulation/vapour retardant indicated on exterior face of stud walls.

.8 Hold insulation in position with clips, wires or as recommended by manufacturer when insulation is installed in horizontal locations.

.9 Do not install batt insulation into stud cavity until exterior wall membrane has been installed.

.10 Do not enclose insulation until it has been reviewed by Consultant.

.11 Installation of Attic Rafter Vents:

.1 Install in accordance with manufacturer's written instructions.

.2 Install in each rafter or truss space beginning at soffit area and continue up the cavity to the ridge vent or to a common air space.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Foamed-in-place insulation in exterior hollow steel door frames.

.2 Foam-in-place insulation around protrusions through the exterior wall envelope and juncture of different cladding materials.

1.2 RELATED REQUIREMENTS

.1 Section 07 21 13 – Board Insulation

.2 Section 07 21 16 – Fibrous Insulation

.3 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier

.4 Section 07 27 19 – Sheet Membrane Vapour Barrier

.5 Section 07 92 00 – Sealants

.6 Section 08 11 13 – Steel Doors and Frames

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C518-21, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.2 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

.3 ASTM E331-00(2016), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference

.4 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission of Loss of Building Partitions and Elements

.2 Canadian Urethane Foam Contractors' Association Inc. (CUFCA).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 SDS - Safety Data Sheets.

.4 Underwriters' Laboratories of Canada (ULC)

.1 ULC 101, Standard Methods of Fire Endurance Tests of Building Construction and Materials (CAN/ULC S101-14).

.2 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies (ULC S102) (2018).

.3 ULC 705.2, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application (2020).

.4 ULC 770, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams (CAN/ULC-S770-15).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Cooperate and coordinate with the requirements of other units of work specified in other sections.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide one electronic copy of WHMIS SDS - Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.

.2 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: submit certified test reports for insulation 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-101 for fire endurance and CAN/ULC-102 for surface burning characteristics.

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

1.6 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Obtain air and vapour seal materials from a single manufacturer regularly engaged in manufacturing the products specified in this Section.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience, and companies that are members and licensed with CUFCA having trained and certified installers in accordance with CAN/ULC S705.2 and CUFCA requriements.

.3 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations provincial Occupational Health and Safety Act.

1.7 DELIVERY, STORAGE, AND HANDLING

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

.2 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – General Requirements, Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

.2 Ensure temperature is maintained throughout the curing period.

.3 Provide sufficient ventilation during and until insulation has cured, to ensure safe working conditions. Introduce fresh air and exhaust air continuously during the 24 hour period after application.

Part 2 Products

2.1 MATERIALS

.1 Insulation: open cell, low expansion, one component, spray polyurethane foam.

- .1 Air Infiltration: < 0.01 cfm/ft2 @ 1.56 psf (75Pa) to ASTM E283.
- .2 Water Infiltration: no leakage to ASTM E331.
- .3 Sound Transmission Classification: 55 to ASTM E90.
- .4 Tensile Strength: >5 N/cm2 to HTC method 2106.
- .5 RSI Value: minimum 0.88 m2 K/W to CAN/ULC 770.
- .6 Acceptable Materials:
  - .1 EnerFoam, DuPont.
  - .2 HandiFoam Window & Door Sealant, Fomo Products Inc.
  - .3 CF 812 WD, Hilti (Canada) Ltd.

.2 Thermal Barrier: spray applied fire retardant overcoat meeting applicable requirements of the Building Code for thermal barrier of foamed plastic.

- .1 Gypsum/fibre based:
  - .1 Acceptable Materials:
    - .1 A/D Thermal Barrier, Carboline (formerly AD Fire Protection Systems)
    - .2 CafcoBlaze-Shield II, Isolatek International.
    - .3 Monokote Z-3306, WR Grace & Co.
- .2 Intumescent Coatings:
  - .1 Basis-of-Design Materials:
    - .1 DC315 Intumescent Coating, IFTI

Part 3 Execution

3.1 PREPARATION

.1 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

.2 Clean spaces that are to receive insulation, of dirt, dust, grease, loose material or other foreign matter that may inhibit adhesion.

.3 Prior to application, slightly moisten surfaces to which foam in place insulation is being applied, to accelerate curing.

.4 Temporarily brace frames as may be required to prevent possible bowing of frames due to over expansion of the foam-in-place insulation.

3.2 INSTALLATION

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

.2 Apply insulation by spray method, to a uniform monolithic density without voids and that foam is continuous at corners.

.3 Fill exterior hollow metal door frames 75% full with foam-in-place insulation prior to installation of door frames. Fill the remainder of the frame after installation, through the gap between the frame and the wall construction.

.4 Install foam-in-place insulation through all protrusions that penetrate the building envelope to achieve and maintain continuity of air/vapour seal. Install foam-in-place insulation to warm side of structural elements to provide a thermal barrier to interior of heated spaces where structural elements are continuous from interior to exterior of building envelope.

.5 Ensure that foam completely fills spaces, without voids, and that foam is continuous at corners.

.6 Patch damaged areas in accordance with manufacturer’s written instructions.

3.3 PROTECTION

.1 Do not permit subsequent construction work to disturb applied insulation.

3.4 CLEANING

.1 Cut back excess foam-in-place insulation once cured, flush with surrounding surfaces, or recess back for application of sealant as specified in Section 07 92 00 – Sealants.

.2 Upon completion of foam-in-place insulation, clean adjacent surfaces of overspray and dusting to the satisfaction of the consultant.

.3 At conclusion of work, remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section includes requirements for supply and installation of a spray polyurethane foam air and vapour seal system, and other components to bridge and seal the following air leakage pathways and gaps between; but not limited to, the following:

- .1 Connections of the walls to the roof air seal.
- .2 Connections of the walls to the foundations.
- .3 Expansion joints.
- .4 Openings and penetrations.
- .5 Piping, conduit, duct and similar penetrations.
- .6 All other air leakage pathways in the building envelope.
- .7 A spray applied thermal barrier over the polyurethane.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier

.3 Section 07 62 00 – Sheet Metal Flashing and Trim

.4 Section 07 92 00 – Sealants

.5 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C518-19 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .2 ASTM D1621-16 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.
- .3 ASTM D1622-20 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- .4 ASTM D1623-17 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- .5 ASTM D2842-19 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
- .6 ASTM D6226-21 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
- .7 ASTM E96/E96M-22a - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 SDS - Safety Data Sheets.

.3 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule #1113-16, Architectural Coatings.

.4 Underwriters' Laboratories of Canada (ULC)

.1 ULC 101, Standard Methods of Fire Endurance Tests of Building Construction and Materials (CAN/ULC-S101-14).

.2 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies (ULC S102). (2018)

.3 ULC 127, Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Building Materials. (CAN/ULC S127-14)

.4 ULC 705.1, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification (CAN/ULC S705.1-15).

.5 ULC 705.2, Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application (2020).

.6 ULC 718, Standard for Site Quality Assurance Program for Spray Polyurethane Foam (2018).

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide one electronic copy of WHMIS SDS - Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.

.2 Quality assurance submittals: submit following in accordance with Section 01 45 00 – Quality Control.

.1 Test reports: submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.2 Submit test reports in accordance with ULC-101 for fire endurance and ULC-102 for surface burning characteristics.

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

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

.5 Moisture content of wood: measure moisture content of wood that is to be in direct contact with insulation. Submit results to Consultant for review. Measure ten different locations and report on plans and details.

1.5 QUALITY ASSURANCE

.1 Applicators to conform to Manufacturer’s third party Site Quality Assurance Program.

.2 Qualifications:

.1 Installer: person specializing in sprayed insulation installations with five years documented experience, approved by manufacturer.

.2 Manufacturer: company with minimum five years experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.

.3 Health and Safety Requirements: Worker protection:

.1 Protect workers as recommended by ULC-705.2 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.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials in sealed unopened containers clearly indicating manufacturer, product identification and safety information.

.4 Store materials above minimum temperature as recommended by manufacturer.

.5 Store materials in dry and well-ventilated area away from weather and direct sunlight. Maintain temperatures between 18ºC and 30ºC.

.6 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Ventilate area in accordance with Section 01 51 00 – Temporary Utilities.

.2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.

.3 Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation materials, primer and overcoat.

.4 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.

.5 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.

.6 Apply insulation only when surfaces and ambient temperatures are within manufacturer’s prescribed limits.

.7 Use of insulation products manufactured with HCFCs or CFCs as blowing agents is prohibited.

.8 Plan and coordinate the insulation Work to minimize the generation of cut-offs and waste. Sequence Work to maximize use of insulation off-cuts and waste.

1.8 WARRANTY

.1 The work under this section shall be warranted by the contractor against defects in workmanship or material for a period of two years from date of substantial completion.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

.1 Acceptable Materials: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following:

.1 WallTite v3, BASF.
.2 Heatlok Soya, Demilec Inc – Cornell Group.
.3 Insulthane Extreme, Elastochem
.4 JM Corbond III Canadian Formula, Johns Manville.
.5 Polarfoam PF-7300, Polyurethane Foam Systems Inc.
.6 BOREAL NATURE, Solutions Genyk Inc.

2.2 MATERIALS

.1 Insulation: spray polyurethane to CAN/ULC-S705.1, meeting requirements of Montreal Protocol for ozone protection without ozone depleting substances in blowing agents and as follows:

.1	Density to ASTM D1622:	≥ 28 Kg/m^3
.2	Thermal Resistance	
	180 days @ 23 deg C to ASTM C518.:	1.97 RSI/50 mm.
.3	Open Cell Content to ASTM D6226:	≤ 8%
.4	Water Vapour Permeance,	
	50 mm sample to ASTM E96:	≤ 60 ng/Pa.s.m^2
.5	Air Barrier Material, 25-30 mm:	0.00004 L/s/m^2 @ 75 Pa
.6	Water Absorption to ASTM D2842:	< 4%
.7	Tensile Strength to ASTM D1623:	≥ 200 kPa
.8	Compressive Strength to ASTM D1621:	≥ 170 kPa
.9	Flame Spread Classification: to CAN/ULC S102 and CAN/ULC S127 and as follows:	
	.1 Flame Spread:	< 300
	.2 Smoke Developed:	< 400

.2 Primers: in accordance with manufacturer's recommendations for surface conditions.

.1 Maximum VOC limit 100 g/l to SCAQMD Rule #1113.

.3 Thermal Barrier: spray applied fire retardant overcoat meeting applicable requirements of the Building Code for thermal barrier of foamed plastic.

.1 Gypsum/fibre based:

.1 Acceptable Materials:

.1 A/D Thermal Barrier, Carboline (formerly AD Fire Protection Systems)

.2 CafcoBlaze-Shield II, Isolatek International.

.3 Monokote Z-3306, WR Grace & Co.

.2 Intumescent Coatings:

.1 Basis-of-Design Materials:

.1 DC315 Intumescent Coating, IFTI

2.3 EQUIPMENT

.1 Comply with CAN/ULC S705.2 and the equipment manufacturer's recommendations for application type.

2.4 ACCESSORIES

.1 Prime substrate when required by spray polyurethane manufacturer or the membrane manufacturer. Follow requirements of the manufacturer for the type of primer and the installation of the primer for the surface conditions.

Part 3 Execution

3.1 EXAMINATION

.1 Inspect areas to receive work of this Section and ensure conditions are suitable to begin application.

.2 Verify that surfaces are clean, dry, and free of matter that may inhibit adhesion.

.3 Verify other work on and within spaces to be insulated is complete prior to application.

.4 Verify that work penetrating through air seal is complete.

.5 Verify that appropriate back-up material has been installed in all large voids.

.6 Confirm wood framing moisture content is suitable (not more than 15%) for installation prior to commencement of work.

3.2 PREPARATION

.1 Mask and protect adjacent surfaces from overspray or damage.

.2 Clean substrates of dirt, dust, grease, oil, loose material and other matter which may affect bond of spray applied materials.

.3 Remove oil from galvanized sheet steel substrates and apply prime coating in accordance with manufacturer's instructions.

.4 Apply primer where recommended by manufacturer, to manufacturer's written instructions.

3.3 APPLICATION

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

.2 Apply insulation to clean surfaces in accordance with ULC-S705.2, ULC S718, and manufacturer's printed instructions.

.3 Apply insulation to a uniform monolithic density without voids.

.4 Apply sprayed foam insulation in thickness as indicated.

.5 Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened.

.6 Repair damaged areas in accordance with manufacturer's application guidelines for insulation.

.7 Cover spray polyurethane foam with fire retardant overcoat when installed on building interior in accordance with manufacturer’s instructions. Apply overcoat monolithically, without voids to fully cover insulation.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 PROTECTION

.1 Do not permit subsequent construction work to disturb applied insulation.

.2 Protect spray polyurethane foam installation from ultraviolet exposure in accordance with manufacturer’s requirements.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

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

END OF SECTION

PART 1 General

1.1 RELATED REQUIREMENTS

.1 Structural Drawings – Cast-in-Place Concrete

.2 Section 04 22 00 – Unit Masonry

.3 Section 07 21 13 – Board Insulation

.4 Section 07 21 19 – Foam-In-Place Insulation

.5 Section 07 61 00 – Sheet Metal Roofing

.6 Section 07 62 00 – Sheet Metal Flashing and Trim

.7 Section 07 92 00 – Sealants

.8 Section 08 11 13 – Steel Doors and Frames

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D1970/D1970M-21, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.2 ASTM D5147/D5147M-18 Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.

.3 ASTM E96/E96M-122a, Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

.4 ASTM E2178-21a, Standard Test Method for Determining Air Leakage Rate and Circulation of Air Permeance of Building Materials.

.2 Canadian Standards Association (CSA)

.1 CSA A123.23-15 (R2020), Product Specification for Polymer-Modified Bitumen Sheet, Prefabricated and Reinforced.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-56M (withdrawn), Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

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 which 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.

.2 Arrange for manufacturer’s factory-trained agent to be on site at beginning of installation to provide training and supervision of personnel who will install membrane. Agent shall also provide frequent inspection visits thereafter to assure quality and competence of membrane installations.

.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.

1.4 ACTION SUBMITTALS / INFORMATION SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's printed product literature, specifications and datasheet 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.

.2 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 – Quality Control.

.1 Existing Substrate Condition: report deviations, as described in PART THREE -EXAMINATION in writing to Consultant.

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

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

1.5 QUALITY ASSURANCE

.1 Applicator: company specializing in performing work of this section with minimum three years documented experience with installation of air/vapour barrier systems.

.1 Completed installation must be approved by the material manufacturer.

.2 Single-Source Responsibility: obtain primary air and vapour materials from a single manufacturer regularly engaged in the manufacturing and supply of the specified products and meeting or exceeding the material properties and performance characteristics of the materials and manufacturers named in this Section.

.3 Mock-ups:

.1 Construct mock-up in accordance with Section 01 45 00 – Quality Control.

.2 Construct typical wall panel, 3 m long by 4 m wide, incorporating openings, insulation, building corner condition; illustrating materials interface and seals.

.3 Locate where directed by Consultant.

.4 Mock-up may remain as part of Work.

.5 Allow 24 hours for inspection of mock-up by Consultant before proceeding with air/vapour barrier work.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver sheet materials in factory wrapped rolls with labels indicating manufacturer's name or trade name, compliance with acceptance to specified standards, material type thickness and roll width and area.

.2 Store materials in clean, dry area in accordance with manufacturer’s instructions.

.3 Handle and store materials in accordance with manufacturer's written recommendations.

.4 Protect materials during handling and application to prevent damage.

.5 Packaging Waste Management: Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Maintain temperature and humidity recommended by materials manufacturer before, during and after installation.

.3 Ensure wood has a moisture content less than 19% prior to encapsulating with impermeable membrane.

.4 Apply air/vapour barrier membrane to cast-in-place concrete, precast concrete, masonry (strike masonry joints flush) which are smooth, clean, dry, and in good condition. Moisture, grease, machine oil or other foreign material must be removed. Concrete must be cured, minimum seven days, and dry before application, and when temperature is 5 degrees C or higher or as per manufacturer’s recommendations.

.5 All membrane shall be installed at surface and ambient temperature within range as stated by manufacturer, in dry weather conditions.

.6 For applications below manufacturer recommendations consult membrane manufacturer's technical representative for instructions and, obtain Consultant's approval before proceeding with Work.

.7 Self adhered membrane shall not be applied below application temperature of. minus 10 °C despite primers being able to be applied at colder temperatures.

1.8 WARRANTY

.1 Manufacturer’s Warranty: issue and written and signed warranty in the name of the Owner, certifying the product will meet the physical characteristics published

by the manufacturer for a period of five years starting from the completion date of installation of membranes.

.2 Installer's Warranty: Submit installers warranty stating that air and vapour membranes and accessories are installed in accordance with manufacturer's recommendation and that membrane, transitions and through-wall flashing membranes, primers, mastics, adhesives and sealants are sourced from one manufacturer.

PART 2 Products

2.1 SELF-ADHESIVE AIR AND VAPOUR BARRIER SYSTEM MATERIALS

.1 Primer: manufacturer's recommended SBS synthetic rubbers, adhesive resins and solvents used to prime porous substrates to enhance adhesion of self-adhesive membranes at temperatures above -10°C.

.2 Air/Vapour Barrier Membrane: to CAN/CGSB 37.56 or ASTM D1970; SBS modified bitumen, self-adhering sheet membrane with polyethylene facer, for application temperatures between -10°C and 10°C and as follows:

.1 Thickness: 1 mm to 1.5 mm.

.2 Tensile strength: 11.3 kN/m to 15.4 kN/m to ASTM D5147.

.3 Ultimate elongation: 25% to 40%.

.4 Flexibility at cold temperature: minimum -30°C.

.5 Air permeability: <0.0003 L/sec. m2..

.6 Water vapour permeability: <0.05 perm.

.7 Static puncture: minimum 178 N.

.8 Lap adhesion: 800 N/m.

.9 Acceptable Materials:

.1 CCW-705LT, Carlisle.

.2 Perm-A-Barrier Wall Membrane LT, GCP Applied Technologies.

.3 Blueskin SALT, Henry Company.

.4 AVB LT, IKO.

.5 Sopraseal Stick 1100 T, Soprema.

.6 Exoair 110 LT, Tremco Inc.

.7 Air Shield LT, W.R. Meadows.

.3 Air/Vapour Barrier Membrane: to CAN/CGSB 37.56 or ASTM D1970; SBS modified bitumen, self-adhering sheet membrane with polyethylene facer, for application temperatures above 5°C and as follows:

.1 Thickness: 1 mm to 1.5 mm.

.2 Tensile strength: minimum 6 kN/m.

.3 Ultimate elongation: 25% to 40%.

.4 Flexibility at cold temperature: minimum -17°C.

.5 Air permeability: <0.0003 L/sec. m2.

.6 Water vapour permeability: <0.05 perm.

.7 Static puncture: 400 N.

.8 Lap adhesion: minimum 1750 N/m.

.9 Acceptable Materials:

.1 Perm-A-Barrier Wall Membrane, GCP Applied Technologies.

.2 Blueskin SA, Henry Company.

.3 AquaBarrier AVB, IKO.

.4 AVB LT, IKO.

.5 Sopraseal Stick 1100, Soprema.

.6 Exoair 110, Tremco Inc.

.7 Air Shield, W.R. Meadows.

2.2 MASTICS AND ADHESIVES

.1 Waterproofing Mastic: solvent-based mastic containing SBS modified bitumen, fibres and mineral fillers, used to seal around penetrations and extrusions.

.1 Compatibility: With air/vapour barrier membrane, substrate and insulation.

.2 Specific gravity at 20°C: 1.0 kg/l to 1.12 kg/l.

.3 Application Temperature: -10°C to +35°C.

.4 Solids by Weight: 70% to 83 %.

.5 Acceptable Materials:

.1 Bituthene Mastic, GCP Applied Technologies.

.2 Air-Bloc 21 or Air-Bloc 230-21 Adhesive, Henry Company.

.3 570-05 Polybitume Henry Company.

.4 925 BES Sealant Henry Company.

.5 AquaBarrier Mastic, IKO.

.6 Sopramastic, Soprema.

.7 Exoair Termination Mastic, Tremco Inc.

.8 Pointing Mastic, W.R. Meadows.

2.3 ACCESSORIES

.1 Thinner and cleaner for Butyl or Neoprene Sheet: as recommended by sheet material manufacturer.

.2 Attachments: galvanized steel bars and anchors.

.3 Roof-to-Wall Transition Membranes: Manufacturer’s recommended reinforced self adhesive, compatible with roofing air and vapour membranes and wall materials specified in this Section.

.4 Through Wall Membranes: Manufacturer’s recommended reinforced self adhesive, compatible with air and vapour membrane and that will not become plastic and extrude onto finished surfaces when exposed to high wall temperatures.

.1 Acceptable Materials:

.1 Blueskin TWF, Henry Company.

.2 TWF, IKO.

.3 Sopraseal Stick 1100T, Soprema.

.4 3015TWF, 3M.

.5 Sealant: Non-hardening sealant compatible with membrane materials, recommended by membrane manufacturer and in accordance with Section 07 92 00 - Sealants.

.6 Substrate Primer: Aerosol or cylinder spray adhesive compatible with substrate and membrane materials and as recommended by membrane manufacturer.

.7 Masonry Flashing Membrane: self-adhesive membrane as recommended by membrane manufacturer and composed of thermoplastic polymer modified bitumen and a high density polyethylene film with a silicone release film on the lower surface.

PART 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept work of this section.

.2 Verification of Conditions: Verify that conditions of substrate or work previously installed under other Sections or Contracts are acceptable for membrane installation in accordance with manufacturer’s written recommendations.

3.2 PREPARATION

.1 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with membrane manufacturer's requirements.

.2 Remove loose or foreign matter, which might impair adhesion of materials.

.3 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas or sharp protrusions

.4 Do not install materials during rain or snowfall.

.5 Report unsatisfactory conditions to Consultant in writing.

.6 Do not start work until deficiencies have been corrected.

.1 Beginning of Work implies acceptance of conditions.

3.3 INSTALLATION – SELF ADHERING SYSTEM

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Prime surfaces of difficult to stick to substrates using adhesive in accordance with manufacturer’s written recommendations before applying membrane.

.3 Apply primer to substrates in accordance with manufacturer’s written instructions. Apply primer that will be covered with membrane the same day. Re-prime areas that are not covered the same day.

.4 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 150 mm overlap at all end and side laps.

.5 Corner details: Double cover outside and inside corners, use 300 mm wide initial strip of membrane centred on axis of corner. Follow with full width of sheet membrane to cover initial strip completely.

.6 Construction and control joints: Install membrane in double thickness over properly sealed joints, use 300 mm wide initial strip of membrane centred over joint. Follow with full width of sheet membrane. Assure that joints are properly sealed; joint filler and a compatible sealant are installed.

.7 Tie-in to door frames, roofing system and at the interface of dissimilar materials as indicated in drawings in order to facilitate a continuous air, vapour & moisture membrane.

.8 Roll laps and membrane with a counter top roller to effect seal.

.9 Small protrusions (pipes, etc.) through the waterproofing membrane, should be pre-stripped with a membrane and sealed with mastic.

.10 Inspect membrane installation meticulously and immediately. Holes and tears in the membrane must be repaired with air / vapour barrier membrane material. The repair must exceed the affected surface area by a minimum of 150 mm. The membrane piece applied for the repair must be sealed around its edges with mastic.

3.4 INSTALLATION – THROUGH WALL FLASHINGS

.1 Apply through-wall flashing membrane where detailed on the drawings. Apply through-wall flashing membrane where detailed on the drawings. At openings, extend flashing 200 mm beyond jambs.

.2 Coordinate installation of through wall flashing with air/vapour barrier of this Section, to ensure a water tight installation and to maintain continuity of the air/vapour barrier. Sequence membrane flashing installation with air/vapour barrier installation, so that air/vapour barrier membrane overlaps top edge of membrane flashing, minimum 50 mm and is completely and continuously sealed in place to maintain air/vapour barrier and to shed water in cavity to the exterior.

.3 Apply continuous membrane flashing over all ledger angles or supporting sills, extending flashing up behind air/vapour barrier, and up vertical surface minimum 200 mm. Coordinate installation of flashing with installation of air/vapour barrier, so that air/vapour barrier weather laps over membrane flashing to provide a weather tight installation and to maintain continuity of the air/vapour barrier. Extend flashing horizontally over ledger angle or supporting sill, stopping maximum 10 mm from horizontal leg of ledger angle or supporting sill. At openings, extend flashing 200 mm beyond jambs.

.4 For the application of SBS modified self-adhered through-wall flashings and other applications of SBS modified self-adhered transition membranes, condition the substrate with applicable primer.

.1 Apply primer at rate recommended by manufacturer to all areas to receive SBS modified self-adhering sheet membrane as indicated on drawings by roller or spray and allow to dry.

.2 Primed surfaces not covered by self-adhering membrane or self-adhering through-wall flashing membrane during the same working day must be re-primed.

.5 Prime surfaces and allow to dry, press membrane firmly into place, overlap minimum 50 mm at all side and end laps. Promptly roll all laps and membrane to ensure the seal.

.6 Ensure applications form a continuous flashing membrane and extend up a minimum of 203 mm up the back-up wall.

.7 Seal the top edge of the membrane where it meets the substrate using termination sealant. Trowel-apply a feathered edge to seal termination to shed water.

.8 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. At locations where flashing terminates or intersects wall openings including door frames, “end dam” flashing to protect openings and redirect water out. Trim off excess as directed by the Consultant.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.2 The Consultant shall inspect installed membrane for continuity of membrane prior to placement of insulation.

.3 Non-confirming work and damages: Make repairs to manufacturers written instructions.

3.6 PROTECTION

.1 Protect finished work from penetrations.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Structural Drawings – Cast-In-Place Concrete

.2 Section 07 92 00 – Sealants

1.2 REFERENCES

.1 American Concrete Institute International (ACI):

.1 ACI 302.2R-06, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM D882-18, Standard Test Method for Tensile Properties of Thin Plastic Sheeting

.2 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.

.3 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction. (Withdrawn)

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 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.

.2 Verify with manufacturers and all tradesmen involved with installation procedures of building products incorporated into vapour and air retarder elements.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – 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.

1.5 QUALITY ASSURANCE

.1 Mock-ups

.1 Construct mock-up in accordance with Section 01 45 00 – Quality Control.

.2 Construct typical underslab installation, minimum 10 sq.m. incorporating insulation, corner condition, junction with foundation; lapping, penetration, illustrating materials interface and seals.

.3 Locate where directed by Consultant.

.4 Mock-up may remain as part of Work.

.5 Allow 24 hours for inspection of mock-up by Consultant before proceeding with air/vapour barrier work.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

.2 Deliver sheet materials in factory wrapped rolls with labels indicating manufacturer's name or trade name, compliance with acceptance to specified standards, material type thickness and roll width and area.

.3 Store materials in clean, dry area in accordance with manufacturer’s instructions.

.4 Handle and store materials in accordance with manufacturer's written recommendations.

.5 Protect materials during handling and application to prevent damage.

.6 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Apply vapour barrier membrane within the range of ambient and substrate temperatures recommended by vapour barrier membrane manufacturer.

Part 2 Products

2.1 VAPOUR BARRIER SHEET MATERIALS

.1 Plastic Sheet Vapour Retarder (Roof): 6 mil polyethylene sheet meeting requirements of CAN/CGSB-51.34.

.2 Plastic Sheet Vapour Retarder (Underslab): High density, puncture resistant polyolefin resin sheet in accordance with ASTM E1745 and CAN/CGSB-51.34, and as follows:

.1 Thickness: 15 mil.

.2 Vapour Permeance: Nominal ≤ 0.02 Perms maximum.

.3 Tensile Strength and Puncture Resistance: ASTM E1745 Class A minimum.

.4 Acceptable Materials:

.1 VaporFlex 15, Layfield Construction Materials.

.2 VaporBlock VB 15, Raven Industries.

.3 Stego Wrap 15 mil, Stego Industries LLC.

.4 Perminator 15 mil, W.R. Meadows.

2.2 ACCESSORIES

.1 Accessory Materials: Provide manufacturer's required seam tape, pipe boots and vapour proofing mastic forming a complete system in accordance with ASTM E1643.

.2 Sealant: Asbestos free non-hardening sealant, compatible with vapour retarder materials, recommended by vapour retarder manufacturer in accordance with Section 07 92 00 – Sealants.

.3 Substrate Crack Filler: Closed cell foam backer rod.

.4 Fasteners: Provide non-corrosive metal screws, nails, plastic clips and other fasteners as recommended by vapour retarder manufacturer required for complete installation of Work.

Part 3 Execution

3.1 EXAMINATION

.1 Examine surfaces to receive membrane. Notify Consultant if surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 INSTALLATION: SHEET VAPOUR BARRIER

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

.2 Install sheet vapour retarder on warm side of ceiling assemblies prior to installation of gypsum board to form continuous retarder in accordance with manufacturers 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 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 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Install sealant bead with no gaps; smooth out folds and ripples occurring in sheet over sealant.

.6 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 100 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Install sealant bead with no gaps; smooth out folds and ripples occurring in sheet over sealant.

3.3 INSTALLATION: UNDERSLAB SHEET VAPOUR BARRIER

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

.2 Install vapour barrier in accordance with manufacturer’s written instructions and ASTM E1643, and generally as follows:

.1 Unroll vapour barrier with the longest dimension parallel to direction of concrete placement.

.2 Lap vapour barrier onto face of grade beams.

.3 Overlap joints 200 mm and seal with manufacturer’s required tape.

.4 Seal penetrations including pipe and conduit risers in accordance with manufacturer’s written instructions.

.5 Make no additional penetrations except as required for placing of reinforcing steel and permanent utilities.

.3 Repair damaged areas by cutting patches of vapour barrier membrane; sized to overlap damaged area a minimum of 150 mm to each side of puncture; and tape all sides using manufacturer’s required tape.

3.4 PROTECTION

.1 Do not permit adjacent work to damage work of this section.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes glass fibre reinforced shingle, sheet materials, metal flashing and trims and accessories.

.2 This Section is the basis of design for alternate roofing assembly as indicated on the Drawings.

.1 Base Bid: Metal roofing assembly noted as R1 on the Drawings and as indicate din Section 07 61 00 – Sheet Metal Roofing.

.2 Alternate Price: Shingle roofing assembly noted as R1 ALT on the Drawings.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 62 00 – Sheet Metal Flashing and Trim

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM B749-20 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

.2 ASTM D1970/D1970M-21- Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

.3 ASTM D3161/D3161M-20, Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method).

.4 ASTM D3462/D3462M-23, Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.

.5 ASTM D4586/D4586M-07(2018), Standard Specification for Asphalt Roof Cement, Asbestos-Free.

.6 ASTM D6381/D6381M-24, Standard Test Method for Measurement of Asphalt Shingle Mechanical Uplift Resistance.

.7 ASTM F1667/F1667M-21A, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

.2 Canadian Roofing Contractors' Association (CRCA):

.1 Roofing Specification Manual.

.3 Canadian Standards Association (CSA Group):

.1 CSA-A123.5-16 (R2020), Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules

.2 CSA A123.51-14(R2023), Asphalt Shingle Application on Roof Slopes 1:6 and Steeper.

.3 CAN3-A123.52-M85(R2011), Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3.

.4 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Ontario Industrial Roofing Contractors' Association (OIRCA):

.1 OIRCA Guide Specification.

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 Sheet Metal Manual.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Product characteristics.

.2 Performance criteria.

.3 Installation instructions.

.4 Limitations.

.5 Colour and finish.

.2 Submit Workplace Hazardous Materials Information System WHMIS SDS - Safety Data Sheets. WHMIS SDS acceptable to Labour Canada and Health and Welfare Canada for shingles. Indicate VOC content.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit duplicate samples of full size specified shingles.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria and installation sequence.

1.5 CLOSEOUT SUBMITTALS

.1 Submit closeout data in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide manufacturer's printed recommendations for general maintenance, including cleaning instructions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Unused shingles remain property of Owner.

1.7 QUALITY ASSURANCE

.1 Installer Qualifications: Installer shall be a member in good standing of the local Roofing Contractors Association at the time of installation.

.2 Mock-ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.1 Provide 3000 x 3000 mm mock-up including accessories and roofing components.

.2 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application.

.3 Locate where directed.

.4 Allow 48 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.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver 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.

.5 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.9 WARRANTY

.1 Manufacturer's Special Warranty: Provide manufacturer' standard product warranty indicating that they will be responsible to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period; materials failures will include manufacturing defects and failure of asphalt shingles to self seal after a reasonable time, and as follows:

.1 Material Warranty Period: 30 years from date of Substantial Performance, prorated, with first 15 years non prorated.

.2 Workmanship Warranty Period: ten years from date of Substantial Performance.

.2 Provide warranty for asphalt shingles to include in maintenance manuals as specified in Section 01 78 00 – Closeout Submittals: Operations and Maintenance Data Manuals.

Part 2 Products

2.1 SHINGLES

.1 Shingles: to CSA A123.5 and ASTM D3462, glass-fibre reinforced, mineral-granule surfaced, self sealing with Class A fire rating and as follows:

.1 Type: Architectural.

.2 Mass: minimum 120 kg/10m^2.

.3 Butt Edge: Straight cut.

.4 Strip Size: Manufacturer's standard size.

.5 Algae Resistance: Granules treated to resist algae discoloration.

.6 Colours: as selected by Consultant from manufacturer's standard colour range.

.7 Basis of Design Materials:

.1 Cambridge, IKO Global.

.2 Hip and Ridge Shingles: Manufacturer's standard to match asphalt shingles.

2.2 SHEET MATERIALS

.1 Roofing felt: synthetic underlayment as recommended by shingle manufacturer.

.1 Basis-of-Design Materials:

.1 Stormtite, IKO Global.

.2 Waterproofing Underlayment: self adhering membrane for high temperature applications; rubberized asphalt will not flow up to temperatures as high as116°C.

.1 Primer: as recommended by manufacturer.

.2 Acceptable Materials:

.1 Ice and Water Shield HT, Grace Construction Products.

.2 Stormshield, IKO.

.3 Jiffy Seal Ice & Water Guard HT, Protecto Wrap.

.4 LapLock PSU (HT), Roofnado

.5 Lastobond Shield HT, Soprema.

2.3 METAL FLASHING AND TRIM

.1 Comply with requirements of Section 07 62 00 – Sheet Metal Flashing and Trim.

.2 Fabricate sheet metal flashing and trim in accordance with recommendations in SMACNA's "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 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 shingle and up the vertical surface.

.3 Cricket, Backer, and Saddle Flashings: Fabricate with concealed flange extending a minimum of [450] [610] mm beneath upslope shingles and 150 mm beyond each side of chimney and 150 mm above the roof plane.

.4 Open Valley Flashings: Fabricate in lengths not exceeding 3050 mm with 25 mm high inverted W 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: ASTM B749, 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.

2.4 ACCESSORIES

.1 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.

.1 Acceptable Materials:

.1 ShingleVent II, Air Vent Inc., CertainTeed Company.

.2 Cobra Rigid Vent II, GAF Materials Corporation.

.3 Cor-A-Vent

.4 SmartAir Ridge Vent, Globe Building Materials, Inc.

.5 RidgeMaster Plus, Mid America Building Products.

.2 Roof Vents: high impact black plastic internally screened roof vents.

.1 Basis-of-Design Materials:

.1 SV50 Model #601-1640, Menzies Metal Products

.3 Asphaltic Cement: to ASTM D4586, asbestos free.

.4 Nails: to CSA B111, of galvanized steel, sufficient length to penetrate 19 mm into deck. Provide capped fasteners when using synthetic materials.

.1 Where nails are in contact with metal flashing, use nails made from same metal as flashing.

.5 Zinc Strip: 100 mm wide (plus 25 mm drip edge fold) x 0.5 mm thick zinc strip with self healing neoprene fasteners or nails with neoprene gaskets compatible with zinc. Provide fasteners of sufficient length to penetrate 19 mm into deck.

.6 Snow Stops: extruded aluminum with stainless steel base plate, powder coated finish; profile as directed by Consultant.

.1 Basis of Design Materials:

.1 Pipe-Style, Alpine Snowguards.

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrate and surface conditions are in accordance with shingle manufacture recommended tolerances prior to installation of 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 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 shingles.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Removal of Existing Roofing.

.1 Remove existing roofing, flashings and underlay, and expose structure.

.2 Leave surfaces free from dirt and loose material.

3.3 PROJECT CONDITIONS

.1 Weather Limitations: Proceed with installing shingles only when existing and forecasted weather conditions will permit work to be performed according to manufacturers' recommendations and warranty requirements, and when substrate is completely dry.

.2 Provide additional roofing nails and sealing cement when weather requires.

3.4 INSTALLATION: UNDERLAYMENT

.1 Single Layer Felt Underlayment: Install single layer of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Lap sides a minimum of 50 mm over underlying course. Lap ends a minimum of 100 mm, stagger end laps between succeeding courses at least 1830 mm. Fasten with felt underlayment nails.

.1 Install felt underlayment on roof deck not covered by self adhering sheet underlayment. Lap sides of felt over self adhering sheet underlayment not less than 76 mm in direction to shed water. Lap ends of felt not less than 150 mm over self adhering sheet underlayment.

.2 Self Adhering Ice Dam Protection Sheet: Install two rows of self adhering sheet, totalling 2125 mm in width, wrinkle free, on roof deck. Comply with low temperature installation restrictions of underlayment manufacturer if applicable.

.1 Eaves: Extend from edges of eaves 610 mm beyond interior face of exterior wall.

.2 Rakes: Extend from edges of rake 610 mm beyond interior face of exterior wall.

.3 Valleys: Extend from lowest to highest point 450 mm on each side.

.4 Hips: Extend 450 mm on each side.

.5 Ridges: Extend 900 mm on each side without obstructing continuous ridge vent slot.

.6 Sidewalls: Extend beyond sidewall 450 mm and return vertically against sidewall not less than 100 mm.

.7 Dormers, Chimneys, Skylights, and other Roof Penetrating Elements: Extend beyond penetrating element 450 mm and return vertically against penetrating element not less than 100 mm.

.8 Roof Slope Transitions: Extend 450 mm on each roof slope.

3.5 INSTALLATION: UNDERLAYMENT VALLEY PROTECTION

.1 Place eave protection as valley protection in accordance with manufacturer's instructions.

.2 Place one layer of prefinished sheet metal flashings, minimum 600 mm wide, centered over open valleys and crimped 25 mm down center. Weather lap joints minimum 150 mm. Nail in place minimum 450 mm on centre, 25 mm from edges.

.3 Valley to be a minimum 150 mm wide at top and increase by 3 mm/300 mm to a maximum of 200 mm.

.4 Embed each shingle in a band of plastic cement.

.5 Ensure top corners of shingles are tapered from the valley.

3.6 INSTALLATION: METAL FLASHING

.1 General: Install metal flashings and other sheet metal in accordance with requirements in Section 07 62 00 – Sheet Metal Flashing and Trim.

.2 Apron Flashings: Extend lower flange over and beyond each side of down slope shingles and up the vertical surface.

.3 Step Flashings: Install with a head lap of 50 mm and extend over the underlying 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 shingles and beyond each side.

.5 Open Valley Flashings:

.1 Adhere one ply of 900 mm wide self adhering ice dam protection material, centred in valley.

.2 Install 610 mm wide flashing centred in valley, lapping ends at least 203 mm in direction to shed water.

.3 Fasten upper end of each length to roof deck beneath overlap.

.4 Secure hemmed flange edges into metal cleats spaced 305 mm apart and fastened to roof deck.

.5 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 shingles. Fasten and seal to shingles as recommended by manufacturer.

3.7 INSTALLATION: SHINGLES

.1 Install shingles in accordance with manufacturer's written instructions, recommendations in ARCA's Steep Roofing Division, requirements for ARCA Warranty Certificate for roofs having a slope of 1:3 (4:12) or greater in accordance with CAN3 A123.51, low slope of less than 1:3 (4:12) to 1:6 (2:12) in accordance with CAN3 A123.52.

.2 Install starter strip along lowest roof edge, consisting of an shingle strip with tabs removed with self sealing strip face up at roof edge.

.1 Extend shingles 19 mm over fascia at eaves and rakes.

.2 Install starter strip along rake edge.

.3 Install first and remaining courses of shingles stair stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure. (No blocking or racking of shingles.)

.4 Install first and remaining courses of shingles stair stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

.5 Fasten shingles in the desired weather exposure pattern; use number of fasteners per shingle as recommended by manufacturer.

.6 Open Valleys: Cut and fit shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley, and as follows:

.1 Set valley edge of shingles in a 76 mm wide bed of asphalt roofing cement.

.2 Do not nail shingles to open valley metal flashings.

.7 Ridge Vents:

.1 Install continuous ridge vents 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:

.1 Maintain open area of 1/300 roof area for ventilation.

.2 Maintain 50% of ventilation from ridge vent; remainder from soffit vents.

.8 Install zinc strips to all ridge locations with minimum 51 mm exposed to the weather.

.9 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.

3.8 CLEANING

.1 Leave Work area clean at end of each day.

.2 Clean gutters and drains at end of Work.

3.9 PROTECTION

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

.2 Repair damage to adjacent materials caused by shingles installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Composite metal panels, face sheets and accessories for soffit applications.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier

.3 Section 07 62 00 – Sheet Metal Flashing and Trim

.4 Section 07 92 00 – Sealants

.5 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

.1 Aluminum Association, Inc. (AA)

.1 AA DAF-45-2003 (R2009), Designation System for Aluminum Finishes.

.2 American Aluminum Manufacturers Association (AAMA):

.1 AAMA 2605-22, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels. (With Coil Coating Appendix)

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-22, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C297/C297M-16, Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions.

.3 ASTM D1781-98(2021), Standard Test Method for Climbing Drum Peel for Adhesives.

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 20M-17, Standard for Sheet Steel Cladding for Industrial, Commercial and Institutional Building Applications.

.5 Canadian Standards Association (CSA)

.1 CSA S136-16, North American Specification for the Design of Cold Formed Steel Structural Members

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 SDS - Safety Data Sheets.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with other Work having a direct bearing on Work of this section.

.2 Pre-Installation Meeting: Convene pre-installation meeting one prior to beginning work of this Section and on-site installation with Contractor, Consultant, installer, manufacturer's representative to:

.1 Review construction schedule, material availability, personnel, equipment, facilities and other relevant issues to avoid unnecessary delays.

.2 Review methods and procedures related to panel installation, including manufacturer's written instructions.

.3 Review warranty requirements.

.3 Manufacturer's representative shall also provide frequent inspection visits during the course of work of this Section to assure quality and competence of panel installation.

1.5 ACTION SUBMITTALS / INFORMATION SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and datasheet.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate arrangement of cladding system, including dimensions, location of joints, profiles of panels, types and locations of supports, fasteners, flashing, closures and all components related to cladding installation.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit duplicate samples, 300 x 300 mm showing composite panel in thickness specified from representative materials, finishes and colours. Include clips, anchors, supports, fasteners, closures, and other panel accessories.

.4 Installation Data: Submit manufacturer's installation instructions, special handling criteria, installation sequence, and cleaning procedures.

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

.6 Certificates: Provide product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.7 Manufacturers' Field Reports: Submit copies of manufacturers field reports.

1.6 CLOSEOUT SUBMITTALS

.1 Submit maintenance data for cleaning and maintenance of panel finishes for incorporation into operation and maintenance manual specified in Section 01 78 00 – Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Structural design to CSA-S136.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance and is approved by manufacturer.

.3 Mock-Up

.1 Construct mock-up in accordance with Section 01 45 00 – Quality Control.

.2 Construct mock-up indicating relationship between panels, attachments to building frame, air spaces, air/vapour retarder membrane, sealants and seals.

.3 Locate where directed by Consultant.

.4 Approved mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 – Common Product Requirements.

.2 Deliver, store and protect material in accordance with panel manufacturer's recommendations.

.3 Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap. Do not expose panels with strippable film to direct sunlight or extreme heat.

.4 Store off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

.5 Prevent contact with materials which may cause discolouration or staining.

.6 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.9 WARRANTY

.1 Material Warranty: Submit a written warranty, signed by manufacturer, providing five year warranty to include coverage for failure to meet specified requirements.

.2 Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal panels within the specified warranty period and agreeing to repair finish or replace panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, colour fade, chalking, cracking, peeling, and loss of film integrity for a period of 20 years from date of Substantial Performance.

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 Alucobond Plus, Alcan Composites Inc.

.2 Accumet 2000, Flynn.

.3 Alpolic, Mitsubishi Chemical.

.4 NORTEM® Architectural Facade Systems

.5 Reynobond, Reynolds American Manufacturing.

2.2 PERFORMANCE/DESIGN CRITERIA

.1 Loads: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of panel:

.1 As calculated in accordance with applicable code.

.2 Maximum Allowable Deflection: L/180 of span.

.3 Thermal Movement: Provide for expansion and contraction within system components caused by a seasonal temperature range from -40 degrees C to 50 degrees C without overstressing components causing buckling, failure of connections, failure of joint seals or other detrimental effects.

.4 Design expansion joints to accommodate movement in cladding and between cladding and structure to prevent permanent distortion or damage to cladding, damage to infills, racking of joints, breakage of seals, or water penetration.

.5 Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

2.3 COMPOSITE METAL PANEL MATERIALS

.1 Composite aluminum panel: Aluminum sheets thermally bonded in continuous process, under tension, to thermoplastic core with no glues or adhesives between dissimilar materials, and as follows:

.1 Total Composite Thickness: 4 mm.

.2 Core: thermoplastics.

.3 Aluminum Face Sheets:

.1 Alloy: AA3000 Series.

.2 Thickness: 0.51 mm.

.3 Factory Finish: coil coated with fluoropolymer paint to AAMA 2605.

.4 Colour: to match SMX SLVR MTLC by Alpolic, Mitsubishi Chemical.

.4 Bond Integrity: tested for resistance to delamination as follows:

.1 Bond Strength: 10.3 MPa minimum to ASTM C297.

.2 Peel Strength: 100 N mm/mm minimum to ASTM D1781.

.3 No degradation in bond performance after 8 hours of submersion in boiling water and after 21 days of immersion in water at 21 degrees C.

.5 Basis of Design Manufacturer:

.1 NORTEM® Architectural Facade Systems

.2 Aluminum extrusions and stiffeners:

.1 Alloy: AA-6063-T5.

.2 Colour: Mill finish where non-exposed.

2.4 ACCESSORIES

.1 Provide blocking and bracing required for panel system.

.2 Isolation Tape: Manufacturers standard material for separating dissimilar metals from direct contact.

.3 Panel Stiffeners: structurally fastened or restrained at ends, secured to rear face of composite panel with silicone or double sided high bond isolating tape to prevent weather staining and frost lines to the face of the panel as recommended by panel manufacturer, size stiffeners to maintain panel flatness to specified tolerances, material as recommended by manufacturer.

.4 Flashing and Trim: Fabricate flashing from 1.57 mm minimum thickness aluminum sheet, of same colour and gloss as cladding in exposed locations. Provide lap strip under flashing at abutted conditions; with lapped surfaces sealed with a full-bed of non-hardening sealant.

.5 Closures: Manufacturer's standard metal closures and trims, to suit cladding profile.

.6 Gaskets: Manufacturer's standard type, suitable for use with system, permanently resilient; ultraviolet and ozone resistant; colour as selected.

.7 Sealants: Sealants within the panel system, as recommended by manufacturer, colour to be selected by Consultant.

.8 Fasteners:

.1 Attachment of the panel system to the primary panel structural supports shall be made using manufacturer’s recommended fasteners.

.2 Typical joinery shall be attached with concealed, non-corrosive fasteners. When exposed fasteners are required in isolated conditions, the fastener shall be obscured in the panel joinery, exposed fasteners shall be stainless steel.

.9 Soffit vent: Continuous soffit vent of prefinished aluminum. Confirm style and location with Consultant.

2.5 FABRICATION

.1 Form sections true to shape, accurate in size, square, and free from distortion or defects.

.2 Factory fabricate components ready for field installation, in longest practicable lengths.

.3 Fabricate corners in single continuous piece.

.4 Tolerances:

.1 Panel bow shall not exceed 0.8% of panel overall dimension in width or length.

.2 Panel dimensions shall allow for field adjustment and thermal movement.

.3 Panel lines, breaks and curves shall be sharp, smooth and free of warps or buckles.

.4 Panel shall be visually flat.

.5 Panel surfaces shall be free of scratches or marks caused during fabrication.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify dimensions, tolerances, and method of attachment with other work.

.3 Verify that field measurements are as indicated on Shop Drawings.

.4 Report unsatisfactory conditions to Consultant in writing; do not start Work until unsatisfactory conditions are rectified.

3.3 PREPARATION

.1 Obtain all dimensions from job site.

.2 Ensure all structural support is aligned and condition is acceptable.

.3 Building surfaces shall be smooth, clean and dry, and free from defects detrimental to the installation of the system. Notify Contractor of conditions not acceptable for installation of system.

.4 Inspect system and components before installation and verify that there is no shipping damage.

.5 Do not install damaged panels; repair or replace as required for smooth and consistent finished appearance.

3.4 INSTALLATION

.1 Install composite panels in accordance with manufacturer's written instructions and shop drawings.

.2 Erect panels plumb, level and true.

.3 Allow for thermal movement.

.4 Do not install component parts that are observed to be defective, including warped, bowed, dented, scraped and broken members.

.5 Install cladding to structural support by hidden mechanical fasteners.

.6 Ensure fasteners penetrate framing. Where fastener does not penetrate framing, do not remove fastener. Removal of fastener will damage integrity of air/vapour membrane. Realign fastener location and install new fastener in close proximity to original fastener.

.7 Install pre-formed closures, sealed to arrest direct weather penetration.

.8 Ensure panels aligned vertically and horizontally.

.9 Assemble and secure system so stresses on sealants are within manufacturers' recommended limits.

.10 Separate dissimilar metals; use appropriate gasket and fasteners to minimize corrosive or electrolytic action between metals.

.11 Install flashings to divert all moisture and condensation to exterior. Trim and flash as detailed. Use only membrane flashing supported by insulation per architectural details.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.2 Submit reports to Consultant within three days of review and submit.

3.6 CLEANING

.1 Remove strippable film coating (if used) as soon as possible after surrounding material has been installed.

.2 Remove all excess materials, debris and equipment at completion.

.3 Clean all panels clean and free of all grime and dirt.

.4 Touch-up damaged finishes with manufacturer’s recommended touch-up paint.

.5 Replace damaged panels and components that, in the opinion of the Consultant cannot be satisfactorily repaired.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Through colour high density fibre cement wall panels.

.2 Accessories.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 21 13 – Board Insulation

.3 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier.

.4 Section 07 62 00 – Sheet Metal Flashing and Trim.

.5 Section 07 92 00 – Sealants.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C1185-08(2016), Standard Test Methods for Sampling and Testing Non-Asbestos Fibre-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.

.2 ASTM C1186-22, Standard Specification for Flat Fiber-Cement Sheets.

.3 ASTM E84-22, Standard Test Methods for Surface Burning Characteristics of Building Materials.

.4 ASTM E186-20, Standard Reference Radiographs for Heavy-Walled (2 to 412 in. (50.8 to 114 mm)) Steel Castings.

.2 DIN Deutsches Institut Fur Normung

.1 DIN EN 12467, Fibre-cement flat sheets - Product specification and test methods (includes Amendment :2018).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other Work having a direct bearing on Work of this section.

.2 Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

.2 Pre-Installation Meetings: convene pre-installation meeting in accordance with Section 01 31 19 – Project Meeting one week prior to beginning work of this Section and on-site installation with Contractor's Representative, Consultant, installer, manufacturer’s representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and datasheet and including preparation instructions and recommendations.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Provide shop drawings indicating attachment methods, joinery, accommodation of thermal movement, edge conditions, panel joints, fixture locations, anchorages, accessories, finish colours of panels and accessories, patterns and textures. Provide details at junctions and penetrations and applicable project details. Indicate sealing methods and compliance with design criteria and requirements of related work.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit duplicate samples, 150 mm long samples of each system specified showing profile in selected colour, pattern and texture.

.4 Installation Data: Submit manufacturer's installation instructions, special handling criteria, installation sequence, and cleaning procedures.

1.6 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit Operation and Maintenance data for installed products. Include Manufacturer’s instructions covering maintenance requirements.

1.7 QUALITY ASSURANCE

.1 Installer Qualifications: Engage experienced installer, with a minimum of five years experience, who has completed systems similar in material, design, and extent to that indicated for Project and with record of successful performance.

.2 Mock-Up:

.1 Provide a mock-up for evaluation of surface preparation techniques and application workmanship of the following details:

.1 Sill and head connections at windows and penetrations.

.2 Joint between panels.

.3 Detailing of corner caps and flashings.

.4 Any adjacent material connecting to siding.

.2 Reviewed mock-up may remain as part of finished Work if accepted by Consultant. Do not proceed with remaining Work until mock-up has been reviewed by Consultant.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer’s unopened packaging until ready for installation.

.2 Store siding flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

.3 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.9 SITE CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

.2 Proceed with siding installation when substrate is completely dry.

1.10 WARRANTY

.1 Manufacturer’s Warranty: Submit manufacturer‘s standard warranty that panels are free from defects in materials and workmanship beginning from the date of substantial completion and as follows:

.1 Product Warranty: manufacturers standard limited product warranty for a period of 10 years.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis-of-Design: Materials and colours listed below form the Basis-of-Design materials for this project.

.2 Materials other than named products Basis-of-Design materials may be acceptable to the Consultant; submit information in accordance with Section 01 62 00 – Product Options and Substitutions no later than seven (7) days prior to bid closing date and as follows:

.1 Proposed alternates shall match colour range, texture and performance characteristics of named products, and shall not require a change to colour board for Project.

.2 Proposed alternates found acceptable by Consultant will be listed in an Addendum.

.3 The Consultant is not obliged to accept any materials presented for their review and does not need to provide reasons for rejection of proposed alternates.

2.2 MATERIALS

.1 Fibre Cement Board Panels: Panels made from fibre reinforced cement board, free from asbestos fibres; in accordance with ASTM C1186, Grade IV; and as follows:

.1 Surface Burning Characteristics: Flame spread index of zero, smoke developed index of five, maximum; when tested in accordance with ASTM E84.

.2 Combustibility: Noncombustible, when tested in accordance with ASTM E186.

.3 Water Tightness: No water droplets on underside, when tested in accordance with ASTM C1185.

.2 Through Color High Density Fibre Cement Panels (FC1):

.1 Application: Exterior application with exposed fasteners.

.2 Thickness: 10 mm.

.3 Panel Size: 1220 mm x 2500 mm.

.4 Finish: Manufacturers standard through panel colour.

.5 Pattern: grooved face with fine sanding lines in longitudinal direction.

.6 Colour: LT40.

.7 Layout: as indicated on Drawings.

.8 Joints: dry and not sealed; 8 mm wide.

.9 Basis of Design Materials:

.1 linea, Equitone Inc.

.3 Through Color High Density Fibre Cement Panels (FC2):

.1 Application: Exterior application with exposed fasteners.

.2 Thickness: 8 mm.

.3 Panel Size: 1250 mm x 2500 mm.

.4 Finish: Manufacturers standard through panel colour.

.5 Pattern: fine sanding lines in longitudinal direction.

.6 Colour: TE00 – Calico.

.7 Layout: as indicated on Drawings.

.8 Joints: dry and not sealed; 8 mm wide.

.9 Basis of Design Materials:

.1 tectiva, Equitone Inc.

2.3 ACCESSORIES

.1 Thermally Broken Clip System and Sub-girts: as specified in Section 07 21 13 – Board Insulation.

.2 Flashing and Trim: As specified in Section 07 62 00 – Sheet Metal Flashings and Trim, prefinished, galvanized sheet steel flashing.

.3 Isolation Tape: Manufacturers standard material for separating dissimilar metals from direct contact.

.4 Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant; colour as directed.

.5 Fasteners: Corrosion resistant fasteners as recommended by siding manufacturer for materials being fastened to.

.1 Exposed fasteners to be colour matched to cladding colour indicated.

.6 Sealant: as indicated in Section 07 92 00 - Sealants and as recommended by manufacturer. Colour of exposed sealant to match adjacent panel.

.7 Accessories: provide accessories as detailed on drawings and recommended by siding manufacturer for building configuration, and as follows:

.1 Provide accessories made from same material as adjacent material, unless otherwise indicated.

.2 Provide accessories matching colour and texture of adjacent material, unless otherwise indicated.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify building surfaces are smooth, clean and dry, and free from defects before beginning of installation of products specified in this Section:

.1 Notify Contractor of conditions not acceptable for installation of system.

.2 Installation of products specified in this Section will denote acceptance of site conditions.

.2 Inspect all panels and components prior to installation and verify that there is no shipping damage; do not install damaged panels, repair or replace as required for smooth and consistent finished appearance.

3.2 PREPARATION

.1 Building surfaces shall be smooth, clean and dry, and free from defects detrimental to the installation of the system. Notify Contractor of conditions not acceptable for installation of system.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

.3 Ensure air/vapour barrier installation is complete and has been reviewed by the Consultant.

3.3 INSTALLATION

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

.2 Place fasteners uniformly as recommended by panel manufacturer for local design windloads (with 2x factor for gusts).

.3 Use fasteners as recommended by panel manufacturer to suit project conditions.

.4 Install panel using spacers at joints. Leave bottom edge of panel above all horizontal trims exposed, no caulking shall be placed at this overlap of horizontal reveal trim. Factory primed edge shall always be used.

.5 Install a kickout flashing to deflect water away from the siding at locations indicated on Drawings and as required to direct water away from building.

.6 Allow minimum vertical clearance between the bottom edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

.7 Maintain clearance between siding and adjacent finished grade.

.8 Touch-up of nails shall be performed after application, but before protection wrap is removed to prevent spotting of touch-up finish.

.9 Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

3.4 CLEANING

.1 Remove damaged, improperly installed, or otherwise defective siding materials and replace with new materials complying with specified requirements.

.2 Clean finished surfaces according to siding manufacturer's written instructions and maintain in a clean condition during construction.

3.5 PROTECTION

.1 Protect installed products until completion of project.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 35 00 – Delegated Design

.2 Section 06 10 00 – Rough Carpentry

.3 Section 07 62 00 – Sheet Metal Flashing and Trim

.4 Section 07 92 00 – Sealants

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM A653/A653M-22, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D523-14(2018), Standard Test Method for Specular Gloss.

.3 ASTM D659-86e1, Method of Evaluating Degree of Chalking of Exterior Paints.

.4 ASTM D2244-22, Standard Practice for Calculation of Colour Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

.5 ASTM D4138-07a(2022), Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.29-M89 (withdrawn), Rubber-Asphalt Sealing Compound.

.2 CAN/CGSB-37.5-M89 (withdrawn), Cutback Asphalt Plastic Cement.

.3 Canadian Roofing Contractors Association (CRCA):

.1 CRCA Roofing Specifications Manual.

.4 Canadian Standards Association (CSA International)

.1 CSA-A123.23-15 (2020), Product Specification for polymer-modified bitumen sheet, prefabricated and reinforced.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 SDS - Safety Data Sheets.

.6 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC):

.1 CCMC-2011, Registry of Product Assessments.

.7 Ontario Industrial Roofing Contractors' Association (OIRCA):

.1 OIRCA Guide Specification.

.8 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 Architectural Sheet Metal Manual, 7th Edition, 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: 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 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor, Consultant, installer, manufacturer's representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's printed product literature for sheet metal roofing system materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.1 Indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural supports.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit duplicate samples, minimum 300 x 300 mm showing each profile in selected colour, finish and texture.

.4 Submit proof of manufacturer's CCMC Listing and listing number to Consultant.

.5 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.5 QUALITY ASSURANCE

.1 Fabricator Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and who has completed projects similar in material, design, and extent to that indicated for this Project.

.3 Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Documents requirements including, but not limited to, the following:

.1 Seal and signature to shop drawings and design submittals.

.2 Field review of installed components.

.3 Completion of Letters or Commitment and Compliance.

.4 Obtain each type of metal roofing system through one source from a single manufacturer.

.5 Mock-Ups

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application.

.3 Locate where directed.

.4 Allow 48 hours for inspection of mock-up by Consultant before proceeding with sheet metal flashing 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 and store materials in accordance with manufacturer's instructions.

.2 Protect panels during transportation, unloading, storing, and erecting to prevent bending, warping, twisting, and surface damage.

.3 Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

.4 Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

.5 Prevent contact with materials which may cause discolouration or staining.

.6 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.7 WARRANTY

.1 Manufacturers Warranty for Finishes: 20 years from date of Substantial Performance.

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 the following:

.1 Agway Metals Inc.

.2 VicWest Steel.

.3 Westform Metals.

.4 Westman Steel.

.5 Approved Alternates

2.2 PERFORMANCE / DESIGN CRITERA

.1 General: The complete roof cladding system shall meet the following performance/design criteria and maintain its intended appearance, remain wind and watertight, allow for expansion and contraction of metal components and transmit loads to the supporting structural back-up.

.2 The design, and erection of a complete metal roof system is the responsibility of this subcontractor and are based on the performance criteria specified. The method assembly, reinforcing and anchorage is schematic and shows general intent only. Location and methods of providing same shall be this subcontractor's responsibility who shall design the assembly, reinforcing and anchorage to suit specific conditions in an acceptable manner complying with the requirements specified herein.

.3 Provide flashing as shown and required to make the system wind and watertight, and still allow for thermal movement.

.4 All fastenings shall be concealed where possible. Where exposed in finished surfaces, screw heads shall be neat and symmetrical, made completely watertight and capable of allowing expansion and contraction of metal roof cladding. Exposed fasteners shall be color-matched to finished metal cladding or stainless steel and as scheduled.

.5 Thermal Movements and Wind Loads: The metal wall and associated flashing systems shall be so designed and constructed as to provide for such expansion and contraction of component materials as will be caused by an ambient temperature range of -40°C to +60°C without causing harmful buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.6 Provide and/or make allowances for free noiseless vertical and horizontal thermal and wind loading movement, due to the contraction and expansion of any and all component parts.

.7 Assembly and erection procedures shall take into account the ambient temperature range and wind pressure at the time of installation.

.8 The system shall provide clear internal paths of drainage in order to drain any trapped moisture to the exterior, discharging moisture in a manner avoiding staining of architectural finishes, collecting in puddles, formation of unsafe icicles and dripping onto pedestrians.

.9 Fasten panel assembly to building structure in a manner, which transmits all loads to the main structure without exceeding the capacity of any fastener.

2.3 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: to ASTM A653/A653M, commercial quality (CS), with Z275 galvanized coating and as follows:

.1 Base Metal Thickness: minimum 0.70 mm.

.2 Surface: regular spangle.

.3 Finish: prefinished as specified below.

.4 Profile:

.1 Panel Width: 610 mm.

.2 Ribbed, shallow vee in direction of standing seam.

.3 Seam Profile: Standing Seam.

.5 Basis of Design Materials:

.1 AR Standing Seam AR-38, Agway Metals Inc.

2.4 PREFINISHED STEEL SHEET

.1 Prefinished steel with factory applied silicone modified polyester.

.1 Class: F1S.

.2 Colour: to match QC28259 Tile Red | Rouge tuile, Perspectra Plus Series™.

.3 Specular gloss: 25-35 units +/-5 to ASTM D523 for matte finish.

.4 Coating thickness: dry film thickness not less than 0.9 mil to ASTM D4138.

.5 Resistance to accelerated weathering for chalk rating of eight, colour fade five units or less and erosion rate less than 20% to ASTM D2244 and ASTM D659.

2.5 ICE AND WATER SHIELD MEMBRANE

.1 Waterproofing Underlayment: self adhering membrane for high temperature applications; rubberized asphalt will not flow up to temperatures as high as116°C.

.1 Primer: as recommended by manufacturer.

.2 Acceptable Materials:

.1 Ice and Water Shield HT, Grace Construction Products.

.2 Stormshield, IKO.

.3 Jiffy Seal Ice & Water Guard HT, Protecto Wrap.

.4 LapLock PSU (HT), Roofnado

.5 Lastobond Shield HT, Soprema.

2.6 ACCESSORIES

.1 Provide components required for complete metal roofing system assembly including trim, copings, fasciae, corner units, ridge cap, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items; match material and finish of metal roofing system.

.2 Isolation coating: alkali resistant bituminous paint.

.3 Plastic cement: to CAN/CGSB-37.5.

.4 Snap Cap

.1 Provide snap caps for full length of the roof panel and retained by panel clips, fabricated Z275 galvanized (zinc coated) sheet steel conforming to ASTM A653/A653M structural quality Grade 230 having a nominal core thickness 0.76 mm. Finish and colour to match roof and wall sheet.

.5 Ridge Vent: Manufacturer's standard aluminum ridge vent, 203 mm wide x 43 mm high x 3048 mm lengths, equipped with built-in weather baffle, install with end caps and fastening straps.

.6 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer and as indicated in Section 07 92 00 - Sealants.

.7 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.

.8 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.9 Fasteners: Concealed as recommended by manufacturer to suit design load requirements and application.

.10 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.11 Flashing, Roof Curbs, Eaves and Trim: Prefinished flashing materials to match roofing materials in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim.

.12 Touch-up paint: as recommended by prefinished material manufacturer.

.13 Snow Guards: continuous type, fabricated of non-corrosive prefinished metal as directed by Consultant. Installed without penetrating metal roofing system, and complete with predrilled holes, clamps, or hooks for anchoring.

2.7 FABRICATION

.1 Fabricate all components of the system in the factory, ready for field installation.

.2 Provide sheet and all accessories in longest practicable length to minimize field lapping of joints.

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 Examine substrates to ensure proper attachment to framing.

.2 Examine roof deck to verify deck is clean and smooth, free of depressions, waves or projections and within flatness tolerances required by metal roofing system manufacturer.

.3 Verify roof opening, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

.4 Verify deck is dry and free of snow or ice.

3.3 INSTALLATION

.1 Use concealed fastenings except where approved by Consultant before installation.

.2 Provide underlay under sheet metal roofing. Secure in place and lap joints 100 mm minimum.

.3 Install sheet metal roof panels using cleats spaced at 300 mm on centre.

.4 Secure cleats with two fasteners each and cover with cleat tabs.

.5 Stagger transverse seams in adjacent panels.

.6 Flash roof penetrations with material matching roof panels, and make watertight.

.7 Form seams in direction of water-flow and make watertight.

3.4 INSTALLATION – STANDING SEAM ROOFING

.1 Fold lower end of each pan under 20 mm.

.1 Slit fold away from corner to form tab where pan turns up to make standing seam.

.2 Fold upper end of each pan over 50 mm.

.3 Hook 20 mm fold on lower end of upper pan into 50 mm fold on upper end of underlying pan.

.2 Apply sheet metal roofing beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.

.3 Finish standing seams 38 mm high on flat surfaces. Bend up one side edge 40 mm and other 45 mm.

.1 Make first fold 6 mm wide single fold and second fold 12 mm wide, providing locked portion of standing seam with 5 plies in thickness.

.2 Fold lower ends of seams at eaves over at 45 degrees angle.

.3 Terminate standing seams at ridge and hips by turning down in tapered fold.

.4 Form valleys of sheets not exceeding 3 m in length. Lap joints 150 mm in direction of flow.

.1 Extend valley sheet minimum 150 mm under roofing sheets.

.2 At valley line, double fold valley and roofing sheets and secure with cleats spaced 450 mm on centre.

3.5 ACCESSORY INSTALLATION

.1 Install accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

.2 Install components required for a complete metal roofing system assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

.3 Install flashing and trim in accordance with performance requirements, manufacturer's written installation instructions, and SMACNA recommendations; provide concealed fasteners where possible, and set units true to line and level;

install work with laps, joints, and seams that will be permanently watertight and weather resistant.

.4 Install exposed flashing and trim that is without excessive 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 weather-resistant performance.

.5 Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer. Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty. Seam-Mounted Metal Snow Guard Pads Stainless-steel clamps attached to vertical ribs of standing-seam metal roof panels.

3.6 CLEANING

.1 Remove temporary protective coverings and strippable films, if any, as metal roofing system are installed, unless otherwise indicated in manufacturer's written installation instructions.

.2 Clean finished surfaces as recommended by metal roofing system manufacturer upon completion of metal roofing system installation; maintain in a clean condition during remainder of construction.

.3 Replace metal roofing system components that become damaged or have deteriorated beyond successful repair by finish touch-up or similar minor repair procedures.

.4 Remove all excess materials, debris and equipment at completion.

.5 Clean all panels clean and free of all grime and dirt.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Metal flashings, eaves troughs.

.2 Accessories.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier

.3 Section 07 61 00 – Sheet Metal Roofing

.4 Section 07 92 00 – Sealants

.5 Section 08 11 13 – Steel Doors and Frames

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-22 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM B32-20, Standard Specification for Solder Metal.

.3 ASTM D4586/D4586M-07(2018), Standard Specification for Asphalt Roof Cement, Asbestos-Free.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-37.29-M89 (withdrawn), Rubber-Asphalt Sealing Compound.

.2 CAN/CGSB-79.1-M91 (withdrawn), Insect Screens.

.3 Canadian Standards Association (CSA International)

.1 CSA A123.3-05 (R2015), Asphalt Saturated Organic Roofing Felt.

.2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 SDS - Safety Data Sheets.

.5 Ontario Industrial Roofing Contractors' Association (OIRCA):

.1 OIRCA Guide Specification.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 Architectural Sheet Metal Manual, 7th Edition, 2012.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: 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.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit Product data in accordance with Section 01 33 00 – Submittal Procedures

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures

.1 Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures

.1 Submit two (2) samples, 150 mm in size illustrating metal finish colour.

1.6 QUALITY ASSURANCE

.1 Fabricator Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and who has completed projects similar in material, design, and extent to that indicated for this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

.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.

.5 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.8 WARRANTY

.1 The same warranty provisions apply to flashings associated with roofing as to the roofing.

.2 Provide the manufacturers standard warranty with the minimum coverage of 20 years for the paint finish against chalking, fading, peeling, checking, cracking, or colour change.

.3 Provide Warranty for sheet metal flashing and trim to include in maintenance manuals as specified in Section 01 78 00 – Closeout Submittals.

Part 2 Products

2.1 SHEET MATERIALS

.1 Pre-Coated Galvanized Steel: Type A commercial quality to ASTM A653/A653M, Z275 (G90) zinc coating designation; minimum 0.61 mm base metal thickness, finished one side. Shop pre-coated with silicone modified polyester coating; colour as selected by Consultant.

.2 Galvanized Steel: Type A commercial quality to ASTM A653/A653M, Z275 (G90) zinc coating designation; minimum 0.61 mm base metal thickness.

.3 Form flashings and fascias to profiles indicated.

2.2 EAVES TROUGHS

.1 Form eaves troughs from 0.85 mm thick prefinished steel sheet metal.

.2 Sizes and profiles as indicated on Drawings unless otherwise indicated.

.3 Provide corner rainwater diverter at all roof valleys.

2.3 ACCESSORIES

.1 Fasteners: Same material and finish as flashing metal, to CSA B111, as recommended by sheet metal manufacturer, non-corrosive. Finish of exposed parts to match material being fastened.

.2 Counter Flashing Wind Restraint Clips: Provide clips being installed before counter flashing to prevent wind uplift of the counter flashing lower edge.

.3 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.4 Underlayment: No. 15 asphalt saturated roofing felt to CSA A123.3.

.5 Sealant: as specified 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.

.6 Isolation coating: alkali resistant bituminous paint.

.7 Plastic Cement: to ASTM D4586/D4586, asphalt based, asbestos free.

.8 Solder: to ASTM B32, alloy composition Sn.

.1 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered

.9 Insect Screen: stainless steel wire, type 304, 18 x 16 mech using nominal 0.28 mm wire diameter, having minimum 66% opening size, using non-magnetic stainless steel wire to CAN/CGSB 79.1.

.10 Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather resistant seaming and adhesive application of flashing sheet metal.

.11 Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

.12 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

.1 Fabricate sheet metal building flashings and trim in accordance with the recommendations of SMACNA's Architectural Sheet Metal Manual that apply to the design, dimensions, metal, and other characteristics as required.

.2 Form sections true to shape, accurate in size, square, and free from distortion or other defects detrimental to appearance or performance.

.3 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

.4 Make flashings of prefinished metal for all flashings adjacent to roofing at roof edges and area dividers and where exposed to view from ground. Make flashings for other locations, of plain galvanized metal as follows:

.1 Use 0.50 mm metal core thickness except where otherwise indicated.

.2 Use 0.62 mm metal core thickness wherever a flat length exceeding 305 mm wide occurs.

.3 Use 0.80 mm metal core thickness for concealed fastening strips.

.5 All straight run joints shall be S-Lock. Make joints to allow for thermal movement, space S-Lock joints at 2440 mm maximum centers.

.6 Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant in accordance with SMACNA standards.

.7 Make flashings for building into masonry and concrete so that joints can be lapped 100 mm or more.

.8 Strengthen free edges of metal flashings by folding to form a 13 mm hem.

.9 Make flashings to curbs and walls a minimum of 200 mm high, where possible.

.10 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.

.11 Make joints for corners and intersections with standing seams except where exposed of pre-finished metal when seams shall be flat locked.

.12 All bends machine made; form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.13 Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, non-corrosive metal recommended by sheet metal manufacturer, and as follows:

.1 Size as recommended by SMACNA manual or sheet metal manufacturer for application but not less than thickness of metal being secured.

.14 Back paint metal flashings in contact with dissimilar metals or materials with bituminous paint that would result in electrolytic action or corrosion.

Part 3 Execution

3.1 EXAMINATION

.1 Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and nailing strips located.

.2 Verify that solid wood blocking or sheathing provided to back-up flashings, nails, screws set, and wood provides a smooth flat plane.

3.2 INSTALLATION - GENERAL

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

.2 Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking and fastener disengagement.

.3 Install metal flashings on all surfaces such as sleepers, wall junctions, curbs, through roof penetrations and the like, and as otherwise required to provide flashing type protection to details. Additionally install counter and base flashings unless otherwise directed by the Consultant.

.4 Fasten and install roof edge flashing capable of all resisting according to recommendations of FMG Loss Prevention Data Sheet 1-49, for wind conditions as outlined in the Building Code for the Work Area.

.5 Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:

.1 Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.

.2 Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

.3 Temperature change (range): 67 degrees Celsius ambient; 100 degrees Celsius material surfaces..

.6 Provide sheet metal flashing and trim to create a rain screen assembly to the completed air/vapour and roofing membrane termination details.

.7 Call for inspection by roofing inspector, of completed roofing work prior to the installation of any metal flashings. Provide other flashing inspections, such as at start-up and periodic inspections, by the roofing inspector at frequencies as required.

.8 Coordinate installation of flashing work of this Section with flashing work of other Sections which ties into this work. Coat surfaces of different metals such as aluminum and galvanized steel which are in contact to each other, with bituminous paint to prevent electrolysis.

3.3 INSTALLATION – METAL FLASHING

.1 Install sheet metal flashing and trim in accordance with performance requirements, manufacturer's installation instructions, and SMACNA's Architectural Sheet Metal Manual.

.2 Fasten metal base flashing to walls along top of flashing. Form lapped corner joints.

.3 Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted by Consultant.

.4 Provide underlay under sheet metal, secure in place and lap joints minimum 100 mm.

.5 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using S-lock forming tight fit over hook strips, as detailed.

.6 Lock end joints and caulk with sealant.

.7 Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

.8 Underlayment: Install a slip sheet of red rosin paper and a course of polyethylene underlayment where installing stainless steel or aluminum directly on cementitious or wood substrates.

.9 Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

.10 Install wind clips as required for flashing.

.11 Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the Item manufacturer, to drain roof in the most efficient manner.

.12 Coordinate roof drain flashing installation with roof drainage system installation.

.13 All exposed and pre-finished flashings to provide a smooth flat surface free of indentations, bumps, oil-canning, or twists, all edges, bends hard, sharp and true to line.

3.4 INSTALLATION – EAVES TROUGHS

.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 Seal joints watertight.

3.5 CLEANING

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

.2 Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

.3 Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Performance.

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

3.6 PROTECTION

.1 Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Performance.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes through penetration firestopping and smokeseal systems for penetrations through the following fire resistance rated assemblies, including both empty openings and openings containing penetrating items:

.1 Wall and partitions.

.2 Smoke barriers.

.3 Construction enclosing compartmentalized areas.

.2 This Section includes fire resistive joint systems for the following:

.1 Floor-to-wall joints.

.2 Head-of-wall joints.

.3 Wall-to-wall joints.

.3 This specification section provides requirements for Rated Systems or systems requiring Engineered Judgements (EJ):

.1 Use of materials that have not been tested in a system or that are not capable of obtaining an Engineered Judgement will not be acceptable for use on this Project.

.2 Materials having only a ULC, CUL or FM Approved label will not be acceptable for use on this Project, unless supporting documentation is provided indicating its use in a ULC and FM Approved Rated Assembly Listing for Firestop Systems and Components of an Engineered Judgement specific to the installation conditions of the project.

.4 This Section includes requirements for installation of Fire Stop systems under a single source of responsibility; either through direct supervision of the Contractor or a single trade responsibility performed by a specialty Subcontractor at the choice of the Contractor.

.5 This Section includes requirements for third-party verification of installed Fire Stop system components forming a part of the work of this Section by an inspection agency that employs personnel who are qualified to perform this work in accordance a recognized training program acceptable to the Consultant and Authority Having Jurisdiction.

1.2 DEFINITIONS

.1 Fire-Resistance Rating: The time in minutes or hours that a material or assembly of materials will withstand the passage of flame and transmission of heat when exposed to fire meeting the requirements of CAN/ULC S101 or as determined by formal testing of material or assembly of materials meeting requirements of CAN/ULC S115, or an interpretation of information derived from formal testing in accordance with requirements of the Building Code and acceptable to the Authority Having Jurisdiction.

.2 Fire Separation: Assembly that acts as a barrier against the spread of fire, smoke and noxious gases resulting from combustion as defined by the Building Code

and includes the following assemblies having a Fire-Resistance Rating requiring Fire Stopping as follows:

.1 Penetration-Type Fire Stop systems located within load bearing walls and partitions.

.2 Penetration-Type Fire Stop systems located within non-load bearing walls and partitions.

.3 Penetration-Type located within floor assemblies.

.4 Building Perimeter-Type located between floor assemblies and exterior wall and roof construction.

.5 Construction Joint-Type and other assemblies having a Fire-Resistance Rating indicated on Drawings or Schedules.

.3 Fire Compartment: Spaces within a building that are enclosed by exterior walls or separated from other parts of the building by enclosing Fire Separations having a Fire-Resistance Rating.

.4 Firewall: Assembly that is a Fire Separation constructed from non-combustible construction subdividing a building or separating adjoining buildings to resist the spread of fire and that has a Fire-Resistance Rating, and structural stability to remain intact under fire conditions for the required fire-rated time.

.5 Fire Stop: System consisting of a material, component and means of support used to fill gaps between Fire Separations or between Fire Separations and other assemblies, or used around items that wholly or partially penetrate a Fire Separation.

1.3 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM A1008/A1008M-21a, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.2 ASTM E119-22, Standard Test Methods for Fire Tests of Building Construction and Materials.

.3 ASTM E814-13a(2017), Standard Test Method for Fire Tests of Penetration Firestop Systems.

.4 ASTM E1966-15(2019), Standard Test Method for Fire-Resistive Joint Systems.

.5 ASTM E2174-20a, Standard Practice for On-Site Inspection of Installed Firestop Systems..

.6 ASTM E2307-20, Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus.

.7 ASTM E2393-20a, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.2 Factory Mutual (FM):

.1 FM Approval 4990, Firestopping. 2009.

.2 FM Approval 4991, Approval of Firestop Contractors. 2013.

.3 Firestop Contractors International Association (FCIA):

.1 FCIA Manual of Practice, 8th Edition.

.4 International Firestop Council (IFC):

.1 IFC Guidelines for Evaluating Fire Stop Systems in Engineering Judgments. 2018

.2 IFC Guidelines for Evaluating Engineering Judgements -: Perimeter Fire Barrier Systems. 2018

.3 Recommended IFC Guidelines for Evaluating Engineering Judgments on Fire Resistant Duct Enclosure Systems for Ventilation Ducts. 2009

.5 National Fire Protection Agency (NFPA):

.1 NFPA (Fire) 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 Edition.

.6 Underwriters Laboratories Inc. (UL):

.1 UL 1479-2015, Standard for Fire Test of Through-Penetration Firestops.

.7 Underwriter's Laboratories of Canada (ULC):

.1 ULC Firestop Systems and Components, 2017 Edition.

.2 ULC 101-2014, Standard Methods of Fire Endurance Tests of Building Construction and Materials. (CAN/ULC-S101-14)

.3 ULC 102-2018, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. (ULC S102)

.4 ULC 114-2018, Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.5 ULC 115-2018, Standard Method of Fire Tests of Firestop Systems.

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 Consultant in accordance with Section 01 31 19 – Project Meetings to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Schedule: Submit a schedule listing surfaces or components to which firestopping and smokeseals is to be applied, and indicating the firestopping and smokeseals system and materials required and detailing installation not later than 30 working days following Award of Contract.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide electronic copy of Workplace Hazardous Materials Information System WHMIS SDS - Safety Data Sheets in accordance with WHMIS acceptable to Labour Canada, and Health and Welfare Canada.

.2 Quality assurance submittals: submit following in accordance with Section 01 45 00 – Quality Control.

.1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics and CAN-ULC S115.

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

.2 Document from Engineer of Record showing compliance of alternative fire stopping solution with CAN-ULC S115 and the EJ guidelines provided by the National Research Council, Best Practices Guide on Fire Stops and Fire Blocks and Their Impact on Sound Transmission.

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

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

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

.3 Provide a third party inspection agency upon completion of the Work of this Section to inspect the fire stopping work and submit written reports and verifications/approval of the installation of products and systems and the products are installed to the manufacturer’s requirements to achieve the required fire ratings.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Use materials and methods of determining required thickness of application that have the full acceptance of Authority Having Jurisdiction and that are tested in accordance with ULC S115, and that form a part of a ULC or CUL listed system, Engineered Judgement or Equivalent Fire Resistance Rated Assembly.

.2 Installer Qualifications: company or person specializing in fire stopping installations and approved by manufacturer with five years documented experience.

.3 Use materials and methods of determining required thickness of application that have the full acceptance of authority having jurisdiction.

.4 Where possible determine thickness to be applied from tests of assemblies identical to the assembly to be protected, conducted in accordance with ULC S-101, ASTM E119, ULI 1479, NFPA 251, and ASTM E814.

.5 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.

.6 Where the assembly includes conditions that do not correspond to those included in any previously tested assembly and for which no relevant engineering information is available use the same system and material as would be required for a tested assembly with similar conditions and that will achieve at least the minimum level of performance required in a previously tested assembly.

.7 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.

.8 Source Responsibility: Obtain through penetration firestop and joint systems, for each kind of penetration and construction condition indicated, from a single source of installation responsibility.

.9 Delegated Design Professional: Use a Professional Engineer, registered in the province of the Work and familiar with installations of similar scope and complexity to design firestopping and smokeseals.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 00 – 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.

.3 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – General Requirements, Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Install firestopping and smokeseals materials only when the areas in which they are scheduled are closed-in and protected from dampness.

.2 Environmental Limitations: Install firestopping and smokeseals systems when ambient or substrate temperatures are within temperature and moisture limits permitted by firestopping and smokeseals system manufacturers or when substrates are not wet due to rain, frost, condensation, or other causes.

.3 Ventilate firestopping and smokeseals 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, 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 EZ-Path Fire Rated Pathways.
.4 Firestop Systems Inc.
.5 Hilti Canada Ltd.
.6 Johns Manville Fire Protection Systems.
.7 Nuco Self Seal Firestopping Products.
.8 Passive Fire Protection Partners Firestop Systems Inc.
.9 Roxtec, Preformed Fire Stopping Systems.
.10 Specified Technologies Inc.
.11 Tremco Ltd.

2.2 PERFORMANCE/DESIGN CRITERIA

.1 Delegated Design Requirements: Design firestopping and smokeseals required by the Contract Documents to withstand fire ratings indicated and in accordance with requirements of the Building Code, and as described in Section 01 35 00 – Delegated Design.

.2 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the 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 or ASTM E814, 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 or ASTM E814, 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 cm^2 in overall cross sectional area.

.4 Firestopping and Smokeseals 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 smokeseals 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 smokeseals 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 smokeseals 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 MATERIALS: FIRESTOPPING AND SMOKESEALS, GENERAL

.1 Compatibility: Provide firestopping and smokeseals systems that are compatible with one another, with the substrates forming openings, and with the items, if

any, penetrating firestopping and smokeseals systems, under conditions of service and application, as demonstrated by firestopping and smokeseals 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 smokeseals 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 smokeseals assembly not less than the fire resistance rating of surrounding floor and wall assembly.

.4 Firestopping and Smokeseals 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 Smokeseals 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 smokeseals systems that are needed to install fill materials. Use only components specified by firestopping and smokeseals system manufacturer and approved by the qualified testing and inspecting agency for firestopping and smokeseals 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/m^2, 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 Basis-of-Design Materials:

.1 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 $_{c}UL_{us}$ Number.

.6 Date of installation.

.7 Name of installing Subcontractor .

.8 Contact telephone number for repair or replacement of firestopping materials.

2.4 FILL MATERIALS

.1 General:

.1 Provide firestopping and smokeseals systems containing the types of fill materials indicated in the Firestopping and Smokseals 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 Smokeseals 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 Smokeseals 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:

.1 Pre-manufactured intumescent blocks.

.1 Acceptable Materials:

.1 CFS-BL Intumescent Blocks, Hilti.

.2 Intumescent Blocks, Roxtec.

.2 Pre-manufactured sleeves, consisting of an adjustable core.

.1 Acceptable Materials:

.1 CP 653 Speed Sleeves, Hilti.

.2 EZ-Path Fire Rated Pathway, Specified Technologies.

.3 Pre-manufactured cable management system, consisting of a system of intumescent inserts and adjustable cores

.1 Acceptable Materials:

.1 Transit, Hilti.

.2 Preformed Fire Stopping Systems, Roxtec.

.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 Pillows/Bags: Reusable, heat expanding pillows/bags consisting of glass fibre cloth cases filled with a combination of mineral fibre, water insoluble expansion agents and fire retardant additives.

.12 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

.13 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 MIXING

.1 For those products requiring mixing before application, comply with firestopping and smokeseals 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.

2.6 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/m^2, minimum metal core thickness 0.95 mm (20 ga.).

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 Examine surfaces, components, materials to receive firestopping and smokeseals material; report any conditions which would detrimentally affect the application of the material or the proper firestopping and smokeseals 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 smokeseals. Notify Consultant in writing of any deficiencies affecting the proper performance of the firestopping and smokeseals, 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.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.

.4 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 smokeseals 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 FIELD QUALITY CONTROL

.1 Review: notify Consultant when ready for review and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

.1 Cut tests may be made at random by the Owner. Frequency of cut tests shall be determined by the Consultant, but will not be more than 1% of total length of firestopping and smokeseals.

.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 ONE - 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.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 – Cleaning.

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

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

.1 Design and provide through penetration firestopping and smokeseals as follows for:

.1 Systems with No Penetrating Items: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Silicone sealant.

.3 Intumescent putty.

.4 Intumescent foam blocks or boards.

.5 Intumescent spray foam.

.2 Systems for Metallic Pipes, Conduit, or Tubing: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Silicone sealant.

.3 Intumescent putty.

.4 Intumescent foam blocks or boards.

.5 Intumescent spray foam.

.3 Systems for Non-metallic Pipe, Conduit, or Tubing: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Silicone sealant.

.3 Intumescent putty.

.4 Intumescent wrap strips.

.5 Firestopping and Smokeseals device.

.6 Intumescent spray foam.

.4 Re-enterable and Cable Managed Systems for Electrical, and Data and Communications Cables:

.1 Prefabricated Firestop Sleeve CP653 (Hilti).

.2 Preformed Intumescent Blocks CFS-BL (Hilti).

.3 Preformed Intumescent Blocks (Roxtec).

.4 Prefabricated Cable Pathways (EZ-Path).

.5 Systems for Electrical, and Data and Communications Cables: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Silicone sealant.

.3 Intumescent putty.

.4 Silicone foam.

.5 Prefabricated Firestop Sleeve CP 653 (Hilti).

.6 Preformed Intumescent Blocks CFS-BL (Hilti).

.7 Preformed Intumescent Blocks (Roxtec).

.8 Prefabricated Cable Pathways (EZ-Path).

.9 Intumescent foam blocks or boards.

.10 Intumescent spray foam.

.6 Systems for Cable Trays: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Intumescent putty.

.3 Silicone foam.

.4 Pillows/bags.

.5 Intumescent foam blocks or boards.

.7 Systems for Insulated Pipes: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Intumescent putty.

.3 Silicone foam.

.4 Intumescent wrap strips.

.5 Intumescent foam blocks or boards.

.6 Intumescent spray foam.

.8 Systems for Miscellaneous Electrical Penetrations: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Intumescent putty.

.3 Intumescent foam blocks or boards.

.4 Intumescent spray foam.

.9 Systems for Miscellaneous Mechanical Penetrations: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Intumescent foam blocks or boards.

.3 Intumescent spray foam.

.10 Systems for Groupings of Penetrations: Select one or more of the following fill materials:

.1 Latex sealant.

.2 Intumescent wrap strips.

.3 Firestopping and Smokeseals device.

.4 Intumescent composite sheet.

.5 Intumescent foam blocks or boards.

.6 Intumescent spray foam.

.2 Design and provide joint firestopping and smokeseals as follows for:

.1 Floor-to-Floor, Fire Resistive Joint System: Provide materials to meet the following criteria:

.1 Assembly Rating: As indicated.

.2 Nominal Joint Width: As indicated.

.3 Movement Capabilities: Compression and extension.

.2 Floor-to-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:

.1 Assembly Rating: As indicated.

.2 Nominal Joint Width: As indicated.

.3 Movement Capabilities: To be confirmed, compression, extension, or horizontal shear.

.3 Head-of-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:

.1 Assembly Rating: As indicated.

.2 Nominal Joint Width: As indicated.

.3 Movement Capabilities: Compression and extension.

.4 Wall-to-Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:

.1 Assembly Rating: As indicated.

.2 Nominal Joint Width: As indicated.

.3 Movement Capabilities: Compression and extension.

.3 Design and provide perimeter fire containment firestopping and smokeseals as follows for:

.1 Perimeter Fire Containment System: Provide materials to meet the following criteria:

.1 Integrity Rating: As indicated.

.2 Insulation Rating: As Indicated.

.3 Linear Opening Width: As indicated.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Technical sections as required.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C794-18, Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

.2 ASTM C834-17, Standard Specification for Latex Sealants.

.3 ASTM C919-22, Standard Practice for Use of Sealants in Acoustical Applications.

.4 ASTM C920-18, Standard Specification for Elastomeric Joint Sealants.

.5 ASTM C1193-16, Standard Guide for Use of Joint Sealants.

.6 ASTM C1330-18, Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

.7 ASTM C1521-19 (2020), Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

.8 ASTM D2240-15(2021), Standard Test Methods for Rubber Property, Durometer Hardness.

.2 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (2018) (CEPA).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 SDS - Safety Data Sheets.

.4 Sealant, Waterproofing, and Restoration Institute (SWRI) publication – Sealants: The Professionals' Guide 2013.

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-22, Adhesives and Sealants Applications.

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (2019 ammend.) (TDGA).

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC 115-2018, Standard Method of Fire Tests of Firestop Systems.

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.4 Manufacturers Sample Warranty.

.2 Submit WHMIS SDS - Safety Data Sheets. WHMIS SDS acceptable to Labour Canada and Health and Welfare Canada for sealants. Indicate VOC content.

.3 Submit manufacturer's installation instructions for each product used.

.4 When required by Consultant, submit test certificates from an approved Canadian materials testing laboratory indicating that sealants meet the requirements of the standards specified, and that the tests have been conducted in accordance with ASTM D2240.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Provide colour samples of the actual sealants for approval; painted or printed colour charts are not acceptable.

1.4 QUALITY ASSURANCE

.1 Caulking shall be performed by a caulking contractor with minimum three years successful experience in Work of similar size and complexity.

.2 Before performing Work of this Section, submit the names of proposed materials. If specified using Standards, indicate Qualification Number.

.3 Compatibility: Ensure sealants are compatible with adjacent materials and are approved by manufacture for use with adjacent materials.

.4 Mock-Ups

.1 Construct mock-up in accordance with Section 01 45 00 – Quality Control.

.2 Before performing caulking work do sample applications of each type of sealant for approval. Site locations for sample applications shall be designated by Consultant. Approved samples shall form standard for this project and no work of inferior quality will be allowed. Start no final work until approval of samples is given by the Consultant.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 – Common Product Requirements.

.2 Deliver containers labelled and sealed, complete with written application and maintenance instructions.

.3 Store materials in a dry heated enclosure in accordance with manufacturer's instructions.

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

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

.6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.8 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Consultant.

.9 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.10 Fold up metal banding, flatten, and place in designated area for recycling.

.11 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.6 PROJECT CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 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.

1.7 WARRANTY

.1 Contractor hereby warrants that caulking work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces in accordance with General Conditions, but for three years.

.2 Provide Warranty for sealants to include in maintenance manuals as specified in Section 01 78 00 – Closeout Submittals.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers: Subject to compliance with requirements in this Section and as recommended by the manufacturer, manufacturers offering products that may be incorporated into the Work include the following:

.1 Master Builders Solutions (previously BASF, Sonneborn).

.2 Chemtron Manufacturing Ltd.

.3 Dow

.4 GE Silicones Limited.

.5 Loxon, Sherwin Williams
.6 MAPEI Inc.
.7 Pecora
.8 Sika Chemical of Canada Ltd.
.9 Tremco Ltd.
.10 W.R. Meadows

2.2 PERFORMANCE REQUIREMENTS

.1 Sealant system shall satisfy following requirements for duration of warranty period:

.1 Waterproof, flexible, and thermally compatible with substrate under applicable service conditions.
.2 Provide a weather-tight seal that does not allow moisture penetration.
.3 Shall not debond, crack, or craze.
.4 Shall not leak.

.2 Reference to products does not relieve manufacturer of responsibility to comply fully with specified criteria.

2.3 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Unless otherwise specified, VOC content limits of sealants shall be in accordance with SCAQMD Rule 1168 and as follows:

.1 Architectural Materials:
.1 Sealants: VOC content limit 250 g/L.
.2 Sealant Primers for Non-Porous Surfaces: VOC content limit 250 g/L.
.3 Sealant Primers for Porous Surfaces: VOC content limit 775 g/L.

.2 Roofing:
.1 Non-Membrane Related Sealants: VOC content limit 300 g/L.
.2 Single Ply Roofing Sealants: VOC content limit 450 g/L.
.3 SBS Membrane Sealant Primer: VOC content limit 500 g/L.

.3 All Other Applications:
.1 Sealants: VOC content limit 420 g/L.
.2 Sealant Primers: VOC content limit 750 g/L.

2.4 SEALANT MATERIAL DESIGNATIONS

.1 Type S-1: Acrylic Latex One Part, Shore A Hardness 20, to ASTM C834.

.1 Acceptable Materials:
.1 Latacalk, Chemtron.

.2 Sonolac, BASF Sonneborn.

.3 Latex 100, Tremco.

.2 Type S-2: Silicone Sealant; mould and mildew resistant.

.1 To ASTM C920; type S; grade NS; class 50; use NT, G, and A.

.1 Acceptable Materials:

.1 Multiseal, Chemtron.

.2 Dowsil 795 Silicone, Dow

.3 SCS2000, GE.

.4 895 NST, Pecora

.5 Spectrem 2 Silicone, Tremco Inc.

.2 To ASTM C920; type S; grade NS; class 50; use NT, G, and A.

.1 Acceptable Materials:

.1 Dowsil 790 Silicone, Dow.

.2 SilPruf SCS 2000, GE.

.3 890 NST, Pecora

.4 Spectrem 1 Silicone, Tremco Inc.

.3 To ASTM C920; type S; grade NS; class 25; use NT, G, and A.

.1 Acceptable Materials:

.1 OmniPlus, BASF Sonneborn.

.2 Dowsil 786 Silicone, Dow.

.3 SCS1700, General Electric.

.4 898 NST, Pecora

.5 Tremsil 200, Tremco Inc.

.3 Type S-3: Silicone Sealant, general construction and air-seal sealant.

.1 To ASTM C920: type S; grade NS; class 25; use NT, M, G, A, O.

.1 Acceptable Materials:

.1 Dowsil 790 Silicone, Dow (for porous substrates)

.2 Dowsil 795 Silicone, Dow (for non-porous substrates)

.4 Type S-4: Silicone Sealant, structural glazing.

.1 To ASTM C920: type S; grade NS; class 25; use NT, A, G, O.

.1 Acceptable Materials:

.1 SSG4000, General Electric. (black colour) Shore A 39

.2 860, Pecora (black or white colour) Shore A 25

.3 Proglaze SSG, Tremco Inc. (black colour) Shore A 40

.2 To ASTM C920: type S; grade NS; class 50; use NT, A, G, O.

.1 Acceptable Materials:

.1 Dowsil 995 Silicone, Dow. (black, grey or white colour) Shore A 40

.5 Type S-5: Acoustical Sealant, interior, non-skimming, non-hardening, simple component synthetic rubber sealant.

.1 Acceptable Materials:

.1 Metaseal, Chemtron.
.2 AIS 919, Pecora
.3 Acoustical Sealant, Tremco.

.6 Type S-6: 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 MasterSeal NP2, BASF.
.2 Thioplast 400, Chemtron.
.3 830, Isoflex.
.4 Dynatrol II, Pecora
.5 Sikaflex 2c NS, Sika.
.6 Dymeric, Tremco.

.7 Type S-7: Single-component polyurethane or hydrid sealant, non-sag, for general construction.

.1 To ASTM C920: type S; grade NS; class 25; use NT, M, A, O, T.
.2 Acceptable Materials:
.1 Masterseal NPI or 150, BASF Sonneborne.
.2 Multiflex, Chemtron.
.3 H1 or S1, Loxon
.4 Mapeflex P1, MAPEI Inc.
.5 Dynatrol I-XL Hybrid, Pecora
.6 Sikaflex 1a or SikaHyflex 150LM, Sika.
.7 Dymonic FC, Tremco Inc.
.8 Pourthane NS, W.R. Meadows Canada.

.8 Type S-8: 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 Sonolastic SG, BASF Sonneborn.
.2 Mapeflex P2 SL, MAPEI Inc.
.3 Dynatrol II, Pecora
.4 Sikaflex 2c SL, Sika.
.5 THC-901, Tremco Inc

.9 Type S-9: 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, MC-1-25-B-N.

.1 Acceptable Materials:
.1 Sonolastic SL 1, BASF Sonneborn.
.2 Urexpan NR-201, Pecora
.3 Vulkem 45 SSL, Tremco Inc.

.10 Type S-10: Control joint sealant, two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.

.1 Basis-of-Design Materials:

.1 Loadflex, Sika.

.11 Type S-11: Control Joint Sealant, two component, polyurea based, load bearing, self levelling sealant.

.1 Acceptable Materials:

.1 Euco Qwikjoint 200, Euclid Chemical.

.2 Planiseal Rapid Joint 15, MAPEI Inc.

.12 Type S-12: Control Joint Sealant, two component, semi-rigid epoxy, load bearing, self levelling sealant.

.1 Acceptable Materials:

.1 Dural 340 SL, Euclid Chemical.

.2 Rezi-Weld Flex, WR Meadows.

.13 Type S-13: Single-component polyurethane sealant, medium-modulus, non-sag, low-VOC, UV stable.

.1 To ASTM C920: type S; grade NS; class 50; use NT, T, M, A, O, I.

.2 Acceptable Materials:

.1 Multiflex, Chemtron.

.2 Vulkem 116, Mameco.

.3 Dymonic 100, Tremco Inc.

2.5 COLOURS

.1 Colours: To match adjacent materials, as selected by Consultant, from manufacturer's standard colour range. Confirm with Consultant prior to application.

2.6 SEALANT SELECTION

.1 Where no specified type of sealant is shown or specified, confirm sealants specified in this Section appropriate for its location.

.2 Make sealant selections consistent with manufacturer's recommendations.

.3 Use acrylic sealant Type S-1 only on the interior and only in situations where little or no movement can occur.

.4 Use mould & mildew resistant silicone sealant Type S-2 for non-moving joints in washrooms and kitchens. Do not use on floors.

.5 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type specified. Use Type S-6 for joints over 19 mm.

.6 Use structural glazing silicone Type S-4 for sealing glass, interior and exterior.

.7 Use acoustical sealant Type S-5 and air seal sealant Type S-3 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.

.8 Use multi-component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.

.9 Use multi-component sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.

.10 Use polyurethane, semi-self levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%.

.11 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.

.12 Use control joint sealant S-11 as filler for interior, horizontal saw cut or preformed control joints, where joints are subject to low temperatures (freezer floors) and where joints require nosing support.

.13 Use control joint sealant S-12 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to thermal shock conditions, traffic loops, and where a high bond strength is required.

.14 Use sealant S-13 for sealing exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.

2.7 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.

.5 Allow backer rod to breathe outside of packaging 24 hours before application.

.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/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.3 Bond Breaker Tape.

.1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.

.2 Preformed Sealants

.1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint

widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to substrates.

.1 Acceptable Materials:

.1 Dowsil; 123 Silicone Seal, Dow.

.2 UltraSpan US1100, GE Silicones

.3 Spectrem Simple Seal, Tremco.

.3 Primer: Non-staining type as recommended by sealant manufacturer.

.4 Joint Cleaner: Non-corrosive solvent type recommended by sealant manufacturer for applicable substrate materials.

.5 Bond Breaker: Pressure-sensitive plastic tape that will not bond to sealants.

Part 3 Execution

3.1 PROTECTION

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

3.2 EXAMINATION

.1 Carefully inspect surfaces, materials to receive sealants and verify they are physically capable of retaining sealant bond.

.2 Verify that fillers and backing provided under other Sections properly installed.

.3 Grind joint surfaces if required to achieve adequate surface preparation.

3.3 SURFACE PREPARATION

.1 Prepare surfaces in accordance with manufacturer's instructions.

.2 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.3 Maintain workmanship of highest quality in accordance with best trade practice.

.4 Ensure that joint forming materials are compatible with sealant.

.5 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work. Wire brush loose materials and other foreign matter which might impair adhesion of sealant.

.6 Use air stream to blow out dirt and water from crevices.

.7 Ensure joint surfaces are dry and frost free.

.8 Prime all porous material (e.g. wood, masonry, concrete, ceramic or paver tile, etc).

.9 Prime other joints when recommended by manufacturer. Use a brush that will reach all parts of the joints. Mask adjoining surfaces with tape prior to priming to prevent staining.

3.4 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.5 BACKUP MATERIAL

.1 Use backer rod as specified, to limit depth of sealant and to act as bond breaker at back of joint.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

.3 Where depth of joint does not permit the use of backer rod apply paper masking tape to back of joint to act as bond breaker.

.4 Ensure that no joints are formed which are bonded on adjacent sides where there is any possibility of movement.

3.6 MIXING

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

3.7 APPLICATION

.1 Apply sealant in strict accordance with manufacturer's recommendations.

.2 For joints where movement is possible, apply backer rod to achieve a joint depth of one half the joint width but not less than 9 mm; for joints larger than 25 mm use a depth of 13 mm.

.3 Use pressure gun fitted with suitable nozzle. Use sufficient pressure to fill voids and joints solid.

.4 Form surface of sealant smooth, free from ridges, wrinkles, sags, or air pockets and imbedded impurities. Neatly tool surface to a slight concave appearance.

.5 Tool sealants to achieve air tight joints. Use wet tools as required.

.6 Ensure bead is solid, filling entire space between sides and bedding material, exerting sufficient pressure to obtain maximum bond, by allowing sealant to bulge out in advance of nozzle.

.7 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.

.8 Seal perimeters of hollow metal door frames on both sides.

.9 Seal control joints in gypsum board and stucco, and junctures between interior partitions with exterior walls.

.10 Seal window and door frames around the inside perimeter, so that an airtight seal is obtained, as indicated on drawings.

.11 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.

.12 Seal at all locations where dissimilar material meet.

.13 Curing

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.3 On porous surfaces allow sealant to cure overnight, and remove excess by light wire brushing.

3.8 CLEANING

.1 Clean adjacent surfaces immediately and leave Work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

.4 Correct staining and discolouring of adjacent surfaces as directed by Consultant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Steel doors and frames, interior and exterior, fire rated and non-fire rated.

1.2 RELATED REQUIREMENTS

.1 Section 07 21 19 – Foamed-In-Place Insulation.

.2 Section 07 27 13 – Modified Bituminous Air and Vapour Barrier.

.3 Section 07 62 00 – Sheet Metal Flashing and Trim.

.4 Section 07 92 00 – Sealants.

.5 Section 08 71 00 – Door Hardware.

.6 Section 09 91 00 – Painting.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fenestration Rating Council (NFRC):

.1 ANSI/NFRC 100-2020 (EOA2), Procedure for Determining Fenestration Product U-Factors.

.2 ANSI/NFRC 102-2023 (EOA0), Procedure for Measuring the Steady State Thermal Transmittance of Fenestration Systems.

.3 ANSI/NFRC 200-2020 (EOA2), Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

.4 ANSI/NFRC 400-2020 (EOA1), Procedure for Determining Fenestration Product Air Leakage.

.2 American National Standards Institute (ANSI)/ Steel Door Institute (SDI):

.1 ANSI/SDI A250.4-2011, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

.2 ANSI/SDI A250.8-2003 (R2008), Recommended Specifications for Standard Steel Doors and Frames.

.3 ANSI/SDI A250.11-2012, Recommended Erection Instructions for Steel Frames.

.3 American Society for Testing and Materials International (ASTM):

.1 ASTM A653/A653M-22, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

.3 ASTM A879/A879M-22, 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-22a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.5 ASTM C1363-19, Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

.6 ASTM D1622/D1622M-20, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.7 ASTM D4726-18, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors.

.8 ASTM D6386-22, Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

.9 ASTM D7396-14 (2020), Standard Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting.

.10 ASTM E283/E283M-19, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.4 Builders Hardware Manufacturers Association (BHMA):

.1 BHMA A156.115 -2016, Hardware Preparation in Steel Doors and Steel Frames.

.2 BHMA A156.16-2018, Auxiliary Hardware.

.5 Canadian General Standards Board (CGSB):

.1 CGSB 41-GP-19MA-84, (withdrawn) Rigid Vinyl Extrusions for Windows and Doors.

.2 CAN/CGSB 82.5-M88, (withdrawn) Insulated Steel Doors.

.6 Canadian Standards Association (CSA Group):

.1 CSA Plus A440H-14, User Guide to AAMA/WDMA/CSA 101/I.S.2/A440 NAFS 2011 – North Fenestration Standard/Specification for Windows, Doors, and Skylights.

.2 CSA A440S1-19, Canadian Supplement to AAMA/WDMA/CSA 101/1.S.2/A440-17, North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

.3 CSA-G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).

.4 CSA W47.1:19, Certification of companies for fusion welding of steel.

.5 CSA W59-18, Welded Steel Construction, Includes Errata (2020).

.7 Canadian Steel Door Manufacturers' Association (CSDMA)/National Association of Architectural Metal Manufacturers (NAAMM):

.1 NAAMM HMMA 840-17, Guide Specification for Receipt, Storage and Installation Hollow Metal Doors and Frames.

.2 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2009.

.3 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.4 CDSMA, Guide Specification for Installation and Storage of Hollow Metal Doors and Frames, 2012.

.8 Green Seal Environmental Standards

.1 Standard GS-11, Paints, Coatings, Stains and Sealers, 2015.

.9 International Code Council (ICC):

.1 ICC A117.1-2017, Accessible and Usable Buildings and Facilities.

.10 National Fire Protection Association (NFPA):

.1 NFPA (Fire) 80, Standard for Fire Doors and Other Opening Protectives, 2022 Edition.

.2 NFPA (Fire) 252, Fire Tests of Door Assemblies, 2022 Edition.

.11 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule 1113-16, Architectural Coatings.

.2 SCAQMD Rule 1168-22, Adhesives and Sealants Applications.

.12 The Society for Protective Coatings (SSPC):

.1 SSPC-PS 12.01, One Coat Zinc-Rich Painting System. (Includes 2004 Revisions)

.13 Underwriters' Laboratories of Canada (ULC):

.1 ULC 104, Standard Method for Fire Tests of Door Assemblies. (CAN/ULC S104-15)

.2 ULC 105, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC-S104. (CAN/ULC S105:2016)

.3 ULC 701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering. (CAN/ULC-S701-11) (withdrawn)

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with frame opening construction, door, and hardware installation.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate door and frame configurations and finishes, location of cut-outs for hardware reinforcement.

.2 Submit manufacturer’s printed product literature, specifications and data sheets for each type of door and frame specified

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate general construction of each type of door and frame, configurations and elevations, locations, door handing, sizes, material, material thickness, core description and details, edge construction, jointing methods, mortises, reinforcements, anchors, arrangement of hardware, fire ratings and finish.

.2 Reference doors and frames to door schedule on drawings. Indicate door numbers and wall construction.

.3 Include explanation of all abbreviations, symbols and codes contained in schedule.

.3 Test and Evaluation Reports:

.1 Submit test reports from approved independent testing laboratories, certifying compliance with specifications.

.2 All test reports that reference the NAFS must include, on the first page, a summary of the results including, at minimum:

.1 The product manufacturer.

.2 The type of product.

.3 The model number/series number.

.4 The primary product designation.

.5 The secondary product designation.

.1 Positive design pressure.

.2 Negative design pressure.

.3 Water penetration resistance test pressure.

.4 Canadian air infiltration and exfiltration levels.

.6 The test completion date.

.7 The report will also contain the following information:

.1 Test dates.

.2 Report preparation dates.

.3 Test information retention period.

.4 Location of testing facilities.

.5 Full description of test samples, including:

.1 finish, weathering characteristics

.2 Condensation resistance.

.3 Forced entry resistance.

.6 Complete description of amendments, as applicable.

.7 Conclusion.

.8 Drawings signed by the testing laboratory, if provided.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for cleaning and maintenance of finishes for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Quality Standard: Comply with ANSI A250.8, unless more stringent requirements are indicated. Comply with ANSI A117.1

.2 Manufacturer/Fabricator Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience, and a member in good standing of the Canadian Steel Door and Frame Manufacturer's Association.

.3 Installer Qualifications: 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.

.4 Preconstruction Testing: 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

1.8 REGULATORY REQUIREMENTS

.1 Fire Rated Frames Assemblies: Listed to CAN4-S104.

.2 Installed Fire Rated Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Remove frames from wrappings or coverings upon receipt on site and inspect for damage and notify shipper and supplier if damage is found. Clean and touch up minor scratches or disfigurement caused by shipping or handling with zinc-rich primer acceptable to Consultant. Remove and replace damaged items that cannot be repaired as directed.

.2 Store all materials in a dry area, under cover. All products shall be stored where they will not be exposed to, or come in contact with, the elements.

.3 Store doors in an upright position with heads uppermost. Place all material on planking or blocking at least 100 mm off grade or 50 mm off a paved surface or floor slab.

.4 Provide minimum 6 mm space between all units to permit air circulation.

.5 Adequately protect surfaces from damage during moving, handling and storage.

.6 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE/DESIGN CRITERIA

.1 Perform work in accordance with CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, except as otherwise specified herein.

.2 Provide doors and frames complying with ANSI A250.8 for quality and ANSI A250.4 for physical-endurance level.

.3 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

.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 CAN4-S104 and CAN4-S105 for ratings indicated. Fire labels must be factory applied by the manufacturer, protected and not tampered with.

.5 Thermal Transmittance: R-value of 3.4 (U-value of 1.7) to ASTM C1363 and NFRC 102.

.6 Air Infiltration: < 0.1 cfm/ft2 to ASTM E283 and NFRC 400.

2.2 MATERIALS

.1 Doors and Frames: coated steel sheets to ASTM A924/A924M; coating designation to ASTM A653/A653M, commercial steel (CS), Type B, ZF120 (A40) galvannealed; 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)
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
Notes: Provide guard boxes to protect mortised cut-outs from spray applied insulation, fully sealed.		

.3 Door Core Materials

.1 Honeycomb Core (interior only): Structural small cell 25 mm maximum. kraft paper honeycomb; weight 36.3 kg/ream minimum, density 16.5 kg/m^3 minimum, 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 Polyurethane: rigid, cellular type, board, conforming to ASTM D1622/D1622M, or foamed-in-place, 29 kilograms per cubic meter density minimum, containing no urea formaldehyde resins.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule #1168.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Interlocking Edge Seam Adhesive: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMERS

.1 Touch-up primer: to ASTM A780/A780M and SSPC-PS 12.01.

.1 Maximum VOC limit 50 g/L to GS-11.

2.5 FINISHING

.1 Shop apply zinc rich primer to repair damaged zinc coatings arising from fabrication; cure primer fully before shipping to site; include compatible primer for site finishing and correction of surface abrasions to zinc coatings and factory applied primer.

.2 Remove weld slag and splatter from exposed surfaces.

.3 Fill and sand smooth tool marks, abrasions and surface blemishes to present smooth uniform surfaces. Prepare surfaces for field painting to ASTM D6386 and ASTM D7396 and Section 09 91 00 - Painting.

2.6 ACCESSORIES

.1 Door silencers (bumpers): Grey rubber, 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 Floor anchors: 3.5 mm minimum adjustable floor clip angles with 2 holes for anchorage to floor.

.3 Exterior Top Caps: Rigid polyvinylchloride (PVC) extrusion in accordance with CAN/CGSB 41-GP-19Ma or steel.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fasteners: tamperproof type 304 stainless steel screws with countersunk flat head.

.6 Labels for fire doors and door frame: brass plate, riveted to door and door frame.

.7 Sealant: Section 07 92 00 – Sealants.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule #1168.

2.7 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 undertaken only by a fabricator fully approved by the Canadian Welding Bureau to the requirements of CSA W47.1.

.2 Fabricate steel doors and frames units complying with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

.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 and screens.

.5 Fabricate all rated doors and frames to fire rating labelling authority standard.

2.8 FRAMES FABRICATION – GENERAL

.1 Fabricate frames in accordance with CSDMA specifications and ANSI/SDI A250.8.

.2 Accurately form frames to profiles indicated. Construct frames straight and free from twist or warp.

.3 Exterior frames: 1.6 mm minimum welded, thermally broken type construction. 50 mm face standard frame profile, throat and frame width to suit wall construction.

.4 Interior frames: 1.6 mm minimum; welded type construction. 50 mm face standard frame profile, throat and frame width to suit wall construction. Knock-down frames are not allowed.

.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. For transportation, install stiffener plates or two angle spreaders where required to prevent bending of frame and to maintain alignment when setting. Weld reinforcement in place. Remove prior to installation.

.6 Provide removable portion of stop and frame where required for overhead concealed door closers, properly connected to frame, and prepare for attachment of closer prior to shipment.

.7 Protect mortised cutouts with steel guard boxes.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Provide fire labelled frames for those openings requiring fire protection ratings, as scheduled on Drawings.

2.9 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 o.c. maximum.

2.10 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 of mullions, transom bars, centre rails and sills.

.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 two temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.11 DOOR FABRICATION – GENERAL

.1 Fabricate steel doors rigid, neat in appearance, and free from defects including warp and buckle; 45 mm thickness of types and sizes indicated on drawing, and as follows:

.1 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.

.2 Form edges true and straight with minimum radius suitable for thickness of steel used.

.3 Bevel lock and hinge edges 3 mm in 50 mm; confirm requirement with builder's hardware or door swing that could dictate a different bevel.

.4 Top and bottom of doors shall be provided with inverted, recessed, nominal 1.60 mm steel end channels, welded to each face sheet at 150 mm on centre.

.5 Equip exterior doors with factory installed flush PVC top caps.

.6 Equip fire labelled exterior doors with factory installed flush steel top caps.

.7 Provide fire labelled doors for those openings requiring fire protection ratings and temperature rise ratings, as indicated on Drawings.

.8 Fabricate doors with the following clearances:

.1 Clearance between door and frame and between meeting edges of doors swinging in pairs shall not exceed 3 mm.

.2 Clearance between the bottom of door and floor shall not exceed 19 mm or as required to accommodate specified hardware.

.3 Clearance between bottom of door and a raised non-combustible sill in accordance with NFPA 80.

.4 Clearance between bottom of door and nominal surface of combustible floor coverings in accordance with NFPA 80.

.2 Fabricate doors with longitudinal edges locked seam and spot welded. 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 Exterior Doors: Flush, lock seam construction, insulated doors fabricated in accordance with CAN/CGSB 82.5, and as follows:

.1 Face Sheets: Minimum 1.30 mm base steel sheet thickness.

.2 Insulation Stiffened Core: Insulated and sound deadened with polystyrene or polyurethane core, at choice of the manufacturer, laminated under pressure to each face sheet.

.4 Interior Doors: Flush, lock seam construction, hollow steel doors fabricated in accordance with CSDMA Manufacturing Specifications for Doors and Frames, and as follows:

.1 Face sheets: Minimum 1.30 mm base steel sheet thickness.

.2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.

.5 Fire Rated Doors: Flush, lock seam construction, hollow steel doors fabricated in accordance with CAN4 S104 and NFPA 80, and as follows:

.1 Face sheets: Minimum nominal 1.30 mm base steel sheet thickness.

.2 Stiffened and sound deadened with honeycomb core laminated under pressure to each face sheet.

.3 Labelled by Underwriters Laboratories of Canada, ITS/Warnock Hersey, or other testing laboratory approved by the authority having jurisdiction.

2.12 THERMALLY BROKEN FRAMES

.1 Thermal break: rigid polyvinylchloride extrusion, to ASTM D4726.

.2 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.

.3 Insulate exterior frame components with polyurethane insulation as indicated in Section 07 21 19 - Foam-in-Place Insulation.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION - GENERAL

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

.2 Install fire rated doors and frames in accordance with requirements of NFPA 80.

.3 Install back angle for sill PMMA membrane to terminate on below the threshold in line with the primary air seal.

.4 Install doors, frames and accessories in accordance with reviewed shop drawings, ANSI A250.11, CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames, manufacturer’s data, and as specified in this Section.

.5 Damaged or twisted door and frames, or doors with interior cores or frame telegraphing through, will be rejected.

3.3 FRAME INSTALLATION

.1 Door Frames:

.1 Remove temporary spreaders before installing door frames, leaving exposed surfaces smooth and undamaged.

.2 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set; limit of acceptable frame distortion 2 mm out of plumb measured on face of frame, maximum twist corner to corner of 3 mm; align horizontal lines in final assembly.

.3 Brace frames rigidly in position until adjacent construction is complete; install wooden spreaders at third points of frame rebate to maintain frame width, install centre brace to support head of frames 1200 mm and wider in accordance with ANSI A250.11; do not use temporary metal spreaders for bracing of frames one.

.4 Place frames before construction of enclosing walls and ceilings, except for frames located in existing walls or partitions allowing for deflection of adjacent construction to ensure that structural loads are not transmitted to frames, and as follows:

.1 Check and correct opening width and height, squareness, alignment, twist and plumb as frames are installed in accordance with CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.

.2 Metal Stud Partitions: Provide a minimum of three wall anchors per jamb for frames up to 2150 mm high and one additional anchor for each 600 mm over 2150 mm high; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb; attach wall anchors to studs with screws.

.3 Remove wooden braces after frames are securely fastened or attached to adjacent construction.

.5 Install door silencers.

.6 Do not site weld unless approved by Consultant in writing for the specific location.

.7 For frames over 1220 mm in width, provide vertical support at the centre of head.

.2 Frame Tolerances: Install frames to tolerances listed in ANSI A250.11, and as follows:

.1 Squareness: Maximum 1.6 mm measured across opening between hinge jam and strike jamb.

.2 Plumbness: Maximum 1.6 mm measured from bottom of frame to head level.

.3 Alignment: Maximum 1.6 mm measured offset between face of hinge jamb and strike jamb relative to wall construction.

.4 Twist: Maximum 1.6 mm measured from leading edge of outside frame rabbet to leading edge of inside frame rabbet.

.3 Install door silencers.

.4 Caulk perimeter of frames between frame and adjacent material at interior (primary air seal) and exterior (water shedding) seal sides of the door. Allow drainage at the sill. Primary air seal to be continuous with back angle at sill.

.5 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

.1 Fit hollow metal doors accurately in frames within clearances required for proper operation; shim as necessary for proper operation. Install as specified in ANSI A250.8.

.2 Install hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.3 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, noncombustible sill and thresholds: 6 mm ; 13 mm at openings in non-fire rated separations where undercuts are indicated.

.4 Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

.5 Adjust operable parts for correct clearances and function.

3.5 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.

3.6 ADJUSTING

.1 Adjust doors for smooth, easy, free swinging operation and balanced door movement.

3.7 CLEANING

.1 Clean doors and frames.

3.8 FIELD PAINTING

.1 Prepare surfaces for field painting, to ASTM D6386 and ASTM D7396.

.2 Field painting: refer to Section 09 91 00 - Painting. Protect weatherstrips from paint. Provide final finish, free of scratches or other blemishes.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 08 11 13 – Steel Doors and Frames.

.2 Electrical Documents

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Builders Hardware Manufacturers Association (BHMA).

.1 BHMA 2012 Certified Products Directory.

.2 BHMA A156 Standards Set

.2 Canadian Standards Association (CSA Group):

.1 CSA B651-18, Accessible Design for the Built Environment, Includes Errata 1 (2020)

.3 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA):

.1 CSDFMA Canadian Metric Conversion Guide for Steel Doors and Frames.

.4 Door and Hardware Institute (DHI):

.1 DHI TDH-003-20 Sequence and Format for the Hardware Schedule (2019).

.2 DHI TDH-007-20, Installation Guide for Doors and Hardware (2020).

.3 DHI TDH-009-20, Recommended Location for Architectural Hardware for Standard Steel Frame – Updated 2020.

.5 International Code Council (ICC):

.1 ICC A117.1-2017, Accessible and Usable Buildings and Facilities.

.6 Underwriters Laboratory (ULC):

.1 ULC S133, Standard Method of Tests for Door Closers Intended for Use with Swinging Doors (CAN/ULC-S133:2016)

.2 ULC/ORD-C14(e)-M1985 Guide for Hardware for Fire Doors and Emergency Exits.

.3 ULC/ORD-C228-1995 Door Closers and Holders.

.4 ULC 132, Tests for Emergency Exit and Emergency Fire Exit Hardware (CAN/ULC-S132-2016).

.5 ULC 533, Standard for Egress Door Securing and Releasing Devices. (CAN/ULC-S533-15)

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate with other work having a direct bearing on work of this section.

.1 Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware and

coordinate with shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware in accordance with indicated requirements.

.2 Coordinate with Electrical Documents for type of wire required for electronic hardware, schedule for installation and connection to electronic hardware.

.3 Coordinate layout and installation of electrified hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system and building control system.

.4 Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.

.5 Coordinate Owner's keying requirements during the course of the Work.

.2 Pre-Installation Meetings: convene pre-installation meeting in accordance with Section 01 31 19 – Project Meetings to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's warranty requirements.

1.4 SUBSTITUTIONS

.1 The hardware listed in the Door Hardware Schedule establishes the quality standards, finishes, manufacturers and functions.

.2 Materials other than the named products for the Project may be acceptable to the Consultant. Submit information in accordance with Section 01 62 00 – Product Options and Substitutions.

.3 Notwithstanding the requirements of Section 01 62 00 – Product Options and Substitutions, the Consultant will review all proposed alternates prior to close of bids when submitted no later than seven business days prior to bid closing date as follows:

.1 Proposed alternates shall match colour range, texture and performance characteristics of named products, and shall not require a change to the colour board for the Project.

.2 Proposed alternates found acceptable by the Consultant will be issued in the form of an Addendum.

.3 The Consultant is not obligated to accept any materials presented for their review and does not need to provide reason for rejection of proposed alternates.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and data sheets.

.2 Indicate installation details, material descriptions, dimensions of individual components and profiles and finishes.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit contract hardware list in accordance with attached Hardware Schedule.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.3 Explanation of all abbreviations symbols and codes contained in schedule.

.4 Coordinate Security Contractor, Electrical Contractor and Door and Hardware Contractors to jointly prepare, submit, and obtain certified approval from the Consultant shop drawings for work related to door access control systems prior to undertaking the on-site work. The joint submission will clarify and assign responsibility between these Divisions for labour and materials associated with the supply and installation of electronic and physical components for doors and access control. An individual drawing shall be submitted in AutoCadd format for each door within the project scope depicting both public and secure side of door and arrangement of access control and security components, conduit, and cabling.

.3 Keying Schedule:

.1 Submit keying schedule prepared by or under the supervision of qualified Architectural Hardware Consultant (AHC), detailing Owner's final keying instructions for locks, including schematic keying diagram and index each key set to unique door designations.

.2 Submit keying schedule indicating method of keying, numbers and quantities of keys supplied. Indicate any special keying requirements requested.

.4 Installation Data: Submit Manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

.2 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

.3 Keys: Deliver with identifying tags to Owner.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide a complete set of specialized tools and maintenance instructions as needed for Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

1.8 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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

1.9 REGULATORY REQUIREMENTS

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.2 All hardware items shall be delivered boxed in original factory containers, labelled as to contents.

.3 Store in clean, well ventilated securely locked room accessible only to authorized personnel.

.4 Store hardware on shelves, not on the floor in locked, clean and dry area.

.5 Maintain an itemized inventory list of each item, updated regularly, to show items in storage and items installed.

.6 Protect hardware after installation in manner to not effect finish or operation of hardware.

.7 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.11 WARRANTY

.1 Provide written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

.2 Failures include, but are not limited to, the following:

.1 Structural failures including excessive deflection, cracking, or breakage.

.2 Faulty operation of operators and door hardware.

.3 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

.3 Warranty Period: From date of Substantial Performance, and as follows:

Hardware Type	Warranty Term
Locks, latches and cylinders	Ten years
Closers	30 years
Hinges	One year
Panics	Three years

Hardware Type	Warranty Term
Miscellaneous	One year
Electrical Hardware:	One year

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 As indicated on attached Hardware Schedule.

2.3 AUTOMATIC SWING DOOR OPERATORS

.1 Coordinate the work of all trades, including glass and glazing, masonry, and electrical requirements covered in manufacturer's details and appropriate sections of the specifications.

.2 The electrical contractor shall provide 117 volt, 60 cycle, single phase 15 ampere service for one-two operators, 30 ampere service for three-four operators, and as follows:

.1 Coordinate with electrical contractor for provision of service to each operator from junction box for multiple operators.

.2 Coordinate with electrical contractor shall provide electrical conduit and wiring from specified controls to operators as outlined on manufacturer's drawings.

.3 Finish hardware supplier shall provide and install concealed electro-mechanical swing door operator, consisting of electro-mechanical swinging door operator and electronic control, aluminum header, connecting hardware, and power on/off switch and actuator switches.

.4 Automatic entrance equipment: comply with ANSI A156.10 or A156.19.

.5 Aluminium header extrusions: minimum nominal 4 mm wall thickness with finish anodized AA-M12-C22-A31 clear.

.6 Equipment must operate between -35°C and +55°C in all climate conditions.

.7 Operator: Electro-mechanical system installed in a header to resist dust, dirt and corrosion; entire operator shall be removable from the header as a unit.

.8 Bearings: Fully lubricated and sealed to minimize wear and friction.

.9 Operator shall open the door with a 1/8 HP motor through reduction gears, door arm, and linkage assembly, and as follows:

.1 Low energy operator:

.1 Door opening time: not less than four seconds.

.2 Door closing time: not less than four and a half seconds.

.2 The drive train shall have a positive, constant engagement. The operator shall stop the door in the open position by electrically reducing the motor voltage and stalling against a 90° stop.

.3 Close the door by spring energy; controlled by employing the motor as a dynamic brake.

.4 Pre-load closing spring for positive closing action at a low material stress level for long spring life.

.5 The operator shall function as a manual door closer in the direction of swing with or without electrical power.

.10 The door forces and speeds generated during power opening, and manual opening in both directions of swing, and spring closing in both directions of swing shall conform to the requirements of ANSI A156.10 or A156.19.

.11 Verify that no defects or errors are present in completed phases of the work that would result in poor application or installation, or cause latent defects of the automatic door equipment.

.12 Installation and warranty adjustments shall be performed by authorized distributors factory trained technician.

2.4 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass

2.5 KEYING

.1 Door locks: to be keyed as directed. Prepare detailed keying schedule in conjunction with Owner and Consultant.

.2 Provide keys in duplicate for every lock in this Contract.

.3 Construction Keying: Construction Master Keys using cylinders that feature voiding of construction keys without cylinder removal; provide 10 construction master keys.

.4 Keying System: Provide a factory registered keying system in accordance with the following:

.1 Existing System: Master key or grand master key locks to Owner’s existing system.

.5 Keys: Provide nickel-silver keys in accordance with the following:

.1 Stamping Permanently inscribe each key with a visual key control number and notion stating “DO NOT DUPLICATE”.

.2 Quantity: In addition to one extra blank key for each lock, provide the following:

.1 Cylinder Change Keys: Three.

.2 Master Keys: Five.

.3 Grand Master Keys: Three.

Part 3 Execution

3.1 EXAMINATION

.1 Examine doors and frames, with installer present, for compliance with requirements for installation tolerances, wall and floor constriction and other conditions affecting performance.

.2 Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION GENERAL

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

.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.3 HARDWARE

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Conversion Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.4 Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

.1 Standard Steel Doors and Frames: DHI's "TDH-009-20 Recommended Locations for Architectural Hardware for Standard Steel Frame."

.2 Where indicated to comply with accessibility requirements, comply with ICC A117.1 "Accessible and Usable Buildings and Facilities."

.3 Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

.5 Coordinate removal, storage, and reinstallation of surface protective trim units with finishing work where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way.

.6 Do not install surface mounted items until finishes have been completed on substrates involved and as follows:

.1 Set units level, plumb, and true to line and location.

.2 Adjust and reinforce attachment substrates as necessary for proper installation and operation.

.3 Drill and countersink units that are not factory prepared for anchorage fasteners.

.4 Space fasteners and anchors according to industry standards.

.7 Boxed Power Supplies: Locate power supplies as indicated or, in not indicated, above accessible ceilings; verify location with Consultant, and as follows:

.1 Configuration: Provide one power supply for each door opening.

.8 Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant with requirements in Section 07 92 00 – Sealants.

3.4 INSTALLATION: AUTOMATIC SWING DOOR OPERATOR

.1 Install components as indicated on drawings and as scheduled to manufacturer's recommendations.

.2 Install door holders to limit doors to opening swing specified.

.3 Install operators on interior side of exterior entrances.

.4 Install rubber dampening devices to sound isolate operators from door frames.

.5 Isolate aluminum surfaces from contact with cementitious materials, using thick coating of bituminous paint. Let paint dry before installation of aluminum component.

.6 Conceal wiring between activating devices, electric locking system, and operators.

.7 Coordinate and confirm mechanical systems are balanced to ensure proper closing of doors.

3.5 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.6 PROTECTION

.1 Do not permit adjacent work to damage hardware or finish.

3.7 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean adjacent surfaces soiled by door hardware installation.

.3 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.

.4 Remove protective material from hardware items where present.

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

3.8 DEMONSTRATION

.1 Keying System Setup:

.1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.

.2 Turn over key to Owner.

.2 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware.

.2 Description, use, handling, and storage of keys.

.3 Use, application and storage of wrenches for door closers, locksets, and fire exit hardware.

.3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

END OF SECTION

DOOR HARDWARE SCHEDULE

PROJECT NAME: LOWER HILLSIDE WASHROOM BUILDING IMPROVEMENTS 2222

HARDWARE SETS

SET: 1.0

DOORS: 101, 102, 103, 104, 105
DESCRIPTION: EXT. WR

3	HINGE, FULL MORTISE	TA314 X SIZE TO SUIT	US32D	MK
1	DORMITORY/EXIT LOCK	V33 72 8225 LNMW	US32D	SA
1	PERMANENT CORE	KEYED TO OWNERS REQUEST		OT
1	KICK PLATE	K1050 200MM X WIDTH TO SUIT TORX SCREWS BEV	US32D	RO
1	WALL STOP	412 TORX	US26D	RO
1	THRESHOLD	25*X*AFG X OPENING WIDTH		PE
1	GASKETING	290AS 2 @ DOOR HEIGHT		PE
1	GASKETING	2891AS X DOOR WIDTH		PE
1	SURFACE CLOSER	281 O	EN	SA
1	SWEEP	29326CNB X DOOR WIDTH		PE

SET: 2.0

DOORS: 106
DESCRIPTION: UNI. WR

3	HINGE, FULL MORTISE	TA314 X SIZE TO SUIT	US32D	MK
1	STOREROOM/SERVICE LOCK	72 8206 LNMW	US32D	SA
1	PUSH PLATE	92-RKW PUSH TORX	US32D	RO
1	PERMANENT CORE	KEYED TO OWNERS REQUEST		OT
1	ELECTRIC STRIKE	1500C	630	HS
1	KICK PLATE	K1050 200MM X WIDTH TO SUIT TORX SCREWS BEV	US32D	RO
1	WALL STOP	412 TORX	US26D	RO
1	AUTO OPERATOR	SW200I		BM
1	ELECTROLYNX HARNESS	QC-C3000P		MK
1	ADVANCED LOGIC RELAY	CX-33PS		OT
1	EMERGENCY CALL SYSTEMS	CX-WEC10BK2		OT
1	POSITION SWITCH	DPS-M		SU
1	WAVE TO LOCK	CM-331/43S-SGLR		OT
1	WAVE TO OPEN	CM-325/42SW		OT
1	WAVE TO OPEN C/W LIGHT RING	CM-331/42SW-SGLR		OT
1	TIMER	CX-247		OT
1	KEY SWITCH	ON/OFF/HOLD OPEN		OT

NOTES: DIVISION 26 TO PROVIDE; 120VAC POWER TO FRAME HEADER, FINAL CONNECTION OF AUTO DOOR OPERATOR, ALL BACK BOXES, AND CONDUIT WITH LOW-VOLTAGE WIRING.

- DOOR NORMALLY CLOSED, LATCHED AND OUTSIDE ACTUATOR LIGHT INDICATING GREEN.
- ELECTRIC STRIKE UNLOCKED DURING PREDETERMINED TIME BY TIMER.
- DOOR OPENED BY PUSHING ON DOOR OR INTERACTING WITH OUTSIDE ACTUATOR. ONCE DOOR IS FULLY CLOSED AND LATCHED PRESSING ON INTERACTING WITH WAVE TO LOCK ACTUATOR WILL DISABLE OUTSIDE ACTUATOR CHANGING LIGHT FROM GREEN TO RED AND SECURING THE ELECTRIC STRIKE.
- EGRESS BY DEPRESSING ON INSIDE LEVER OR INTERACTING WITH INSIDE ACTUATOR.
- FREE EGRESS AT ALL TIMES.

SET: 3.0
DOORS: 107, 109
DESCRIPTION: STORAGE

3	HINGE, FULL MORTISE	TA314 X SIZE TO SUIT	US32D	MK
1	STOREROOM/SERVICE LOCK	72 8206 LNMW	US32D	SA
1	PUSH PLATE	92-RKW PUSH TORX	US32D	RO
1	CONC OVERHEAD STOP	6ADJ-*36	630	RF
1	PERMANENT CORE	KEYED TO OWNERS REQUEST		OT
1	KICK PLATE	K1050 200MM X WIDTH TO SUIT TORX SCREWS BEV	US32D	RO
1	THRESHOLD	25*X*AFG X OPENING WIDTH		PE
1	GASKETING	290AS 2 @ DOOR HEIGHT		PE
1	GASKETING	2891AS X DOOR WIDTH		PE
1	SURFACE CLOSER	281 O	EN	SA
1	SWEEP	29326CNB X DOOR WIDTH		PE
1	POSITION SWITCH	DPS-M		SU

SET: 4.0
DOORS: 108
DESCRIPTION: EXST. DOOR

3	HINGE, FULL MORTISE	TA314 X SIZE TO SUIT	US32D	MK
1	STOREROOM/SERVICE LOCK	72 8206 LNMW	US32D	SA
1	PERMANENT CORE	KEYED TO OWNERS REQUEST		OT
1	KICK PLATE	K1050 200MM X WIDTH TO SUIT TORX SCREWS BEV	US32D	RO
1	SURFACE CLOSER	281 CPS	EN	SA

NOTES: CONTRACTOR TO FIELD INSPECT EXISTING CONDITIONS PRIOR TO THE SUBMITTAL STAGE TO VERIFY THE SPECIFIED HARDWARE WILL WORK AS REQUIRED. PROVIDE ALTERNATE SOLUTIONS AND PROPOSALS AS NEEDED.

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 62 00 – Sheet Metal Flashing and Trim

.3 Section 07 92 00 – Sealants

.4 Section 09 91 00 – Painting

.5 Other technical sections as required.

1.2 REFERENCES

.1 Air Movement and Control Association International, Inc. (AMCA):

.1 AMCA 500-L-12 (Rev. 2015), Laboratory Methods of Testing Louvers for Rating.

.2 Aluminum Association (AA):

.1 AA DAF-45-2003(R2009), Designation System for Aluminum Finishes.

.3 American Society for Testing and Materials International (ASTM):

.1 ASTM B209/B209M-21a, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.2 ASTM B211/B211M-23, Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-19.13-M87, Sealing Compound, One Component, Elastomeric, Chemical Curing. (Withdrawn)

.5 Underwriter's Laboratories of Canada (ULC):

.1 ULC 701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering. (CAN/ULC-S701-11) (withdrawn)

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Provide product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer’s data sheets, installation instructions and standard details.

.2 Provide shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate fabrication and erection details, including anchorage, accessories, profiles, and finishes.

.2 Indicate pressure drop, face area, and free area.

.3 Provide samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit colour samples for initial selection for each louvre.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into operations and maintenance manual in accordance with Section 01 78 00 – Closeout Submittals.

1.5 QUALITY ASSURANCE

.1 Installer Qualifications: having minimum of five years successful documented experience installing louvres, and authorized in writing by the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in containers with labels legible and intact and grade-seals unbroken.

.2 Store materials so as to prevent damage or contamination.

.3 Store materials in a dry area, protected from freezing, staining and damage.

.4 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE / DESIGN CRITERIA

.1 Design louvre Work in accordance with Building Codes and to withstand live, dead, lateral, wind, seismic, handling, transportation and erection loads, imposed and other loads.

2.2 LOUVRES

.1 Fixed exterior architectural aluminum louvre: Aerodynamic performance with AMCA Certified Ratings Seal, minimum 50% free area. Maximum pressure drop through louvre 50 Pa, refer to schedule on Drawings for additional data. Overall size as indicated on Drawings.

.2 Construction: welded with exposed joints ground flush and smooth.

.1 Aluminum sheet: ASTM B209/B209M.

.2 Depth: to suit application.

.3 Frame and mullion: ASTM B211/B211M;

.1 Frame: Extruded aluminum alloy Aluminum Association alloy 6063-T5 assembled with fastenings. 2 mm thickness minimum for head, sill, and jamb.

.2 Mullions: Concealed at 1500 mm maximum centres.

.4 Blade: Stormproof with centre watershed in blade, minimum 2 mm thick, maximum blade length 1500 mm.

.5 Effectiveness Ratio: 99% when tested for one hour at an exterior wind velocity of 13 m/s and a rainfall rate of 75 mm/hr.

.6 Finish: as selected by Consultant from manufacturer’s standard colour range.

.7 Options:

.1 Duct collars.

.2 Extended sill, finished to match louvre.

.8 Fastenings: AISI Type 304 stainless steel, SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between:

.1 Aluminum and head of bolt.

.2 Between nut, stainless steel washer and aluminum body.

.3 Bird screen: Crimped 2.90 mm diameter aluminum wire cloth secured to 3 mm minimum thick extruded aluminum U frame mitred at corners. Mesh size: 13 mm.

.4 Blank-off panels (as required):

.1 Aluminum sheet metal to match associated louvre.

.1 Aluminum sheet: ASTM B209/B209M; Alloy 1100-H14, 0.8 mm thick.

.5 Acceptable Manufacturers:

.1 Airolite.

.2 Carnes Co. Ltd.

.3 Construction Specialties Inc.

.4 Nailor.

.5 Ventex Inc.

2.3 ACCESSORIES

.1 Isolation coating: CAN/CGSB-1.108; Bituminous solvent type paint.

.2 Anchors and fasteners: AISI Type 304 stainless steel.

.3 Sealant: CAN/CGSB 19.13, one component silicone base chemical curing, in standard colours as selected by Consultant.

.1 DC795, Dow Corning Inc.

.2 Silpruf SCS 2000 series, GE Silicones.

.4 Joint backing: Product recommended by louvre sealant manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 INSTALLATION

.1 Compliance: comply with manufacturer's installation instructions, datasheets, and standard details.

.2 Coordinate framing and anchorage for louvres with other parts of the Work.

.3 Install bird screen to inside face of louvres.

.4 Install louvres in accordance with manufacturer's instructions and Drawings. Securely anchor into opening.

.5 Install blank-off panels as necessary to accommodate mechanical work, fasten securely and in accordance with Drawings.

.6 Apply isolation coating to separate dissimilar metals, and metals and masonry or concrete unless neoprene washers are shown.

.7 Install duct collars as required and extended sills as indicated.

.8 Seal louvre and blank-off panel perimeter with sealant and joint backing for weathertight seal in accordance with requirements of Section 07 92 00 – Sealants.

3.3 CLEANING

.1 Proceed in accordance with manufacturer’s recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for supply of equipment and services necessary for mechanical preparation of existing substrates to receive new flooring finishes.

1.2 RELATED REQUIREMENTS

.1 Section 03 35 00 – Concrete Finishing.

.2 Section 09 05 23 – Common Work Results for Flooring Preparation.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM):

.1 ASTM D4258-05 (2017), Standard Practice for Surface Cleaning Concrete for Coating.

.2 ASTM D4259-18, Standard Practice for Abrading Concrete.

.2 International Concrete Repair Institute (IRCI):

.1 IRCI Technical Guideline No. 310.2R-2013, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section with requirements of floor levelling and topping materials specified in Section 09 05 23 – Common Work Results for Flooring Preparation for surface profile.

.2 Pre-Construction Meetings: Conduct a pre-construction meeting to discuss existing concrete slab condition, procedures proposed for substrate preparation, location of required on-site mock-ups and surface profile requirements for installation of levelling products in accordance with Section 01 31 19 – Project Meetings, attended by Consultant, Contractor, Subcontractor and other Subcontractors or Suppliers affected by work of this Section.

.3 Scheduling: Schedule work of this Section to occur during non-work hours in occupied buildings to minimize disturbance to adjacent spaces.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Product Data: Submit product data sheets describing mechanical preparation methods and cleaning methods and equipment proposed for use on project.

.2 Informational Submittals: Provide the following submittals before starting any work of this Section:

.1 Dust and Water Control Plan: Submit written description of materials and procedures used to control and remove dust and water from work area,

methods to prevent spread of dust and water to adjacent occupied spaces and to prevent contamination of HVAC systems.

1.6 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Installer: Use installer having experience in preparation of flooring substrates of similar extent and complexity as required for this Project, using equipment and methods to reduce risk of damage to substrates.

.2 Mock-Ups:

.1 Notify Consultant and others affected by work of this Section a minimum of 48 hours in advance of installation of work described in this Section.

.2 Mock-up minimum 10 m2 area indicating typical surface preparation required for the Project, at location as directed by Consultant and agreed upon in advance; create a separate mock-up for each different surface profile required by floor levelling.

.3 Allow 24 hours for review of mock-up by Consultant and others affected by work of the Section before completing work of this Section.

.4 Mock-up will be reviewed for consistency of surface profile required by floor levelling.

.5 Acceptable mock-up will serve as standard for remainder of the Work required for the Project.

.1 Correct mock-up and request additional review by Consultant when changes are required.

.2 Mock-up will remain in place and serve as minimum acceptable standard for work of this Section and related Sections when accepted by Consultant.

Part 2 Products

2.1 EQUIPMENT

.1 Surface Preparation Equipment: Use equipment of a type recommended by Subcontractor that minimizes dust and water generation, and that provides surface profiles required by subsequent floor levelling, and as follows:

.1 CSP 2 through CSP 4 Surface Profiling: Abrasive blast or grinding type equipment with vacuum recovery systems to control dust and collect surface aggregate.

.2 CSP 3 through CSP 8 Surface Profiling: Dry shot blast type equipment with vacuum recovery systems to contained blast materials and collect surface aggregate.

.3 CSP 2 through CSP 10 Surface Profiling: Mechanical impact or high or ultra-high pressure water jet type equipment with aggregate and effluent recovery system.

.2 Limitations: Notify and obtain acceptance from Consultant where surface profiling required by floor levelling use of high or ultra-high pressure water jet, or

mechanical impact methods that have moderate to high potential to cause microcracking before starting work of this Section:

.1 Consultant may consider alternate methods of floor preparation when less damaging methods are not practical based on site conditions or timing of work required by this Section.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that work of others affected by this Section, or work required by this Section is complete before starting mechanical preparation and surface profiling and as follows:

.1 Confirm degree of floor profile require for installation of floor levelling specified in other Sections before starting work of this Section.

.2 Starting work of this Section denotes acceptance of site conditions and implementation of surface profile required of floor levelling required by other Sections.

3.2 PREPARATION

.1 Use methods that reduce potential for microcracking of concrete substrates, and that minimize the amount of water or residue clean-up.

.2 Prepare concrete substrate and create surface profile in accordance with ASTM D4259; clean concrete in accordance with ASTM D4258 using methods compatible with levelling, and as follows:

.1 Prepare surface profiles required by levelling in accordance with ICRI Technical Guideline No. 310.2.

.2 Acceptable substrate surfaces will be free of laitance, oil, grease, flooring adhesive, paint, and other surface contaminates capable of affecting bond of specified floor finishes to concrete substrate.

.3 Prepare surfaces to receive Self-Levelling Underlayment as specified in Section 09 05 23 - Common Work Results for Flooring Preparation to minimum CSP 3 or as otherwise required by Self-Levelling Underlayment manufacturer.

3.3 SITE QUALITY CONTROL

.1 Testing and Inspection Agency: Owner will appoint inspection and testing agency, and as follows:

.1 Notify Consultant, and inspection and testing agency with sufficient timing to allow reasonable opportunity for review; provide assistance and access to the Work.

.2 Inspection and testing will include visual inspection of completed substrate preparation to verify that contamination is removed and specified ICRI surface profile are achieved using ICRI standard rubber mold for visual comparison.

.2 Non-Conforming Work: Repair work that does not meet specified ICRI surface profile at no additional expense to the Owner.

3.4 PROTECTION

.1 Protect prepared substrates from contamination; re-clean substrates that are contaminated by construction operations prior to installation of specified floor levelling.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for preparation of new concrete slabs and existing concrete slabs to receive applied flooring for installation required flatness, and levelness.

.1 New concrete slabs that meet the requirements specified in Section 03 35 00 - Concrete Finishing but require further preparation to meet substrate requirements for flooring finishes specified in various Division 09 Specification Sections.

1.2 RELATED REQUIREMENTS

.1 Section 03 35 00 – Concrete Finishing

.2 Section 09 67 23 – Resinous Flooring

.3 Mechanical Documents: coordination of materials penetrating floor assemblies.

.4 Electrical Documents: coordination of materials penetrating floor assemblies.

1.3 REFERENCES

.1 Southern Coast Air Quality Management District (SCAQMD):

.1 SCAQMD Rule #1113-16, Architectural Coatings.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate compatibility of products specified in this Section with adhesive products specified in Section 09 67 23 – Resinous Flooring; submit Compliance Certification in accordance with items below.

.2 Pre-Construction Meetings: Arrange for Pre-Construction Meeting in accordance with Section 01 31 19 – Project Meetings, with Contractor, Subcontractor, Subcontractors or suppliers affected by the Work of this Section, and Consultant to discuss installation requirements and site reviews required by the Consultant.

.3 Provide minimum 72 hours to Consultant before starting Work of this Section; increase notice period where time period spans weekends or statutory holidays.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.

.2 Action Submittals: Provide the following submittals before starting any Work of this Section:

.3 Product Data: Submit product data for products specified indicating physical properties, performance characteristics, acceptability of substrates, application limitations and test results.

1.6 QUALITY CONTROL

.1 Qualifications: Provide proof of qualifications during the course of the Work of this Section:

.1 Manufacturer: Obtain specified products through one source from a single manufacturer or using materials from a secondary source that are acceptable to the manufacturer.

.2 Installer: Install using personnel experienced in installation of flooring preparation products specified in this Section who are trained, licenced or otherwise approved by the manufacturer.

.2 Certifications: Provide proof of the following during the course of the Work:

.1 Compliance Certification: Provide letter from flooring adhesive manufacturers stating that product selected from Acceptable Products specified in this Section is compatible with flooring adhesives specified in Sections listed in Related Requirements.

1.7 SITE CONDITIONS

.1 Ambient Conditions: Maintain air temperature and substrate temperature in accordance with manufacturer's printed installation instructions.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Products Manufacturers: Subject to compliance with requirements specified in this Section; where multiple listings of manufacturers occur, use any of the following listed manufacturers' Products in accordance with Section 01 62 00 – Product Options and Substitutions:

.1 Ardex Engineered Cements.

.2 Custom Building Products

.3 Laticrete Canada

.4 MAPEI Canada Inc.

.5 Sika Canada Ltd.

.6 W.R. Meadows of Canada.

.2 Unsolicited Substitutions: Consultant may consider additional manufacturers having similar products to Acceptable Products Manufacturers listed above during the construction period, provided they meet the performance requirements established by the named Products and provided they submit requests for substitution before starting any work of this Section:

.1 Do not use substitute materials to establish Bid Price.

.2 Apparent Substitutions that appear as a part of the Project without review and acceptance by the Consultant will be rejected, and replaced with one of the specified Products.

2.2 PERFORMANCE REQUIREMENTS

.1 Volatile Organic Compound (VOC) Limitations: Provide products for each site applied coating used within the building envelope (interior side of weatherproofing system) complying with the VOC Limits established by South Coast Air Quality Management District Rule #1113, Architectural Coatings.

2.3 PATCHING AND LEVELLING MATERIALS

.1 Underlayment: Cementitious, self-levelling, single component, polymer modified underlayment with manufacturer's recommended primer and crack repair materials; for application thicknesses to a minimum feather edge to 13 mm; interior grade and as follows:

.1 Acceptable Materials:

.1 K 15 Premium Self Levelling Underlayment, Ardex.

.2 CustomTech TechLevel 150, Custom Building Products

.3 Supercap SC500, Laticrete

.4 Novoplan® 2 Plus, MAPEI.

.5 Sikafloor Level 125, Sika.

.6 Sure-Flo ST, W.R. Meadows.

.2 Patching and Flash Patching Materials: Cementitious based, polymer modified, fine aggregate, single component, rapid curing, early strength floor patching compounds having high adhesion with manufacturer's recommended primer and surface profile; for application in thicknesses from 4 mm to 25 mm, and as follows:

.1 Acceptable Materials:

.1 SD-P, Ardex.

.2 CustomTech TechPatch MP, Custom Building Products

.3 Skim Lite, Laticrete.

.4 Planiprep SC, MAPEI Inc.

.5 SikaQuick 1000, Sika.

.6 Sealtight Meadow-Crete H, W.R. Meadows.

.3 Fine Finish Flash Patching Materials: Cementitious based, polymer modified, fine aggregate, single component, ultra-fast drying, early strength floor patching compounds having high adhesion with manufacturer's recommended primer and surface profile; for application in thicknesses from 0 mm to 6 mm, and as follows:

.1 Acceptable Materials:

.1 SD-F Feather Finish®, Ardex.

.2 CustomTech Silk Patch, Custom Building Products

.3 Laticrete

.4 Planipatch®, MAPEI.

.5 Sika® Level SkimCoat CA, Sika.

.6 Sealtight Meadow-Patch® T1, W.R. Meadows.

2.4 ACCESSORIES

.1 Primer: Product compatible with and as recommended by patching and levelling product manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify concrete substrates before beginning of installation of Products specified in this Section.

.1 Ensure concrete floors are dry by using test methods recommended by flooring manufacturer, and exhibit negative alkalinity, carbonization or dusting.

.2 Installation of products specified in this Section will denote acceptance of site conditions.

3.2 SURFACE PREPARATION

.1 All substrates must be structurally sound, dry, solid and stable.

.2 Substrate must be clean and free of dust, dirt, oil, grease, paint, curing agents, concrete sealers, latex compounds, loosely bonded toppings, loose particles, laitance, adhesive residue, and any other substance or condition that may prevent or reduce adhesion.

.3 Ensure substrates are sound, level, free of cracks greater than 3 mm in width, and changes in elevation that may adversely affect installation.

.4 Ensure concrete is free of any negative hydrostatic pressure and excessive moisture.

.5 Ensure substrate and ambient room temperatures are between 10°C and 35°C before application and for 72 hours after application.

3.3 INSTALLATION – UNDERLAYMENTS

.1 Mixing:

.1 Mix in a clean mixer in accordance with manufacturer’s written instructions. Use appropriate mixing and delivery method in accordance with area to receive underlayment.

.2 If pump mixing is being used, periodically clean pump in accordance with manufacturer’s written instructions.

.1 Do not overwater.

.2 Thoroughly mix with high-speed mixer (at about 1100 rpm) to a homogenous, smooth, lump-free consistency.

.3 Do not overmix; which could cause air to become trapped, shortening the pot life or cause pin holing during application and curing.

.3 Application:

.1 Place Product in a ribbon pattern to achieve a continuous flow of wet material to avoid trapping air or creating a cold joint.

.2 Set width of pour that is ideal for maintaining a wet edge throughout placement; adjust width of pour to maintain wet edge.

.3 Immediately after placing Product, spread with gauge rake; smooth surface after achieving required thickness.

3.4 INSTALLATION – PATCHING AND FLASH PATCHING PRODUCTS

.1 Mixing:

- .1 Mix in a clean container in accordance with manufacturer's written instructions.
- .2 Do not overwater.
- .3 Thoroughly mix with low-speed mixer (at about 300 rpm) to a smooth, lump-free consistency.
- .4 Do not mix more material than can be applied within eight to ten minutes.
- .5 Avoid air entrapment and prolonged mixing, which will shorten pot life.

.2 Application:

- .1 Select an appropriate flat-edge steel trowel.
- .2 Immediately apply mixed patching and levelling products to substrate, according to the desired thickness. Do not exceed manufacturer's maximum single-coat thickness.
- .3 Blend into the surrounding area and finish to the required smoothness

3.5 PROTECTION

.1 Protect from traffic dirt or dust from other trades until the final installation of the floor covering.

.2 Allow for extended periods of cure and protection when temperatures drop below 16°C and/or when relative humidity is higher than 70%.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 07 27 19 – Sheet Membrane Vapour Barrier

.3 Section 07 84 00 – Firestopping and Smokeseals

.4 Section 07 92 00 – Sealants

.5 Section 09 91 00 – Painting

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C475/C475M-17(2022), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C645-18, Standard Specification for Nonstructural Steel Framing Members.

.3 ASTM C840-20, Standard Specification for Application and Finishing of Gypsum Board.

.4 ASTM C919-22, Standard Practice for Use of Sealants in Acoustical Applications.

.5 ASTM C1002-22, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.6 ASTM C1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.7 ASTM C1396/C1396M-17, Standard Specification for Gypsum Board.

.8 ASTM C1629/C1629M-19, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

.9 ASTM D4977/D4977M-20, Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion.

.10 ASTM D5420-21, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).

.11 ASTM E84-22, Standard Test Method for Surface Burning Characteristics of Building Materials.

.2 Association of the Wall and Ceilings Industries International (AWCI)

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.25-M88, Adhesives, for Bonding Drywall to Wood Framing and Metal Studs. (Withdrawn)

.4 Gypsum Association (GA):

.1 GA-214-2021 Levels of Finish for Gypsum Panel Products.

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule #1168-22, Adhesives and Sealants Applications.

.6 Underwriters' Laboratories of Canada (ULC)

.1 ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. (ULC S102)

.2 ULC 114, Standard Method of Test for Determination of Non-Combustibility in Building Materials.

.3 ULC 702.1, Standard for Thermal Insulation Mineral Fibre for Buildings, Part 1: Material Specification (CAN/ULC-S702.1:2014-AMD1).

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – 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.

.4 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

1.5 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 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 MANUFACTURERS

.1 Acceptable Manufacturers:

.1 Cabot Gypsum Company

.2 CertainTeed Gypsum Canada Inc.

.3 CGC Inc.

.4 Georgia-Pacific Canada, Inc.

.5 Pabco Gypsum.

.6 USG.

2.2 GYPSUM BOARD MATERIALS

.1 Abuse resistant board: gypsum panels with moisture-resistant gypsum core, to ASTM C1629/C1629M and ASTM C1396/C1396M and as follows:

.1 Type: fire resistant.

.2 Thickness: 16 mm minimum.

.3 Edges: tapered.

.4 Surface Abrasion: Level 2 classification in accordance with ASTM D4977/D4977M.

.5 Indentation Resistance: Level 1 classification in accordance with ASTM C1629/C1629M and ASTM D5420.

.6 Soft Body Impact Resistance: Level 2 classification in accordance with ASTM C1629/C1629M.

.7 Hard Body Impact Resistance: Level 1 classification in accordance with ASTM C1629/C1629M.

.8 Basis of Design Materials:

.1 Sheetrock® Brand Mold Tough® AR Firecode® X Panels, USG.

2.3 FRAMING MATERIALS

.1 Studs and Tracks: as indicated in Section 09 22 00 - Non-Structural Metal Framing.

.2 Metal furring runners, hangers, tie wires, inserts, anchors.

.3 Drywall furring channels: 0.75 mm core thickness galvanized steel channels for screw attachment of gypsum board.

2.4 INSULATION MATERIALS

.1 Mineral Fiber Insulation: Un-faced preformed GreenGuard™ or formaldehyde free binder stone wool insulation meeting the requirements of ULC 702.1; having maximum flame spread and smoke developed of 0/0 in accordance with ULC 102 and ASTM E84 and being non-combustible in accordance with ULC 114 and as follows:

.1 Type: 1 to ASTM C665.

.2 Width: to friction fit in stud spaces.

.3 Thickness: to fill cavity thickness.

.4 Acceptable Materials:

.1 Thermafiber SAFB, Owens-Corning Canada Inc.,

.2 AFB Acoustical Fire Batt, Rockwool Inc.

2.5 CEILING/WALL ACCESS DOORS

.1 Architectural, flush mounting access panels for gypsum board installation, thickness and fire rating to match wall assembly, manufacturer’s standard sizes selected to suit access requirements, complete with extruded aluminum frame, concealed hinge and a removable door panel, air tight gasket and screwdriver

slot latch mechanism. Confirm proposed location and number of access doors with Consultant prior to installation.

.1 Fire-Rated Access Doors and Frames:

.1 Concealed Flange Fire-Rated Wall Access Panel: Flush design frame with a drywall bead taping flange, specifically for use with gypsum board.

.1 Frame: 1.61 mm (14 gauge) galvanized steel.

.2 Door Panel: 1.99 mm (16 gauge) galvanized steel, uninsulated.

.3 Hinge: Fully concealed pin type hinge with 90 degree opening, self-closing device. Latch: Allen key operated latch with interior latch release.

.4 Rating: as indicated.

.2 Concealed Flange Fire-Rated Ceiling Access Panel: Flush design frame with a drywall bead taping flange, specifically for use with gypsum board.

.1 Frame: 1.99 mm (16 gauge) galvanized steel.

.2 Door Panel: 1.31 mm (18 gauge) galvanized steel, with high temperature insulation and 0.85 mm (22 gauge) metal liner.

.3 Hinge: Fully concealed pin type hinge with 90 degree opening, self-closing device.

.4 Latch: Allen key operated latch with interior latch release.

.5 Rating: as indicated.

.2 Acceptable Manufacturers:

.1 Access Panel Solutions.

.2 Acudor Products, Inc.

.3 Chicago Metallic/Rockfon Corporation.

.4 Nystrom Building Products Co.

2.6 FINISHES

.1 Paint: in accordance with Section 09 91 00 – Painting.

2.7 ACCESSORIES

.1 Steel drill screws: to ASTM C1002.

.2 Stud adhesive: to CAN/CGSB-71.25.

.3 Laminating compound: as recommended by manufacturer, asbestos-free.

.4 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.

.5 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.

.6 Acoustic sealant: non-hardening, non-skinning, permanently flexible and having VOC content less than the VOC limits of State of California's South Coast Air Quality Management District Rule #1168 in accordance with Section 07 92 00 – Sealants.

.7 Firestopping: refer to Section 07 84 00 – Firestopping and Smokeseals for project as required for all surfaces, penetrations, irregular connections, and locations as described in Section 07 84 00 – Firestopping and Smokeseals.

.8 Polyethylene: in accordance with Section 07 27 19 – Sheet Membrane Vapour Barrier.

.9 Insulating strip: rubberized, moisture resistant, 3 mm thick cork or closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.10 Joint Treatment Materials: Provide joint compound and accessory materials in accordance with ASTM C475/C475M and as follows:

.1 Joint Tape: As recommended by panel manufacturer

.2 Joint Compound for Interior Mould Resistant Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

.1 Pre-filling: Setting type joint compound.

.2 Embedding and First Coat: Setting type joint compound.

.3 Fill Coat: Setting type, sandable topping compound.

Part 3 Execution

3.1 ERECTION

.1 Perform application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Install work level to tolerance of 1:1200.

.5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.6 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.7 Furr gypsum board faced vertical bulkheads within and at termination of ceilings.

.8 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.9 Install gypsum 19 mm above finished floor at base of walls and seal joint for acoustic partitions to achieve STC rating as indicated.

.10 Seal fire rated partitions with fire caulking as indicated in Section 07 84 00 - Firestopping and Smokeseals and authority having jurisdiction.

.11 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.

.12 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.13 Furr duct shafts, beams, columns, pipes and exposed services where 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 metal furring or framing using screw fasteners and stud adhesive for first layer, screw fasteners and laminate compound 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 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 in accordance with ASTM C919. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.

.4 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.5 Install gypsum board on walls vertically to avoid end-butt joints.

.6 Install gypsum board with face side out.

.7 Do not install damaged or damp boards.

.8 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 or using contact adhesive for full length.

.2 Install casing beads where ceilings abut dissimilar materials.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Construct control joints of preformed units or two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.6 Provide continuous polyethylene dust barrier behind and across control joints.

.7 Locate control joints where indicated and at changes in substrate construction at approximate 10 m spacing on long corridor runs and at approximate 15 m spacing on ceilings.

.8 Install control joints straight and true.

.9 Construct expansion joints at building expansion and construction joints. Provide continuous dust barrier.

.10 Install expansion joint straight and true.

.11 Splice corners and intersections together and secure to each member with three screws.

.12 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.13 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.

.14 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with GA-214:

.1 Levels of finish (at locations below or as indicated on drawings)

.1 Level 0: No taping, finishing or accessories required for areas of temporary construction.

.2 Level One: 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 Two: 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 Three: 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 Four: 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 interior of units and where walls are to receive light coating.

.15 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.

.16 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.

.17 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.18 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.19 Mix joint compound slightly thinner than for joint taping.

.20 Remove ridges by light sanding or wiping with damp cloth.

.21 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

3.4 PROTECTION

.1 Protect completed gypsum board from damage.

.2 Protect other work, particularly glass and finished work from damage and accidental application of taping compound.

3.5 CLOSEOUT ACTIVITIES

.1 Repairs: Touch-up minor damage to finishes in accordance with manufacturer’s instructions; remove and replace components that cannot be successfully cleaned and repaired.

3.6 CLEANING

.1 Clean exposed surfaces of panels, including trim, edge mouldings, and suspension system members in accordance with manufacturer’s instructions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Formed metal framing of studs and furring, at interior locations.

1.2 RELATED REQUIREMENTS

.1 Section 09 21 16 - Gypsum Board Assemblies.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM):

.1 ASTM A653/A653M-22, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C645-18, Standard Specification for Nonstructural Steel Framing Members.

.3 ASTM C754-20, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.4 ASTM C919-22, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Association of the Wall and Ceiling Industry (AWCI).

.3 Canadian Standards Association (CSA Group):

.1 CSA S136-16, North American specification for the design of cold-formed steel structural members.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the placement of components within the stud framing assembly.

1.5 ACTION SUBMITTALS / INFORMATIONALSUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Provide data describing standard framing member materials and finish, product criteria, load charts, and limitations.

.2 Provide MSDS information for all products.

.2 Delegated Design:

.1 Professional engineers sealed and signed shop drawings and design submittals requiring structural engineering.

.2 Provide delegated design for the studs where heights or loads exceed manufacturers standard designs.

.3 Submit signed and sealed drawings stamped by a Professional Engineer registered in the Province of Ontario and as indicated in Section 01 35 00 – Delegated Design.

.4 Evaluation Reports: Submit steel manufacturer evaluation reports certified under an independent third-party inspection program reviewed to the local building code.

1.6 QUALITY ASSURANCE

.1 Perform Work to ASTM C754.

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

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

.4 Retain a professional engineer, registered in the province of the Work, to design fabrication and erection of the Work of this Section in accordance with applicable Building Code and Contract Document requirements including, but not limited to, the following:

.1 Seal and signature to shop drawings and design submittals requiring structural engineering.

.2 Site review and certification of installed components.

.3 Completion of Letters or Commitment and Supervision.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver steel stud materials to site in accordance with the construction schedule.

.2 Store materials under cover, away from damp surfaces.

.3 Do not stack framing more than five (5) bundles high. Support the pile straight and level to prevent sag and distortion.

.4 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Waste Management and Disposal.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects.

.2 Construct rated separations in strict accordance with ULC/cUL tested and approved assemblies listed for the specific smoke or fire separation.

.3 Construct sound separations in strict accordance with wallboard manufacturer’s tested and approved assemblies for the Sound Transmission Class (STC) ratings noted.

.4 Provide bridging to prevent member rotation and member translation perpendicular to the minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Do not rely on sheathing to resist torsion or minor axis buckling.

.5 Design assembly to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

.6 Design door support assemblies to accommodate suspended loads, deflection of building structural members, and clearances of intended sliding door openings.

.7 Connections between lightweight steel framing members shall be bolts, welding or sheet metal screws.

.8 Resistances for sheet metal screws shall be based on the manufacturer's lower bound test values multiplied by the appropriate resistance factor given in CSA S136.

2.2 STUD FRAMING MATERIALS

.1 Non-load Bearing Studs: to ASTM C645, hot dipped galvanized to ASTM A653/A653M, or coating with equivalent corrosion resistance, rolled steel, channel shaped, punched for utility access 460 mm on centre, for screw attachment of gypsum board, as follows:

.1 Depth: as indicated on Drawings.

.2 Thickness: 0.45 mm.

.1 Use 0.75 mm heavy weight framing to support fire rated doors.

.2 Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud. Provide deflection track at header locations where partition walls extent to underside of structure.

.1 Double Runner Deflection Track: Outside runner using 50 mm flanges; inner runner 33 mm; maintaining 25 mm minimum deflection space.

.2 Deep Leg Deflection Track: Top runner having 50 mm down standing legs; maintaining 13 mm minimum deflection space.

.3 Slotted Deflection Track for Fire Separations: Premanufactured slotted top runner with 63 mm down standing legs and having 6 mm wide x 38 mm high slots spaced at 25 mm o/c along length of runner; tested and certified for use in fire rated wall construction.

.3 Metal channel stiffener: Size as required 1.4 mm thick cold steel, coated with rust inhibitive coating.

.4 Furring and Bracing Members: Of same material as studs; thickness to suit purpose.

.5 Fasteners for Metal Framing: Type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

.6 Acoustic Sealant: As specified in Section 07 92 00 – Sealants.

.7 Separator: rubberized, moisture resistant 3 mm thick cork or foam strip, 12 mm wide, with self sticking adhesive on one face, lengths as required.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that rough-in utilities are in proper location.

3.2 ERECTION

.1 Align and secure top and bottom runners at 600 mm on centre maximum.

.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.3 Install studs vertically at 400 mm on centre or indicated in approved shop drawings and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.4 Erect metal studding to tolerance of 1:1000.

.5 Attach studs to bottom track using screws, crimp method, or pop rivets. Do not weld.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.9 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.10 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.11 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.12 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.13 Extend partitions to underside of roof except where noted otherwise on drawings.

.14 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks. Use double track slip joint as indicated.

.15 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.16 Install two continuous beads of acoustical sealant or continuous insulating strip under studs and tracks around perimeter of sound control partitions in accordance with ASTM C919.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 04 22 00 – Unit Masonry

.2 Section 07 92 00 – Sealants

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI):

.1 ANSI A108-A118-A136-2021, Installation of Ceramic Tile.

.2 ANSI A137.1-2022, American National Standards Specifications for Ceramic Tile.

.2 American Society for Testing and Materials International (ASTM):

.1 ASTM C144-18, Standard Specification for Aggregate for Masonry Mortar.

.2 ASTM C207-18, Standard Specification for Hydrated Lime for Masonry Purposes.

.3 ASTM C979/C979M-16, Standard Specification for Pigments for Integrally Coloured Concrete.

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB 75.1-M88, Tile, Ceramic. (Withdrawn)

.4 Canadian Standards Association (CSA International):

.1 CSA-A3000-18, Cementitious materials compendium, Includes Update No. 1 and Errata (2021).

.5 International Organization for Standardization (ISO):

.1 ISO 13007: Part 1-6, Ceramic Tiles- Grouts and Adhesives.

.6 Terrazzo Tile and Marble Association of Canada (TTMAC):

.1 Tile Specification Guide 09 30 00, 2019-2021, Tile Installation Manual.

.2 Hard Surface Maintenance Guide.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Preconstruction Meeting: Convene one week before starting work of this section attended by Contractor, Consultant, tile installer, tile supplier and mortar and grout representative to discuss the following:

.1 Substrate and backing surfaces flatness requirements.

.2 Installation techniques associated with specified materials.

.3 Compatibility between specified materials and between adjacent materials.

.4 Concerns arising from site conditions.

.5 Concerns of installers or suppliers arising from as-constructed conditions.

.6 Edge protection, transition and pre-fabricated movement joint profiles.

.7 Waterproofing techniques.

.8 Environmental requirements.

.9 Finish protection.

1.4 ACTION SUBMITTALS / INFORMATION SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's product data for each type of product specified.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures:

.1 Indicate tile layout, patterns, colour arrangement, perimeter conditions, junctions with dissimilar materials, and setting details.

.2 Locate and detail movement joints.

.3 Include TTMAC installation details for each installation location.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Tiles: Submit 2 pieces of each tile specified illustrating colour, texture, size and pattern.

.2 Grout: Submit manufacturer’s full range of colours available for each type of grout specified.

.3 Trims: Submit full size units of each type of trim and accessory in each colour required for installation; minimum 150 mm lengths.

.4 Mount specified material, including grout, on 12 mm thick plywood backer illustrating pattern, colour variations, and grout joint size variations. Include perimeter accessories, movement joints, and trims where applicable.

.4 Manufacturer’s instructions: Submit manufacturer’s recommended and special installation instructions.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit two copies of TTMAC Maintenance Guide and additional information as follows.

.1 Manufacturer’s maintenance data sheets for sealers and other non-tile maintenance materials and accessories.

.2 Warning of maintenance practices or materials that may damage or disfigure finished Work.

.3 Include routine maintenance and stain removal methods.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide minimum 2% of total of each size, colour, and surface finish of tile specified.

.1 Store in original containers, clearly marked to identify the following:

.1 Manufacturer and distributor's name.

.2 Material series name and stocking number.

.3 Material description, including colour and pattern.

.2 Maintenance material same production run as installed material.

1.7 QUALITY ASSURANCE

.1 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years successful documented experience and having completed tile installations similar in material, design and extent to this Project and be a member in good standing with Terrazzo, Tile and Marble Association of Canada (TTMAC).

.2 Conform to requirements of Terrazzo, Tile and Marble Association of Canada (TTMAC), Tile Specification Guide 09 30 13 - Tiling, Tile Installation Manual.

.3 Obtain each type of tile material required from single source. For colour consistency, ensure the supplier has capacity to provide products from the same production run, dye lot, calibre and batch number.

.4 Obtain setting and grouting materials from one manufacturer to ensure compatibility.

.5 Obtain membrane from same manufacturer as setting material or from manufacturer approved by setting material manufacturer to ensure compatibility.

.6 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties and are suitable for intended use.

.2 Submit Master Grade Certificate for each shipment and type of tile signed by the manufacturer and the installer.

.7 Mock-Up:

.1 Construct mock-ups for each form of construction and finish required.

.2 Provide mock-up for of each type of installation required.

.3 Locate where directed by Consultant.

.4 Show workmanship of finished work and construction techniques including installation and incorporation of waterproofing membrane. Where a particularly difficult detail or technique is required, or where special sizes or shapes of product are needed, they shall be included in mock-up.

.5 Accepted mock-ups will form the standard of acceptance for the remainder of the Work.

.6 Approved mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and store packaged materials in original containers with seals unbroken and labels intact.

.2 Store materials to prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

.3 Store cementitious materials and tiles in a dry area, and raised off floor and ground surfaces.

.4 Broken, chipped, warped, stained or damaged tiles will be rejected.

.5 Store liquid materials in unopened containers and protect from freezing.

.6 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.9 SITE CONDITIONS

.1 Ambient Conditions:

.1 Apply tile after completion of Work by other sections.

.2 Surfaces for tile installation must be dry, clean, firm, cured, level and plumb and free from contaminants such as oil, sealers and curing compounds or any other material detrimental to tile adhesion.

.3 Maintain tile materials and substrate temperature between manufacturer's recommended minimum and maximum temperature range.

.4 Maintain temperature range for minimum 48 hours before and during installation and until materials are fully set and cured to manufacturer’s recommendations.

.5 Maintain adequate ventilation where Work generates toxic gases or where there is a risk of raising relative humidity to levels detrimental to building finishes and assemblies.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

.1 Factory blend tile that exhibits colour variations within the ranges selected and package, therefore tile units taken from one package show the same range in colours as those taken from other packages.

.2 Provide tile products manufactured in accordance with CAN/CGSB 75.1 or ANSI A137.1 as appropriate to the Basis-of-Design Materials.

2.2 WALL AND BASE TILE

.1 Porcelain tile: to CAN/CGSB-75.1, and as indicated on Drawings.

2.3 MORTAR AND GROUT MATERIALS

.1 Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following manufacturers:

.1 Ardex Americas.
.2 Custom Building Products Ltd.
.3 Flextile Ltd.
.4 Laticrete International Inc.
.5 MAPEI Inc.

.2 Mortar to be of the following properties unless otherwise specified:

.1 Cement: grey meeting the requirements of CSA A3000.
.2 Hydrated Lime: to ASTM C207, Type N.
.3 Sand: to ASTM C144, passing 16 mesh.
.4 Latex Additive: As approved.
.5 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

.3 Thin Set Mortar: modified, non-sagging, dry-set lightweight cement mortar with polymer and complying with ANSI A118.4, A118.11 and ISO 13007 C2TES1P1.

.1 Acceptable Materials:

.1 ProLite Premium Blend LFT Mortar, Custom Building Products.
.2 66 FlexLite Mortar, Flextile Ltd.
.3 255 Multimax, Laticrete International Inc.
.4 Ultralite Mortar, MAPEI Inc.

.4 Grout: Colouring Pigments:

.1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
.2 Colouring pigments to be added to grout by manufacturer.
.3 Job coloured grout are not acceptable.
.4 Use in Commercial Cement Grout, Dry-Set Grout, and Latex Cement Grout.

.5 Tile Grout:

.1 Epoxy Grout: Multi-component, factory prepared, 100 percent epoxy resin and hardener with sand or mineral filler material; comply with ANSI A118.3 and ISO 13007 Classification R2/RG/ Classification RD for industrial grade.

.1 Colour: Colours to match materials, confirm colour with Consultant prior to ordering.
.2 Acceptable Materials:

.1 CEG-Lite, CEG-IG 100% Solid Commercial Epoxy Grout, Custom Building Products.
.2 FlexEpoxy 100 – 100% Solids 2-Component Epoxy Grout, Flextile Ltd.
.3 Latapoxy SpectraLOCK Pro Premium, Laticrete International Inc.
.4 SpectraLOCK 2000 IG, Laticrete International Inc.

.5 Kerapoxy CQ, Premium Epoxy Mortar and Grout, MAPEI Inc.

2.4 MEMBRANES

.1 Waterproofing Membrane: Liquid rubber with fabric reinforcing.

.1 Acceptable Materials:

.1 Custom 9240 Waterproofing and Crack Prevention Membrane, Custom Building Products.

.2 WP900 or WP980 WP/Crack Isolation Membrane, Flextile Ltd.

.3 9235 Waterproofing Membrane, Laticrete International Inc.

.4 Mapelastic AquaDefense, MAPEI Inc.

2.5 TRIMS AND EDGING

.1 Trim shapes:

.1 Use trim shapes sizes conforming to size of adjoining field wall tile, unless specified otherwise.

.2 Straight edge strips with integral perforated anchoring leg for setting the strip into the setting material:

.1 Height: As required to suit application.

.2 Finish: Brushed stainless steel.

.3 Basis of Design Materials:

.1 Jolly, Schlüter®

2.6 ACCESSORIES

.1 Sealant: in accordance with Section 07 92 00 - Sealants.

.2 Temporary protective coating: Manufacturer's recommended product that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile and mortar/grout products, and is easily removable after grouting is completed without damaging grout or tile.

2.7 CLEANING COMPOUNDS

.1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

.2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 EXAMINATION

.1 Examine surfaces and verify that surfaces are ready to receive tile installation.

.1 Joints and cracks in tile substrates are coordinated with tile joint locations.

.2 Verify tile subject to colour variations has been factory blended and packaged. If not, factory blended, blend tiles at site before installing.

.3 Verify surfaces for compatibility with tile setting material manufacturer's requirements prior to installation.

3.2 PREPARATION

.1 Protect surrounding work from damage or disfiguration arising from work of this Section.

.2 Surfaces: Thoroughly clean substrate surfaces receiving tile finishes to remove grease, oil or dust films, excess water and other contaminants affecting bond of materials within bonding systems and as follows:

.1 Clean back of each tile before installation to remove surface contaminants and cutting residue, firing release dust and other debris detrimental to bond and final surface appearance.

3.3 INSTALLATION

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

.2 Do tile work in accordance with TTMAC Tile Installation Manual and ANSI A137.1 except where specified otherwise.

.3 Apply tile or backing coats to clean and sound surfaces.

.4 Back Buttering: Obtain minimum 95% mortar coverage in accordance with applicable requirements for back buttering of tile in referenced TTMAC and ANSI A108 series of tile installation standards for the following applications:

.1 Tile in wet areas.

.2 Tile having tiles 380 mm or larger in any direction.

.3 Tile installed with chemical resistant mortars and grouts.

.4 Tile having raised or textured backs.

.5 Tile having tile installation rated for Heavy or Extra Heavy Duty.

.5 Apply only as much mortar or adhesive as can be covered within allowable windows as recommended by mortar or adhesive manufacturer or while surface is still tacky.

.6 Fit tile around corners, fitments, fixtures, and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.7 Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions.

.8 Make joints between tile uniform, plumb, straight, true, even and flush with adjacent tile. Confirm joint width with Consultant. Ensure sheet layout not visible after installation. Align patterns.

.9 Make joints watertight, without voids, cracks, excess mortar or grout. Align all joints to give straight uniform grout lines.

.10 Lay out tiles as indicated on drawings. Maintain minimum tile width of one-half unit size unless indicated otherwise on Drawings.

.11 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.12 Form internal angles square, unless otherwise detailed on the Drawings.

.13 Install trims at junction of tile and dissimilar materials.

.14 Allow minimum 24 hours after installation of tiles, before grouting.

.15 Pack joints full and free before mortar takes initial set.

.16 Clean excess grout from surfaces per manufacturer recommendations, as work progresses.

.17 Clean installed tile surfaces after installation and grouting cured.

.18 Install prefabricated control and movement joints in tile Work in accordance with detail 301MJ from TTMAC Installation Manual to suit installation indicated.

.19 Locate expansion, control, contraction, and isolation joints, as indicated in the TTMAC Installation manual to suit installation.

3.4 INSTALLATION – MEMBRANE

.1 Install membrane in accordance with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

.2 Install tiling after liquid applied membranes are cured.

3.5 INSTALLATION – WALL AND BASE TILE

.1 Install tile on concrete and masonry walls to TTMAC details 303W.

3.6 PROTECTIVE COATING

.1 Apply sealer to tiles before grouting in cases of absorbent biscuit tiles and again after completion and cleaning of grouting process.

3.7 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 CLEANING

.1 On completion of placement and grouting, clean tile and grout surfaces with manufacturer's recommended cleaning methods.

.1 Remove grout residue from tile as soon as possible. Preform cleaning while mortar is fresh and before it hardens on surfaces.

.2 Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than ten days after installation.

.3 Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning.

.4 Flush surface with clean water before and after cleaning.

.2 Use manufacturer’s recommended products for cleaning grout film from surfaces.

.3 Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3.9 PROTECTION OF FINISHED WORK

.1 Leave finished installation clean and free of cracked, chipped, broken, unbonded, or other tile deficiencies.

.2 Protect work so that it will be without evidence of damage or use at the time of Substantial Performance.

.3 Protect wall tiles and base tile from impact, vibration, heavy hammering on adjacent and opposite walls for a minimum of 14 days after installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 92 00 – Sealants

.2 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM F1516-13(2018), Standard Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended).

.2 ASTM F1861-21, Standard Specification for Resilient Wall Base.

.2 South Coast Air Quality Management District (SCAQMD), California State:

.1 SCAQMD Rule 1168-22, Adhesives and Sealants Applications.

.3 Underwriters Laboratories of Canada (ULC):

.1 ULC 102.2-2018, Standard Method of Test for Surface Burning Characteristics of Floor Coverings and Miscellaneous Materials and Assemblies.

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

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

.1 Submit one copy of product data for each type of product specified.

.2 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate 300 mm long base.

.3 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention.

1.4 CLOSEOUT SUBMITTALS

.1 Provide manufacturer’s printed recommendations for general maintenance, including cleaning instructions and guidelines for use of waxes and other protective coatings and appearance enhancers in accordance with Section 01 78 00 – Closeout Submittals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide extra materials of resilient base and adhesives in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide 5% of each colour, pattern and type base material required for project for maintenance use.

.3 Extra materials one piece and from same production run as installed materials.

.4 Clearly identify each roll of base material and each container of adhesive.

.5 Deliver to Owner upon completion of the work of this Section.

.6 Store where directed.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Provide products that meet requirements of ULC S102.2 as applicable for required flame spread ratings; labelled and listed by Underwriters Laboratories of Canada (ULC), or another testing and inspecting agency acceptable to authorities having jurisdiction.

.2 Qualifications:

.1 Resilient Flooring Installer: Use an installer who has a minimum of five years documented experience in the installation of resilient flooring in accordance with manufacturer's training or certification program.

.2 Source Limitations: Obtain each type, colour, and pattern of flooring or accessories specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

.3 Mock-Up:

.1 Construct mock-ups as directed by Consultant to verify selections made under sample Submittals and to demonstrate aesthetic effects, patterns, and qualities of materials, and execution before installing flooring materials and accessories in accordance with requirements in Section 01 45 00 – Quality Control.

.2 Install in a representative room or area designated by the Consultant, a sample installation showing pattern as directed by Consultant, seam matching, and corners for the Consultants' review and acceptance.

.3 The mock-up shall represent the minimum acceptable standard for the Work when identified modifications to the mock-up are completed, reviewed, and accepted by the Consultant.

.4 Accepted mock-up room installation can remain as part of the Work.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver materials in good conditions to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

.2 Store materials in a clean, dry, enclosed space off the ground, and protect from the weather and from extremes of heat and cold. Protect adhesive from freezing. Store in the spaces where they will be installed for at least 48 hours before beginning installation.

.3 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.8 SITE CONDITIONS

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

1.9 WARRANTY

.1 Provide Manufacturers Standard Commercial Warranty for product to be free from manufacturers defects for a period of two years from date of Substantial Performance.

Part 2 Products

2.1 MATERIALS – BASE

.1 Base: to ASTM F1861, and as follows:

.1 Type: TS – Thermoset Vulcanized Rubber.

.2 Group: One – solid.

.3 Style: Coved.

.4 Height: 101 mm.

.5 Thickness: 3.17 mm.

.6 Length: 36.5 meter rolls.

.7 End Stops and External Corners: premoulded.

.8 Colour: as selected by Consultant from Manufacturer's full colour range.

2.2 ACCESSORIES

.1 Primers and Adhesives: types recommended by flooring manufacturer for specific material on applicable substrate.

.2 Welding rod: designed to weld seams of base material, as recommended by manufacturer, colour to match base.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Install materials after the other finishing operations, including painting, have been completed.

.3 Verify that surfaces are flat to tolerances acceptable to manufacturer, free of cracks that might telegraph through materials, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring substrate.

3.2 PREPARATION

.1 Remove existing resilient base.

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

.3 Clean substrates of contaminates.

.4 Alkalinity and Adhesion Testing: perform tests recommended by manufacturer. Proceed with installation after substrates pass testing.

3.3 INSTALLATION – GENERAL

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.

.3 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.4 Cut around fixed objects.

3.4 INSTALLATION - BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.8 Heat weld base in accordance with manufacturer's printed instructions.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 CLEANING

.1 Remove excess adhesive from floor, base, and wall surfaces without damage.

.2 Clean, seal, and wax floor and base surfaces in accordance with manufacturer's written instructions.

3.7 PROTECTION

.1 Protect new base from time of final set of adhesive until final inspection.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes resinous flooring systems with epoxy body and coved base.

1.2 RELATED REQUIREMENTS

.1 Section 03 35 00 – Concrete Finishing

.2 Section 07 92 00 – Sealants

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C307-18, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing's.

.2 ASTM C413-18, Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing's and Polymers Concretes.

.3 ASTM C579-18, Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

.4 ASTM C580-18, Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes.

.5 ASTM C811-98(2008), Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacings. (Withdrawn 2012)

.6 ASTM D2240-15(2021) Standard Test Method for Rubber Property – Durometer Hardness.

.7 ASTM D2794-93(2019), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

.8 ASTM E648-19ae1, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

.9 ASTM F1869-22, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.10 ASTM F2170-19a, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Convene pre-installation meeting one week prior to beginning work of this Section, with Contractor, Consultant, installer, manufacturer's representative to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's technical data, application instructions, and general recommendations for each resinous flooring material required.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Verification Sample: submit 150 mm x 150 mm samples of each type of resinous flooring required, applied to a rigid backing, in colour and finish indicated.

.3 Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

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

1.6 Closeout Submittals:

.1 Submit copies of manufacturer’s written maintenance information for inclusion in the operations manual including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work in accordance with Section 01 78 00 – Closeout Submittals.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9001 registered quality system.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

.1 Manufacturers: Obtain primary materials from a single manufacture with not less than ten years of successful experience in manufacturing and installing principal materials described in this Section. Contractor shall have completed at least five projects of similar size and complexity.

.2 Applicators: Use experienced applicators as approved by materials manufacturer who have completed a minimum of ten applications similar in material and extent to those indicated and whose work has a record of successful in service performance.

.3 Single-Source Responsibility: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

.4 Mock-Ups:

.1 Provide required mock-up in accordance with Section 01 45 00 – Quality Control and as follows:

.1 Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

.2 Apply full-thickness mockups to one washroom as selected by Consultant.

.3 Include 1 m length of integral cove base.

.4 Reviewed mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

.5 Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

.6 Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

.7 Materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on-site weighing or volumetric measurements allowed.

.8 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.8 SITE CONDITIONS

.1 Ambient Conditions:

.1 Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

.2 Maintain material and substrate temperature between 18°C and 30°C during resinous flooring application and for not less than 24 hours after application.

.2 Site Conditions:

.1 Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

.2 Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

.3 Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

1.9 WARRANTY

.1 Provide manufacturer’s written warranty covering both material and workmanship for a period of one full year from date of Substantial Completion, or provide a joint and several warranty signed on a single document by material manufacturer

and applicator jointly and severally warranting the materials and workmanship for a period of one full year from date of Substantial Completion.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers: Subject to compliance with requirements in this Section and as recommended by the manufacturer, manufacturers offering products that may be incorporated into the Work include the following:

.1 MAPEI Inc.

.2 Sika Canada Inc.

.3 Stonhard Group.

2.2 MATERIALS

.1 Basis-of-Design Materials: Materials and colours listed below form the Basis-of-Design materials for this project.

.2 Materials other than named products Basis-of-Design materials may be acceptable to the Consultant; submit information in accordance with Section 01 62 00 – Product Options and Substitutions no later than seven days prior to bid closing date and as follows:

.1 Proposed alternates shall match colour range, texture and performance characteristics of named products, and shall not require a change to colour board for Project.

.2 Proposed alternates found acceptable by Consultant will be listed in an Addendum.

.3 The Consultant is not obliged to accept any materials presented for their review and does not need to provide reasons for rejection of proposed alternates.

2.3 COMPONENTS

.1 Resinous Flooring: troweled mortar base with broadcast topping. Liquid rich, slurry type systems will not be accepted.

.1 System Characteristics:

.1 Colour and Pattern: as indicated in Finish Schedule or as selected by Consultant from manufacturer’s standards.

.2 Wearing Surface: medium.

.3 Integral Cove Base: as indicated in Finish Schedule or as directed by Consultant.

.4 Overall System Thickness: nominal 6 mm.

.2 System Components: Manufacturer's standard components that are compatible with each other and as follows:

.1 Primer:

.1 Resin: epoxy.

.2 Formulation Description: two component, 100 percent solids.

.3 Application Method: squeegee and roller.

.4 Number of Coats: one.

.5 Basis of Design Materials:

.1 Standard Primer, Stonhard Group.

.2 Mortar Base:

.1 Resin: epoxy.

.2 Formulation Description: three component, 100 percent solids.

.3 Application Method: metal trowel.

.1 Thickness of Coats: nominal 4 mm.

.2 Number of Coats: one.

.4 Aggregates: pigmented blended aggregate.

.5 Basis-of-Design Materials:

.1 Stonshield HRI Base, Stonhard Group.

.3 Undercoat:

.1 Resin: epoxy.

.2 Formulation Description: two-component, 100% solids, UV stable.

.3 Type: clear.

.4 Finish: gloss.

.5 Number of Coats: one.

.6 Basis-of-Design Materials:

.1 Stonshield undercoat, Stonhard Group.

.4 Broadcast Media:

.1 Type: pigmented.

.2 Number of Coats: one.

.3 Pattern: confirm with Consultant.

.4 Basis-of-Design Materials:

.1 Stonshield quartz aggregate, Stonhard Group.

.5 Sealer:

.1 Resin: epoxy.

.2 Formulation Description: two-component, 100% solids, UV stable.

.3 Type: clear.

.4 Finish: flat.

.5 Number of Coats: one.

.6 Texture level: medium.

.7 Basis-of-Design Materials:

.1 Stonshield Sealer, Stonhard Group.

.3 System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

.1 Compressive Strength: 10,000 psi after 7 days per ASTM C579.

.2 Tensile Strength: 2,000 psi per ASTM C307.

.3 Flexural Strength: 4,300 psi per ASTM C580.

.4 Water Absorption: < 1% per ASTM C413.

.5 Impact Resistance: > 160 in. lbs. per ASTM D2794.

.6 Flammability: Class 1 per ASTM E648.

.7 Hardness: 85 to 90, Shore D per ASTM D2240.

.4 Basis of Design Materials:

.1 Stonshield HRI®, Stonhard Group.

2.4 ACCESSORIES

.1 Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

.2 Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

Part 3 Execution

3.1 PREPARATION

.1 General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

.2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

.1 Mechanically prepare substrates as follows:

.1 Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

.2 Comply with ASTM C811 requirements, unless manufacturer's written instructions are more stringent.

.2 Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

.3 Verify that concrete substrates are dry.

.1 Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 75 percent.

.2 Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. of slab in 24 hours.

.3 Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.4 Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

.3 Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

.4 Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

.5 Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

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

.1 Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

.2 Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

.3 At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

.1 Apply joint sealant to comply with manufacturer's written recommendations.

.2 Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

.3 Integral Cove Base: apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, of cove base. Round internal and external corners.

.4 Apply metal trowel single mortar coat in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

.5 Undercoat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.

.6 Broadcast Media: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

.7 Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 Terminations

.1 Chase edges to “lock” the coating system into the concrete substrate along lines of termination.

.2 Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

.3 Trenches: Continue coating system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

.4 Treat floor drains by chasing the coating to lock in place at point of termination.

3.4 JOINTS AND CRACKS

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

.2 Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

.3 Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports in acceptable format to verify compliance of Work with Contract.

.2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Obtain reports within three days of review and submit.

.4 Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.

.1 Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.

.2 Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.

.3 If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 CURING

.1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 18 hours after application.

3.7 CLEANING

.1 Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

3.8 PROTECTION

.1 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application.

.2 Protect surfaces after final coats.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Provide labor, materials, tools and other equipment, services and supervision required to complete all exterior and interior painting and decorating work as indicated to the full extent of the drawings and specifications.

.2 The Work shall also include, but not necessarily be limited to surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, making good surfaces and areas, pre-treatment, priming and back-priming to the extent / limits defined under MPI preparation requirements.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM F1869-22, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.2 The Master Painters Institute (MPI):

.1 Approved Products List

.2 Architectural Painting Specification Manual.

.3 Maintenance Repainting/Restoration Manual.

.3 The Society for Protective Coatings (SSPC):

.1 SSPC Paint Series, Paint Guidelines.

.2 SSPC SP Series, Surface Preparation Guidelines.

.3 SSPC-PA Series, Paint Application Guidelines.

.4 South Coast Air Quality Management District (SCAQMD):

.1 SCAQMD Rule 1113-16, Architectural Coatings.

.5 Underwriters Laboratories ECOLOGO Certification Program (UL):

.1 UL 2768, Architectural Surface Coatings (formerly CCD 47).

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit list of all painting materials used for the Work to the Consultant and Paint Inspection Agency for review prior to ordering materials for each paint system indicated, including block fillers and primers.

.3 Submit MPI system descriptions for each surface to be painted.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application.

.2 Provide three samples for each colour and material, with texture to simulate actual conditions, on representative samples of the actual substrate.

.3 Information Submittals:

.1 Submit written proof of ability to supply a 100% two year Maintenance Bond, if Paint Association warranty option is not used with Bid Submission.

.2 Submit a list of all painting materials to the Consultant and the Paint Inspection Agency for review prior to ordering materials. If requested, provide an invoice list of all paint materials ordered for project work to Paint Inspection Agency indicating manufacturer, types and quantities for verification and compliance with specification and design requirements.

.3 Submit Workplace Hazardous Materials Information System WHMIS SDS - Safety Data Sheets acceptable to Labour Canada and Health Canada prior to commencement of work for review and for posting at job site as required.

.4 Provide an itemized list complete with manufacturer, paint type and colour coding for all colours used for Owner's later use in maintenance for use in the operations and maintenance manual specified in Section 01 78 00 - Closeout Submittals.

.4 Installation Data: Manufacturer's special installation requirements including special surface preparation procedures and substrate conditions requiring special attention.

1.4 CLOSEOUT SUBMITTALS

.1 Record Documentation: Upon completion, provide itemized list of products used including the following:

.1 Manufacturer's name.

.2 Product name, type and use.

.3 Colour coding number.

.4 Manufacturer's Material Safety Data Sheets (MSDS).

.2 Operation and Maintenance Data: Submit copies of paint manufacturer’s written maintenance information for inclusion in the operations manual in accordance with Section 01 78 00 – Closeout Submittals including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide properly packaged maintenance material as follows:

.1 4 L (1 gal) of each coating type and colour in unopened cans to Owner.

.2 Label each container with colour, type, texture and locations in addition to manufacturer's label.

.3 Store as recommended by the manufacturer and as directed by Owner.

1.6 QUALITY ASSURANCE

.1 Conform to the standards contained in the MPI Architectural Painting Specification Manual or the MPI Maintenance Repainting/Restoration Manual.

.2 Applicator Qualifications: A firm or individual having a minimum of five years documented experience in in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance. Contractor shall maintain a qualified crew of painters throughout the duration of the Work.

.3 All materials, preparation and workmanship shall conform to the requirements of the latest edition of the Master Painters Institute (MPI) Painting Manual as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

.4 Paint Products: Paint manufacturers and paint Products listed under the Approved Product List section of the MPI Painting Manual.

.5 All painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and the local MPI Accredited Quality Assurance Association. The painting contractor shall notify the Paint Inspection Agency a minimum of one (1) week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as required.

.6 All surfaces requiring painting shall be inspected by the Paint Inspection Agency who shall notify the Consultant and General Contractor in writing of any defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate.

.7 The painting contractor shall receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator / supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

.8 Paint manufacturer shall provide certification of all 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 the Owner where "special" coatings or decorating systems (i.e.: textured coatings or non-MPI listed products or systems) are used in painting.

.9 Mock-Up

.1 Prepare and paint a designated interior and exterior surface, area or room to requirements of this section using specified paint or coating to indicate selected colours, gloss, sheen, texture and workmanship to MPI Painting Manual standards for review and acceptance by Consultant and Painting Inspector.

.2 Locate where directed by Consultant.

.3 Approved mock-up will be the acceptable standard of finish quality and workmanship for all similar on-site painting Work.

.4 Approved mock-up may remain as part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver products to site in sealed and original labelled containers showing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.

.2 Store paint materials at minimum ambient temperature of 7 degrees C (45 degrees F) and a maximum of 32 degrees C (90 degrees F), in a secure, dry, heated and well ventilated area and as required by manufacturer's written instructions and authorities having jurisdiction.

.3 Provide adequate fireproof storage lockers, take necessary precautions and post warnings as required by authorities having jurisdiction for storing toxic and volatile/explosive/flammable materials.

.4 Packaging Waste Management

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Waste Management and Disposal.

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 (50 degrees F) for twenty four (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 Provide minimum lighting level of 323 Lux (30 ft candles) on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Specifying body and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C (50 degrees F).

.2 Substrate temperature is above 32 degrees C (90 degrees F) 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 under 85% or when the dew point is more than 3 degrees C (37 degrees F) variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C (37 degrees F) 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 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.3 Test concrete, masonry and plaster surfaces for alkalinity as required.

.4 Do not perform painting and decorating Work when maximum moisture content of substrate exceeds:

.1 Wood: 15%.

.2 Plaster and Gypsum Wallboard: 12 %.

.3 Masonry, Concrete, and Concrete Unit Masonry: 12%.

.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

1.9 COORDINATION

.1 Coordinate the supply of temporary heat and light, scaffolding and platforms, and housekeeping services with Contractor.

.2 Schedule painting work before installation of miscellaneous hardware, surface fittings, fastenings, fixtures and trim by other trade contractors including the hanging of doors and installation of door hardware.

.3 Metal fabricators will be responsible for applying primer to shop applied materials at filed welds, immediately after completion of field welds.

.4 This Section will be responsible for performing minor site touch-up and repair to metal priming system and apply finish coats of paint.

.5 Coordinate correction of defects and deficiencies in substrates which may adversely affect painting work, except for minimal work specified in this Section and preparation of surfaces to receive paint and finishes under this Section of work, with trades responsible for installation of deficient substrates.

.6 Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates.

.7 Coordinate surface preparation and shop priming of structural steel, steel deck, miscellaneous and ornamental metal fabrications, metal doors, frames, and windows including fittings as specified under those respective sections for type of primer including part of the painting system specified in this Section.

.8 Coordinate requirements for painting and identification of mechanical piping and ducting, and electrical conduits with trades responsible for that part of the work. Mechanical Contractor shall provide quantity or length of materials requiring applied finishes, and identify which colour is required on each surface. Painting Contractor shall prepare surfaces and apply coating systems specified in colours required for each surface.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials in accordance with authorities having jurisdiction.

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

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

.4 To reduce contaminants entering waterways, sanitary/storm drain systems or into the ground, adhere to the following procedures:

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

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

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

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

.5 Dry out empty paint cans prior to disposal or recycling.

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

.5 Set aside and protect surplus and uncontaminated finish materials and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.11 GUARANTEE

.1 Furnish either the local MPI Accredited Quality Assurance Association’s two year guarantee or, alternatively, non members must supply a 100% two year Maintenance Bond; both in accordance with MPI Painting Manual requirements. The Maintenance Bond shall warrant that all painting work has been performed in accordance with MPI Painting Manual requirements.

.2 All painting and decorating work shall be in accordance with MPI Painting Manual requirements and shall be inspected by the local MPI Accredited Quality

Assurance Association's Paint Inspection Agency (inspector), whether using either the MPI Accredited Quality Assurance Association's guarantee, or the Maintenance Bond option. The cost for such inspections, and for either the local MPI Accredited Quality Assurance Association's Guarantee, or the Maintenance Bond, shall be included in the Base Bid Price.

.3 Painting and decorating Subcontractors choosing the Maintenance Bond option shall provide a maintenance bond consent from a reputable surety company licensed to do business in Canada. Cash or certified check are not acceptable in lieu of surety consent.

Part 2 Products

2.1 MATERIALS

.1 Use only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers) listed in the latest edition of the MPI Approved Product List (APL) on this project. All such material shall be from a single manufacturer for each system used.

.2 Ancillary materials such as linseed oil, shellac, thinners, solvents to be of highest quality product and provided by an MPI listed manufacturer, and compatible with paint materials being used.

.3 Where required, use only materials having a minimum MPI "Environmentally Friendly" E3 rating based on VOC (EPA Method 24) content levels.

.4 All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment, etc.

.5 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by local Code requirements and/or authorities having jurisdiction.

2.2 EQUIPMENT

.1 Painting and Decorating Equipment: to best trade standards for type of product and application.

.2 Spray Painting Equipment: of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times.

2.3 MIXING AND TINTING

.1 Coatings: Ready-mixed and pre-tinted; re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.2 Paste, Powder or Catalyzed Paint: Mixed in accordance with manufacturer's written instructions.

.3 Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

.1 Do not exceed paint manufacturer's recommendations for addition of thinner. Do not use kerosene or any such organic solvents to thin water-based paints.

.2 Thin paint for spraying in accordance with paint manufacturer's instructions.

2.4 FINISH AND COLOUR

.1 Finish: To MPI Premium Grade finish requirements.

.2 Access doors, registers, exposed piping and electrical panels shall be painted to match adjacent surfaces (i.e. colour, texture and sheen), unless otherwise noted or where pre-finished.

.3 Colours: As noted on the drawings. Any colours not noted are to be provided after award of Contract.

2.5 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as the sheen rating of applied paint with the following values:

Gloss Level	Description	Gloss @ 60 degrees	Sheen @ 85 degrees
G1	Matte Finish (flat)	0 to 5	10 max.
G2	Velvet-Like Finish	0 to 10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Satin-Like Finish	20 to 35	35 min.
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 directed by Consultant.

2.6 EXTERIOR PAINT SYSTEMS

.1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal:

.1 EXT 5.1D – Alkyd (over alkyd primer) - gloss level G5.

.2 Steel - High Heat: heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted:

.1 EXT 5.2A - Heat resistant enamel finish, maximum 205 degrees C.

.2 EXT 5.2B - Heat resistant aluminum enamel finish, maximum 427 degrees C.

.3 EXT 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.

.4 EXT 5.2D - High heat resistant coating, maximum 593 degrees C.

.3 Galvanized Metal: (not chromate passivated; for high contact/high traffic areas (doors, frames, railings, misc. steel, pipes, etc.) and low contact/low traffic areas (overhead decking, ducts, gutters, flashing, etc.).

.1 EXT 5.3N – Alkyd (over w.b. galvanized primer), gloss level G5.

.4 Bituminous Coated Surfaces: (cast iron pipe, concrete, etc.).

.1 EXT 10.2A - Latex (over waterborne rust-inhibitive primer, G4.

2.7 INTERIOR PAINT SYSTEMS

.1 Paint interior surfaces in accordance with the following MPI Painting Manual requirements.

.2 Concrete Masonry Units (Concrete Block and Concrete Brick)

.1 INT 4.2C – Alkyd (over latex block filler), G3

.3 Structural Steel and Metal Fabrications: (columns, beams, joists, etc.).

.1 INT 5.1E – Alkyd; gloss level G5.

.4 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):

.1 INT 5.2A - Heat resistant enamel finish, maximum 205 degrees C.

.2 INT 5.2B - Heat resistant aluminum paint finish, maximum 427 degrees C.

.3 INT 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.

.4 INT 5.2D - High heat resistant coating, maximum 593 degrees C.

.5 Galvanized Metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.).

.1 INT 5.3L - Alkyd gloss level G5.

.6 Dressed Lumber (Including Doors, Door and Window Frames, Moldings, Etc.)

.1 INT 6.3K - Polyurethane varnish G5 finish.

.7 Plaster and Gypsum Board: (gypsum wallboard and textured finishes).

.1 INT 9.2C – Alkyd (over latex primer/sealer) gloss level G4 finish for walls and G1 for ceilings and bulkheads.

.8 Canvas and Cotton Coverings:

.1 INT 10.1B – Alkyd (over latex primer/sealer) , gloss level G3.

.9 Bituminous Coated Surfaces: (cast iron pipe, concrete, etc.)

.1 INT 10.2A – Latex (over w.b rust-inhibitive primer), gloss level G3.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces are ready to receive work as instructed by the product manufacturer.

.2 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

.3 Test shop applied primer for compatibility with subsequent cover materials.

.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.

3.2 PREPARATION

.1 Prepare surfaces in accordance with MPI requirements. Refer to the Manual for specific surface preparation requirements for each substrate material.

.2 No painting work shall commence until all such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor and Inspection Agency.

.3 Sand, clean, dry, etch, neutralize and/or test surfaces under adequate illumination, ventilation and temperature requirements.

.4 Remove and store or mask miscellaneous hardware and surface fittings such as electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to painting. Clean and replace upon completion of painting Work in each area. Remove doors before painting to paint bottom and top edges and re-hung.

.5 Protect adjacent surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, from painting operations with drop cloths, shields, masking, templates, or other suitable protective means.

.6 Correct defects and clean surfaces which affect work of this section. Start of finish painting of defective surfaces indicates acceptance of substrate and making good defects will be at no cost to Owner.

.7 Confirm preparation and primer used with fabricator of steel items.

3.3 APPLICATION

.1 Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other subtrade work) are acceptable for applications of products.

.2 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements with application methods in accordance with best trade practices for type and application of materials used.

.3 Apply products to adequately prepared surfaces, within moisture limits and acceptable environmental conditions.

.4 Apply paint finish in areas where dust is no longer being generated or when wind or ventilation conditions will not affect quality of finished surface.

.5 Apply each coat to uniform finish.

.6 Tint each coat of paint progressively lighter to enable confirmation of number of coats.

.7 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.

.8 Unless otherwise approved, apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

.9 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 900 mm.

.10 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

.11 Allow applied coat to dry before next coat is applied.

.12 Continue paint finish behind wall-mounted items.

.13 Clean and re-install all hardware items that were removed before painting operations were undertaken, ensuring that tagged or labelled items are returned to the exact position from which they were removed.

.14 Clean, prime and re-paint all bolts, nuts and fasteners after torqueing or re-tightening following specified paint finish.

.15 Remove protective coverings and warning signs as soon as possible after operations cease.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Refer to appropriate Mechanical and Electrical Divisions for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

.2 Unless otherwise specified, paint all unfinished conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces in the following areas:

.1 Exposed-to-view exterior and interior areas.

.2 in all interior high humidity interior areas.

.3 Mechanical and electrical rooms.

.3 In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish; 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 or fire rating plates.

.6 Paint or band all natural gas piping in accordance with mechanical specification requirements.

.7 Paint the inside of all ductwork where visible behind louvers, grilles and diffusers for a minimum of 460 mm or beyond sight line, whichever is greater, with primer and one coat of matt black (non-reflecting) paint.

.8 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

3.5 RESTORATION

.1 Clean and re-install all hardware items that were removed before painting operations were undertaken, ensuring that tagged or labelled items are returned to the exact position from which they were removed.

.2 Clean, prime and re-paint all bolts, nuts and fasteners after torqueing or re-tightening following specified paint finish.

.3 Remove protective coverings and warning signs as soon as possible after operations cease.

.4 Protect freshly painted surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.6 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 Consultant.

.2 Advise Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Cooperate with inspection firm and provide access to areas of work.

.4 Notify the Paint Inspection Agency on award of contract and make application for assignment of an Inspector using appropriate forms supplied by the Agency as well as provide a copy of the project painting specification, drawings, colour schedule and list of proposed materials for review purposes prior to commencement of work.

.5 Inspection

.1 Interior and exterior painting work shall be in accordance with MPI Painting Manual requirements and shall be inspected by the Painting Association whether using the Painting Association Guarantee or the Maintenance Bond option noted above.

.2 Cost for inspections and associated guaranties shall be included in the scope of work for this Section.

.6 Fully cooperate at all times with the requirements of the Paint Inspection Agency in the performance of their duties, including providing access and assistance as required to complete inspection work.

.1 All surfaces, preparation and paint applications shall be inspected.

.2 Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection Agency inspector:

.1 Brush or 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 or contamination of paint due to blown contaminants (dust, spray paint, etc.).

.3 Painted 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° to the surface from a distance of 1000 mm.

.2 Visible defects are evident on horizontal surfaces when viewed at 45° to the surface from a distance of 1000 mm.

.3 Visible defects are evident on ceiling surfaces when viewed at 45° to the surface.

.4 When the final coat on any surface exhibits a lack of uniformity of sheen across full surface area.

.4 Painted surfaces rejected by the inspector shall be made good at the expense of the Contractor, as follows:

.1 Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted.

.2 Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.7 CLEANING

.1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers / strippers in accordance with the safety requirements of authorities having jurisdiction.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.8 PROTECTION

.1 Protect all exterior surfaces and areas, including landscaping, walks, drives, all adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting 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.

.2 Protect all interior surfaces and areas, including glass, aluminum surfaces, etc. and equipment and any labels and signage from painting 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 Protect freshly painted surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.4 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Provide labor, materials, tools and other equipment, services and supervision required to complete all exterior and interior repainting and decorating work as indicated to the full extent of the drawings and specifications.

.2 Work listed in this Section includes, but is not limited to, the following:

.1 Moisture testing of substrates.

.2 Surface preparation of substrates as required for acceptance of paint, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to the limits defined under MPI Repainting Manual Preparation requirements.

.3 Specific pre-treatments noted in this specification or as required by the MPI Repainting Manual.

.4 Sealing and priming surfaces for repainting in accordance with MPI Repainting Manual requirements.

.5 Provision of safe and adequate ventilation as required where toxic, volatile or flammable materials are being used.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):

.1 ASTM D16-19, Standard Terminology for Paint, Related Coatings, Materials, and Applications.

.2 ASTM E84-23, Standard Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM F1869-22, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

.2 The Master Painters Institute (MPI):

.1 Approved Products List

.2 Architectural Painting Specification Manual.

.3 Maintenance Repainting/Restoration Manual.

.3 The Society for Protective Coatings (SSPC):

.1 SSPC Paint Series, Paint Guidelines.

.2 SSPC SP Series, Surface Preparation Guidelines.

.3 SSPC-PA Series, Paint Application Guidelines.

.4 South Coast Air Quality Management District (SCAQMD):

.1 SCAQMD Rule 1113-16, Architectural Coatings.

.5 Underwriters Laboratories ECOLOGO Certification Program (UL):

.1 UL 2768, Architectural Surface Coatings (formerly CCD 47).

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate preparation of substrates with other sections of work for the correction of defects and Degree of Surface Deterioration Level DSD-4 deficiencies listed below that may adversely affect repainting work.

1.4 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit list of all repainting materials used for the Work to the Consultant and Paint Inspection Agency for review prior to ordering materials for each paint system indicated, including block fillers and primers.

.3 Submit MPI system descriptions for each surface to be repainted.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Provide stepped samples, defining each separate coat, including block fillers and primers using representative colours required for the project; label each sample for location and application.

.2 Provide three samples for each colour and material, with texture to simulate actual conditions, on representative samples of the actual substrate.

.3 Information Submittals:

.1 Submit written proof of ability to supply a 100% two year Maintenance Bond, if Paint Association warranty option is not used with Bid Submission.

.2 Submit a list of all repainting materials to the Consultant and the Paint Inspection Agency for review prior to ordering materials. If requested, provide an invoice list of all paint materials ordered for project work to Paint Inspection Agency indicating manufacturer, types and quantities for verification and compliance with specification and design requirements.

.3 Submit Workplace Hazardous Materials Information System WHMIS SDS - Safety Data Sheets acceptable to Labour Canada and Health Canada prior to commencement of work for review and for posting at job site as required.

.4 Provide an itemized list complete with manufacturer, paint type and colour coding for all colours used for Owner's later use in maintenance for use in the operations and maintenance manual specified in Section 01 78 00 - Closeout Submittals.

.4 Installation Data: Manufacturer's special installation requirements including special surface preparation procedures and substrate conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

.1 Record Documentation: Upon completion, provide itemized list of products used including the following:

.1 Manufacturer's name.

.2 Product name, type and use.

.3 Colour coding number.

.4 Manufacturer's Material Safety Data Sheets (MSDS).

.2 Operation and Maintenance Data: Submit copies of paint manufacturer's written maintenance information for inclusion in the operations manual in accordance with Section 01 78 00 – Closeout Submittals including specific warning of any maintenance practice or materials that may damage or disfigure the finished Work.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Provide properly packaged maintenance material as follows:

.1 4 L (1 gal) of each coating type and colour in unopened cans to Owner.

.2 Label each container with colour, type, texture and locations in addition to manufacturer's label.

.3 Store as recommended by the manufacturer and as directed by Owner.

1.7 QUALITY ASSURANCE

.1 Conform to the standards contained in the MPI Architectural Painting Specification Manual or the MPI Maintenance Repainting/Restoration Manual.

.2 Applicator Qualifications: A firm or individual having a minimum of five years documented experience in in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance. Contractor shall maintain a qualified crew of painters throughout the duration of the Work.

.3 All materials, preparation and workmanship shall conform to the requirements of the latest edition of the Master Painters Institute (MPI) Maintenance and Repainting Manual as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

.4 Paint Products: Paint manufacturers and paint Products listed under the Approved Product List section of the MPI Maintenance and Repainting Manual.

.5 All repainting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and the local MPI Accredited Quality Assurance Association. The painting contractor shall notify the Paint Inspection Agency a minimum of one (1) week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as required.

.6 All surfaces requiring repainting shall be inspected by the Paint Inspection Agency who shall notify the Consultant and General Contractor in writing of any defects or problems, prior to commencing repainting work, or after the prime coat shows defects in the substrate.

.7 The painting contractor shall receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator / supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before repainting any such work.

.8 Paint manufacturer shall provide certification of all 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 the Owner where "special" coatings or decorating systems (i.e.: textured coatings or non-MPI listed products or systems) are used in painting.

.9 Mock-Up

.1 Prepare and repaint a designated interior and exterior surface, area or room to requirements of this section using specified paint or coating to indicate selected colours, gloss, sheen, texture and workmanship to MPI Maintenance and Repainting Manual standards for review and acceptance by Consultant and Painting Inspector.

.2 Locate where directed by Consultant.

.3 Approved mock-up will be the acceptable standard of finish quality and workmanship for all similar on-site repainting Work.

.4 Approved mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver products to site in sealed and original labelled containers showing manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.

.2 Store paint materials at minimum ambient temperature of 7 degrees C (45 degrees F) and a maximum of 32 degrees C (90 degrees F), in a secure, dry, heated and well ventilated area and as required by manufacturer's written instructions and authorities having jurisdiction.

.3 Provide adequate fireproof storage lockers, take necessary precautions and post warnings as required by authorities having jurisdiction for storing toxic and volatile/explosive/flammable materials.

.4 Packaging Waste Management

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Waste Management and Disposal.

1.9 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 (50 degrees F) for twenty four (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 Provide minimum lighting level of 323 Lux (30 ft candles) on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Specifying body and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C (50 degrees F).

.2 Substrate temperature is above 32 degrees C (90 degrees F) 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 under 85% or when the dew point is more than 3 degrees C (37 degrees F) variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C (37 degrees F) 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 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.3 Test concrete, masonry and plaster surfaces for alkalinity as required.

.4 Do not perform painting and decorating Work when maximum moisture content of substrate exceeds:

.1 Wood: 15%.

.2 Plaster and Gypsum Wallboard: 12 %.

.3 Masonry, Concrete, and Concrete Unit Masonry: 12%.

.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

1.10 COORDINATION

.1 Coordinate the supply of temporary heat and light, scaffolding and platforms, and housekeeping services with Contractor.

.2 Schedule repainting work before installation of miscellaneous hardware, surface fittings, fastenings, fixtures and trim by other trade contractors including the hanging of doors and installation of door hardware.

.3 Coordinate correction of defects and deficiencies in substrates which may adversely affect repainting work, except for minimal work specified in this Section

and preparation of surfaces to receive paint and finishes under this Section of work, with trades responsible for installation of deficient substrates.

.4 Coordinate requirements for repainting and identification of mechanical piping and ducting, and electrical conduits with trades responsible for that part of the work. Mechanical Contractor shall provide quantity or length of materials requiring applied finishes, and identify which colour is required on each surface. Painting Contractor shall prepare surfaces and apply coating systems specified in colours required for each surface.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials in accordance with authorities having jurisdiction.

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

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

.4 To reduce contaminants entering waterways, sanitary/storm drain systems or into the ground, adhere to the following procedures:

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

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

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

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

.5 Dry out empty paint cans prior to disposal or recycling.

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

.5 Set aside and protect surplus and uncontaminated finish materials and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.12 GUARANTEE

.1 Furnish either the local MPI Accredited Quality Assurance Association’s two year guarantee or, alternatively, non members must supply a 100% two year Maintenance Bond; both in accordance with MPI Painting Manual requirements. The Maintenance Bond shall warrant that all painting work has been performed in accordance with MPI Painting Manual requirements.

.2 All painting and decorating work shall be in accordance with MPI Painting Manual requirements and shall be inspected by the local MPI Accredited Quality Assurance Association’s Paint Inspection Agency (inspector), whether using either the MPI Accredited Quality Assurance Association’s guarantee, or the

Maintenance Bond option. The cost for such inspections, and for either the local MPI Accredited Quality Assurance Association's Guarantee, or the Maintenance Bond, shall be included in the Base Bid Price.

.3 Painting and decorating Subcontractors choosing the Maintenance Bond option shall provide a maintenance bond consent from a reputable surety company licensed to do business in Canada. Cash or certified check are not acceptable in lieu of surety consent.

Part 2 Products

2.1 MATERIALS

.1 Use only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers) listed in the latest edition of the MPI Approved Product List (APL) on this project. All such material shall be from a single manufacturer for each system used.

.2 Ancillary materials such as linseed oil, shellac, thinners, solvents to be of highest quality product and provided by an MPI listed manufacturer, and compatible with paint materials being used.

.3 Where required, use only materials having a minimum MPI "Environmentally Friendly" E3 rating based on VOC (EPA Method 24) content levels.

.4 All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment, etc.

.5 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by local Code requirements and/or authorities having jurisdiction.

2.2 EQUIPMENT

.1 Painting and Decorating Equipment: to best trade standards for type of product and application.

.2 Spray Painting Equipment: of ample capacity, suited to the type and consistency of paint or coating being applied and kept clean and in good working order at all times.

2.3 MIXING AND TINTING

.1 Coatings: Ready-mixed and pre-tinted; re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.2 Paste, Powder or Catalyzed Paint: Mixed in accordance with manufacturer's written instructions.

.3 Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

.1 Do not exceed paint manufacturer's recommendations for addition of thinner. Do not use kerosene or any such organic solvents to thin water-based paints.

.2 Thin paint for spraying in accordance with paint manufacturer's instructions.

2.4 FINISH AND COLOUR

.1 Finish: To MPI Premium Grade finish requirements.

.2 Access doors, registers, exposed piping and electrical panels shall be painted to match adjacent surfaces (i.e. colour, texture and sheen), unless otherwise noted or where pre-finished.

.3 Colours: As noted on the drawings. Any colours not noted are to be provided after award of Contract.

2.5 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as the sheen rating of applied paint with the following values:

Gloss Level	Description	Gloss @ 60 degrees	Sheen @ 85 degrees
G1	Matte Finish (flat)	0 to 5	10 max.
G2	Velvet-Like Finish	0 to 10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Satin-Like Finish	20 to 35	35 min.
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 directed by Consultant.

2.6 EXTERIOR PAINT SYSTEMS

.1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal:

.1 REX 5.1D – Alkyd (over alkyd primer) - gloss level G5.

.2 Steel - High Heat: heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted:

.1 REX 5.2A - Heat resistant enamel finish, maximum 205 degrees C.

.2 REX 5.2B - Heat resistant aluminum enamel finish, maximum 427 degrees C.

.3 REX 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.

.4 REX 5.2D - High heat resistant coating, maximum 593 degrees C.

.3 Galvanized Metal: (not chromate passivated; for high contact/high traffic areas (doors, frames, railings, misc. steel, pipes, etc.) and low contact/low traffic areas (overhead decking, ducts, gutters, flashing, etc.).

.1 REX 5.3N – Alkyd (over w.b. galvanized primer), gloss level G5.

.4 Bituminous Coated Surfaces: (cast iron pipe, concrete, etc.).

.1 REX 10.2A - Latex (over waterborne rust-inhibitive primer, G4.

2.7 INTERIOR PAINT SYSTEMS

.1 Paint interior surfaces in accordance with MPI Maintenance Repainting/Restoration Manual premium requirements and the systems listed in this Article.

.2 Concrete Masonry Units (Concrete Block and Concrete Brick)

.1 RIN 4.2C – Alkyd (over latex block filler), G3

.3 Structural Steel and Metal Fabrications: (columns, beams, joists, etc.).

.1 RIN 5.1E – Alkyd; gloss level G5.

.4 Steel - high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues, stacks, etc., with temperature range as noted):

.1 RIN 5.2A - Heat resistant enamel finish, maximum 205 degrees C.

.2 RIN 5.2B - Heat resistant aluminum paint finish, maximum 427 degrees C.

.3 RIN 5.2C - Inorganic zinc rich coating, maximum 400 degrees C.

.4 RIN 5.2D - High heat resistant coating, maximum 593 degrees C.

.5 Galvanized Metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.).

.1 RIN 5.3L - Alkyd gloss level G5.

.6 Plaster and Gypsum Board: (gypsum wallboard and textured finishes).

.1 RIN 9.2C – Alkyd (over latex primer/sealer) gloss level G4 finish for walls and G1 for ceilings and bulkheads.

.7 Canvas and Cotton Coverings:

.1 RIN 10.1B – Alkyd (over latex primer/sealer) , gloss level G3.

.8 Bituminous Coated Surfaces: (cast iron pipe, concrete, etc.)

.1 RIN 10.2A – Latex (over w.b rust-inhibitive primer), gloss level G3.

Part 3 Execution

3.1 EXAMINATION

.1 Prior to commencement of repainting work, thoroughly examine and test conditions and surfaces scheduled for repainting and report in writing to the Consultant any conditions or surfaces that will adversely affect work of this Section.

.2 The degree of surface deterioration (DSD) shall be assessed using the assessment criteria indicated in the MPI Maintenance Repainting Manual 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).

.3 Other than the repair of DSD-1 to DSD-3 defects included under this scope of work, structural and DSD-4 substrate defects discovered prior to and after surface preparation or after first coat of paint shall be made good and sanded by others ready for painting, unless otherwise agreed to by the Owner and painter to be included in this Work.

.4 No repainting work shall commence until all such DSD-4 adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor. The Painting Subcontractor shall not be responsible for the condition of the substrate or for correcting defects and deficiencies in the substrate, which may adversely affect the painting work except for minimal work normally performed by the Painting Subcontractor and as, indicated herein. It shall always, however, be the responsibility of the Painting Subcontractor to see that surfaces are properly prepared before any paint or coating is applied. It shall also be the Painting Subcontractor's responsibility to paint the surface as specified providing that the owner accepts responsibility for uncorrected DSD-4 substrate conditions.

.5 No repainting work shall commence until all such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor and Inspection Agency.

3.2 PREPARATION

.1 Prepare surfaces for repainting in accordance with MPI Maintenance Repainting/Restoration Manual requirements, refer to the MPI Maintenance Repainting/Restoration Manual for specific requirements for each substrate material.

.2 Sand, clean, dry, etch, neutralize and/or test surfaces under adequate illumination, ventilation and temperature requirements.

.3 Remove and store or mask miscellaneous hardware and surface fittings such as electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to painting. Clean and replace upon completion of painting Work in each area. Remove doors before painting to paint bottom and top edges and re-hung.

.4 Protect adjacent surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, from painting operations with drop cloths, shields, masking, templates, or other suitable protective means.

.5 Correct defects and clean surfaces which affect work of this section. Start of finish repainting of defective surfaces indicates acceptance of substrate and making good defects will be at no cost to Owner.

.6 Confirm preparation and primer used with fabricator of steel items.

3.3 APPLICATION

.1 Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other subtrade work) are acceptable for applications of products.

.2 Apply primer, paint or stain in accordance with MPI Repainting Manual Premium Grade finish requirements with application methods in accordance with best trade practices for type and application of materials used.

.3 Apply products to adequately prepared surfaces, within moisture limits and acceptable environmental conditions.

.4 Apply paint finish in areas where dust is no longer being generated or when wind or ventilation conditions will not affect quality of finished surface.

.5 Apply each coat to uniform finish.

.6 Tint each coat of paint progressively lighter to enable confirmation of number of coats.

.7 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer’s recommendations.

.8 Unless otherwise approved, apply a minimum of four coats of paint where deep or bright colours are used to achieve satisfactory results.

.9 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 900 mm.

.10 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

.11 Allow applied coat to dry before next coat is applied.

.12 Continue paint finish behind wall-mounted items.

.13 Clean and re-install all hardware items that were removed before painting operations were undertaken, ensuring that tagged or labelled items are returned to the exact position from which they were removed.

.14 Clean, prime and re-paint all bolts, nuts and fasteners after torqueing or re-tightening following specified paint finish.

.15 Remove protective coverings and warning signs as soon as possible after operations cease.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Refer to appropriate Mechanical and Electrical Divisions for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

.2 Repainting of mechanical and electrical work shall include exposed to view, previously painted mechanical and electrical equipment and components including, but not limited to, panels, conduits, piping, hangers, ductwork, and similar items.

.3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.4 Do not paint over nameplates or fire rating plates.

.5 Paint or band all natural gas piping in accordance with mechanical specification requirements.

.6 Paint the inside of all ductwork where visible behind louvers, grilles and diffusers for a minimum of 460 mm or beyond sight line, whichever is greater, with primer and one coat of matt black (non-reflecting) paint.

.7 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

3.5 RESTORATION

.1 Clean and re-install all hardware items that were removed before painting operations were undertaken, ensuring that tagged or labelled items are returned to the exact position from which they were removed.

.2 Clean, prime and re-paint all bolts, nuts and fasteners after torqueing or re-tightening following specified paint finish.

.3 Remove protective coverings and warning signs as soon as possible after operations cease.

.4 Protect freshly painted surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.6 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 Consultant.

.2 Advise Consultant when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Cooperate with inspection firm and provide access to areas of work.

.4 Notify the Paint Inspection Agency on award of contract and make application for assignment of an Inspector using appropriate forms supplied by the Agency as well as provide a copy of the project painting specification, drawings, colour schedule and list of proposed materials for review purposes prior to commencement of work.

.5 Inspection

.1 Interior and exterior painting work shall be in accordance with MPI Painting Manual requirements and shall be inspected by the Painting Association whether using the Painting Association Guarantee or the Maintenance Bond option noted above.

.2 Cost for inspections and associated guaranties shall be included in the scope of work for this Section.

.6 Fully cooperate at all times with the requirements of the Paint Inspection Agency in the performance of their duties, including providing access and assistance as required to complete inspection work.

.1 All surfaces, preparation and paint applications shall be inspected.

.2 Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection Agency inspector:

.1 Brush or 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 or contamination of paint due to blown contaminants (dust, spray paint, etc.).

.3 Painted 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° to the surface from a distance of 1000 mm.

.2 Visible defects are evident on horizontal surfaces when viewed at 45° to the surface from a distance of 1000 mm.

.3 Visible defects are evident on ceiling surfaces when viewed at 45° to the surface.

.4 When the final coat on any surface exhibits a lack of uniformity of sheen across full surface area.

.4 Painted surfaces rejected by the inspector shall be made good at the expense of the Contractor, as follows:

.1 Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted.

.2 Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.7 CLEANING

.1 Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers / strippers in accordance with the safety requirements of authorities having jurisdiction.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.8 PROTECTION

.1 Protect all exterior surfaces and areas, including landscaping, walks, drives, all adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any labels and signage from painting 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.

.2 Protect all interior surfaces and areas, including glass, aluminum surfaces, etc. and equipment and any labels and signage from painting 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 Protect freshly painted surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.

.4 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 04 22 00 – Unit Masonry.

1.2 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's printed product literature, specifications and datasheet for each product specified.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.1 Indicate, by large scale details, materials, finishes, dimensions, anchorage and assembly.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit duplicate 300 mm long samples of profiles and colours.

1.3 CLOSEOUT SUBMITTALS

.1 Provide manufacturer’s printed recommendations for general maintenance and cleaning of each impact resistant wall protection unit for incorporation into operations and maintenance manual specified in Section 01 78 00 – Closeout Submittals.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in unopened original factory packing clearly labeled to show manufacturer.

.2 Store materials in undamaged packaging in a clean, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 4ºC and a maximum of 38ºC should be maintained.

.3 Materials must be stored flat.

.4 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.6 PROJECT CONDITIONS

.1 Materials must be acclimated in an environment of 18-24ºC for at least 24 hours prior to beginning the installation.

.2 Installation areas must be enclosed and weatherproofed before installation commences.

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 Altro USA, Inc.
- .2 Construction Specialties, Inc.
- .3 IPC Door and Wall Protection Systems.
- .4 Korogard Wall Protection Systems.
- .5 Panolam Surface Systems
- .6 Pawling Corporation.

2.2 WALL PROTECTION

.1 Impact Resistant Wall Covering: Fibre reinforced plastic (FRP) panel resistant to rot, corrosion, and staining and will not support growth of mold or mildew.

- .1 Thickness: 2.4 mm.
- .2 Colour: as selected by Consultant.
- .3 Acceptable Materials:
  - .1 Panolam, FRP.
  - .2 Wall Panels, Marlite FRP.
  - .3 Thermo Design, Sequentia.

2.3 ACCESSORIES

.1 Provide manufacturers joint strips, start and edge trim, and cut-tile transition strips.

.2 Adhesive: water resistant type as recommended by manufacturer for substrate.

.3 Fasteners: Aluminum, nonmagnetic stainless steel, or other non-corrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security type fasteners where exposed to view.

.4 Sealant: in accordance with Section 07 92 00 - Sealants, colour as directed.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Examine areas and conditions under which work is to be preformed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 All surfaces must be free from dust and cleaned prior to installation. The working environment must also be dust free. Failure to comply with these conditions will

reduce the bond strength between the adhesive and substrate, and may cause the panels to debond.

.2 Apply sealer e.g. PVA primer or similar, to absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) minimum of twelve hours prior to the installation.

.3 Prior to installation, complete painting which comes in contact with panels, as sealant used at junctions is non-paintable.

.4 Store panels flat and be pre-conditioned a minimum of 24 hours in ambient temperatures similar to the prevailing operational conditions.

.5 Store panels on a level flat surface off the ground (risk of condensation on the panels if stored on damp surfaces). Storage on uneven surfaces could cause the panels to distort prior to installation.

.6 Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.3 INSTALLATION

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

.2 Install units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

.3 Install units in locations and at mounting heights indicated on Drawings.

.4 Provide splices, mounting hardware, anchors, and other accessories required for a complete installation, and as follows:

.1 Provide anchoring devices to withstand imposed loads.

.5 Provide top and edge mouldings, corners, and divider bars as required for a complete installation of impact resistant wall coverings.

3.4 CLEANING

.1 Immediately upon completion of installation, clean material in accordance with manufacturer's recommended cleaning method.

.2 Remove excess adhesive using methods and materials recommended in writing by manufacturer.

.3 Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.5 PROTECTION

.1 Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A653/A653M-22, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

.3 ASTM C1503-18, Standard Specification for Silvered Flat Glass Mirror.

.2 Canadian Standards Association (CSA):

.1 CSA-G164-18 Hot Dip Galvanizing of Irregularly Shaped Articles, Includes Update No.1 (2020).

.3 International Code Council (ICC):

.1 ICC A117.1-2017, Accessible and Usable Buildings and Facilities.

1.2 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit manufacturer's printed product literature, specifications and datasheet.

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, backing, building-in details of anchors for grab bars.

1.3 CLOSEOUT SUBMITTALS

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

.2 Include list of sources for disposable supplies, replacement parts and service recommendations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 – Closeout Submittals.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

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 American Specialties Inc. (ASI)

.2 Bobrick Washroom Equipment Company.

.3 Bradley Corporation.

.4 Frost Products Ltd.

2.2 MATERIALS

.1 Sheet Steel: to ASTM A653/A653M cold rolled, commercial quality.

.2 Stainless Steel Sheet: to ASTM A666, Type 304, finish as indicated in component list.

.3 Stainless Steel Tubing: Type 304, commercial grade, seamless welded.

.4 Silvered mirror glass: to ASTM C1503, 6 mm thick with safety backing.

.1 Type: 3 A-Tempered.

.2 Tint: Clear.

.3 Edges: Polished.

.5 Fasteners, Screws, and Bolts: concealed, hot dip galvanized after fabrication, tamper-proof and theft resistant exposed fasteners to match material of unit.

.6 Expansion Shields: Fibre, lead, or rubber as recommended by accessory manufacturer for component and substrate.

.7 Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six keys to Owner's representative.

2.3 COMPONENTS

.1 Diaper changing station(BC): surface mounted wall unit, stainless steel with matte black finish, plastic insert, moulded-in steel-on-steel hinge assembly, moulded-in integral support mechanism, 1053 mm wide x 669 mm high, concealed gas shock, tamper resistant hardware, steel backer plate, liner dispenser, safety belt, safety instructions in graphic illustration, labeled with universally accepted symbol.

.1 Basis-of-Design Materials:

.1 KB310-SSWM-MBLK, Koala Kare

.2 Grab bars (GB1): L-Shaped, 90 degree, 760 mm x 760 mm x 32 mm dia x 1.2 mm thick of stainless steel with satin finish, concealed mounting flanges, screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

.1 Basis of Design Materials:

.1 B-5898, Bobrick.

.3 Grab bars (GB2, GB3): straight; 38 mm dia x 1.2 mm thick of stainless steel with satin finish, concealed mounting flanges, screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

.1 Refer to Drawings for location of each length.

.2 Basis of Design Materials:

.1 B-6806.99x24, Bobrick.

.2 B-6806.99x42, Bobrick.

.4 Grab bars (GB4): swing up type, 32 mm dia x 1.2 mm wall thickness of stainless steel with satin finish, mounting plate, welded construction, slip resistant grip, and drop down prevention device, locking in vertical position and meeting requirements of ICC A117.1.

.1 Basis of Design Materials:

.1 B-4998 Series, Bobrick.

.5 Hand Dryer (HD1): surface mounted high speed hand dryer; 1.2 mm thick type 304 stainless steel cover with matte black finish; electric sensor automatically turns dryer on when hands are held under air-outlet opening and across path of sensor; automatic shut off of 85 seconds after dryer turns on if an inanimate object is placed across air-outlet opening.

.1 Basis of Design Materials:

.1 B-7179.MBLK, Bobrick.

.6 Paper towel dispenser (PT): for multi-fold and “C”-fold paper towels, 22 gauge stainless steel cabinet, front panel, refill indicator slot, keyed tumbler lock, surface mount.

.1 Basis of Design Materials:

.1 Model 250-15, Bradley Corporation.

.7 Waste receptacle (WR): 22 gauge steel stainless steel in satin finish, wall mounted, 457 mm H x 356 mm L x 152 mm D, capacity of 25 litres.

.1 Basis of Design Materials:

.1 Model 357, Bradley Corporation.

.8 Feminine napkin/tampon dispenser (SNV): stainless steel, surface mounted unit, min capacity 20 napkins and 30 tampons, operation as directed by Consultant, key locked, continuous hinge front panel.

.1 Basis of Design Materials:

.1 B-2706 Series, Bobrick.

.9 Feminine napkin disposal bin (SND): stainless steel, surface mounting unit, continuous stainless steel piano hinge, self closing push flap with removable stainless steel receptacle with tumbler lock.

.1 Basis of Design Materials:

.1 Model 4722-15, Bradley Corporation.

.10 Soap dispenser (SD): stainless steel; 800 ml capacity tank; keyed lock, vertical surface mounted with soap level indicator.

.1 Basis of Design Materials:

.1 Model 6A03, Bradley Corporation.

.11 Toilet tissue dispenser (jumbo roll type) (TP): holds two jumbo rolls, surface mounted, stainless steel construction, equipped with tumbler lock, accommodates two rolls of 228 mm diameter with satin finish.

.1 Basis-of-Design Materials:

.1 B-2892, Bobrick.

.12 Utility Shelf (SSH): surface mounted, 125 mm deep, 455 mm wide, 1.2 mm thick type 304 stainless steel with satin finish; mounted brackets welded to shelf.

.1 Basis-of-Design Materials:

.1 B-295, Bobrick.

.13 Vandal-Resistant Clothes Hook (CH): 2 mm thick type 304 stainless steel with satin finish; auto-release hook tested to hold minimum of 9 kg (20 lbs) and release at 18 kg (40 lbs) or greater; faceplate to have sloped edges.

.1 Basis-of-Design Materials:

.1 B-983, Bobrick.

.14 Mop Strip (MH): Stainless steel mop and broom holder with non-slip handle restraints, designed to hold three handles 20 mm to 30 mm diameter:

.1 Basis-of-Design Materials:

.1 B-223x24, Bobrick.

.15 Mirror (MR): Silvered mirror glass to ASTM C1503, 6 mm non-tinted float glass with safety backing complete with J shaped aluminum frame in satin finish with 16 mm exposed leg on face of mirror; concealed fastening.. Size as indicated on Drawings.

2.4 FABRICATION

.1 Weld and grind joints of fabricated components, flush and smooth.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.

.4 Back paint components where contact is made with building finishes to prevent electrolysis.

.5 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.

.6 Shop assemble components and package complete with anchors and fittings.

.7 Provide steel anchor plates, adapters, and anchor components for installation at appropriate time for building in. Provide templates, details and instructions for building in anchors and inserts.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify exact location of accessories for installation with Consultant.

.3 Verify wall thickness and construction that will accept recessed accessories.

.4 Verify that solid blocking for support and anchoring of washroom accessories is installed where required. Confirm exact height and location with Consultant and Manufacturers Instructions.

.5 Verify that frames and anchors provided, whether by this Section or others, are correctly and securely installed ready to accept the accessory scheduled for the specific location.

.6 Verify that painting is complete and dry in area of installation before accessories are installed.

3.2 INSTALLATION

.1 Install accessories at heights to meet barrier free compliance and in coordination with drawings. Confirm heights with Consultant prior to installation.

.2 Install plumb and level, securely and rigidly anchored to substrate as recommended by manufacturer.

.3 Install grab bars on built-in anchors provided by bar manufacturer.

.4 Use tamper proof screws/bolts for fasteners.

.5 Fill units with necessary supplies prior to Substantial Performance.

3.3 SCHEDULES

.1 Locate accessories where indicated on drawings and as directed by Consultant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnish products, labour and materials to complete miscellaneous specialties work specified herein.

.2 The contractor shall examine all drawings and specifications to ascertain the scope of the work of this Section.

1.2 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's printed product literature, specifications and data sheet for review by the Consultant.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.1 Indicate location, type, size, hardware, anchor or mounting details and accessories for items as requested by the Consultant.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit samples of work specified herein if specifically required to select colours, finishes or if required by the Consultant.

.4 Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Submit closeout data in accordance with Section 01 78 00 – Closeout Submittals.

.1 Provide manufacturer’s printed recommendations for general maintenance, including cleaning instructions.

1.4 QUALITY ASSURANCE

.1 Other then the specified manufacturers, only manufacturer's properly equipped, who have manufactured and installed work of the same size and character, as that indicated in this Section for each product, will be considered for this work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Handling Requirements:

.1 Handle products in accordance with manufacturer’s instructions; store in manufacturer’s original packaging until ready for installation and protect from impacts and abrasion during storage.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.6 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

.1 For all specified products of this Section, Manufacturer/Supplier to provide a minimum one year warranty against manufacturers defects, commencing from the date of Substantial Completion.

Part 2 Products

2.1 PRODUCT ALTERNATES

.1 Products and materials, as specified herein, are selected for the design, performance and construction required for that particular specialty. Other products and materials, which, in the Consultant's opinion are comparable to those specified, will be accepted as alternates, subject to pre-approval of manufacturers product literature.

2.2 FREESTANDING BENCH

.1 Fabricated steel and wood backless bench as follows:

- .1 Dimensions: 508 mm deep x 2235 mm long x 457 mm high.
- .2 Wood Type: Domestically Sourced Thermally Modified Ash
- .3 Metal Finish: Architectural Series - Powdercoated Metal* (Fine Texture) – Terra
- .4 Basis of Design Materials:
  - .1 Bancal, Landscape Forms.

2.3 ACCESSORIES

.1 Provide installation hardware and accessories required for complete installation.

Part 3 Execution

3.1 EXAMINATION

.1 Verify site conditions.

.2 Verify that substrates are stable and capable of supporting the weight of items covered under this Section.

3.2 INSTALLATION

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

.2 Install all listed manufactured specialties as directed and outlined by the manufacturer/supplier, approved shop drawings and as detailed on the drawings.

3.3 ADJUSTING, CLEANING AND PROTECTION

.1 Protect products from damage until completion of project. Use temporary protective coverings where needed and approved by manufacturer. Remove protective covering at the time of Substantial Completion.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

.3 Prior to Substantial Completion, adjust products to ensure proper operation. Replace or repair any products that do not function properly.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnish products, labour and materials to complete miscellaneous specialties work specified herein.

.2 The contractor shall examine all drawings and specifications to ascertain the scope of the work of this Section.

1.2 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit manufacturer's printed product literature, specifications and data sheet for review by the Consultant.

.2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

.1 Indicate location, type, size, hardware, anchor or mounting details and accessories for items as requested by the Consultant.

.3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit samples of work specified herein if specifically required to select colours, finishes or if required by the Consultant.

.4 Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Submit closeout data in accordance with Section 01 78 00 – Closeout Submittals.

.1 Provide manufacturer’s printed recommendations for general maintenance, including cleaning instructions.

1.4 QUALITY ASSURANCE

.1 Other then the specified manufacturers, only manufacturer's properly equipped, who have manufactured and installed work of the same size and character, as that indicated in this Section for each product, will be considered for this work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Handling Requirements:

.1 Handle products in accordance with manufacturer’s instructions; store in manufacturer’s original packaging until ready for installation and protect from impacts and abrasion during storage.

.2 Packaging Waste Management:

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.6 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.7 WARRANTY

.1 For all specified products of this Section, Manufacturer/Supplier to provide a minimum one year warranty against manufacturers defects, commencing from the date of Substantial Completion.

Part 2 Products

2.1 PRODUCT ALTERNATES

.1 Products and materials, as specified herein, are selected for the design, performance and construction required for that particular specialty. Other products and materials, which, in the Consultant's opinion are comparable to those specified, will be accepted as alternates, subject to pre-approval of manufacturers product literature.

2.2 FREESTANDING BENCH

.1 Reinforced cast stone backless bench with perforated seat and as follows:

.1 Dimensions: 610 mm deep x 2210 mm long x 457 mm high.

.2 Finish: manufacturer’s standard acid-etched/waterproofed finish in colour as directed by Consultant.

.2 Basis of Design Materials:

.1 Mayo, Landscape Forms.

2.3 ACCESSORIES

.1 Provide installation hardware and accessories required for complete installation.

Part 3 Execution

3.1 EXAMINATION

.1 Verify site conditions.

.2 Verify that substrates are stable and capable of supporting the weight of items covered under this Section.

3.2 INSTALLATION

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

.2 Install all listed manufactured specialties as directed and outlined by the manufacturer/supplier, approved shop drawings and as detailed on the drawings.

3.3 ADJUSTING, CLEANING AND PROTECTION

.1 Protect products from damage until completion of project. Use temporary protective coverings where needed and approved by manufacturer. Remove protective covering at the time of Substantial Completion.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

.3 Prior to Substantial Completion, adjust products to ensure proper operation. Replace or repair any products that do not function properly.

END OF SECTION

20 05 00.00 General Instructions for Mechanical Sections

1. General

1.1. WORK INCLUDED

1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the Work.

1.1.2. The Specification is divided into Sections which are not intended to identify contractual limits between Subcontractors nor between the Contractor and their Subcontractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.

1.1.3. Provide mechanical components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.

1.2. INTENT

1.2.1. Mention in the Specifications or indication on the Drawings of equipment, materials, operation and methods, requires provision of the quality noted, the quantity required, and the systems complete in every respect.

1.2.2. The Specifications are an integral part of the accompanying Drawings. Consider any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, as properly and sufficiently specified.

1.2.3. Be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment and part of equipment and repair related damages.

1.3. SECTIONS AFFECTED

1.3.1. These instructions apply to and form a part of all Division 20, 21, 22, and 23 Sections referred herein as Mechanical.

1.4. DEFINITIONS

1.4.1. Where used on the Drawings or in the Specifications, the following words are given the meanings below.

.1 Provide: means supply, install, connect and test.

.2 Demolish: detach existing items and legally dispose of them off site.

.3 Remove and Reinstall: Detach existing items, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: existing items that are not removed and that are not otherwise indicated as being removed, removed and salvaged (turned over to Owner), or removed and reinstalled.

.5 Remove and Salvage: detach existing items and turn over to Owner.

1.5. REGULATIONS

1.5.1. Perform Work in accordance with codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.

1.5.2. Comply with all guidelines and standards issued by the authorities having jurisdiction.

1.5.3. Where names of codes and standards are referenced on the Contract Documents, comply with the latest in force edition in the jurisdiction of the Place of the Work.

1.5.4. Comply with regulations respecting plumbing made under the following legislation except as modified by rules, regulations and by-laws of authorities having jurisdiction:

.1 Vancouver Water Works By-law.

.2 Ontario Water Resources Act.

.3 Ontario Building Code Part 7.

1.5.5. For natural gas systems, follow the requirements of:

.1 Regulations made under the Technical Standards and Safety Act

.2 CAN/CSA B149.1 - Natural Gas and Propane Installation Code.

1.5.6. Provide materials and assemblies with flame-spread ratings and smoke developed classifications in conformance with CAN/ULC-S102 “Test for Surface Burning Characteristics of Building Materials and Assemblies.” Compliance with ASTM E84 “Surface Burning Characteristics of Building Materials” in lieu of CAN/ULC-S102 is not acceptable.

1.5.7. These Specifications are supplementary to the requirements above.

1.5.8. Drawings and Specifications should not conflict with the above regulations but where there are apparent discrepancies, notify the Engineer’s Representative.

1.5.9. Where equipment utilizing refrigerants is provided, comply with regulatory refrigerant phase out requirements and dates applicable in the jurisdiction where the Project is taking place. Where equipment not meeting refrigerant phase out requirements or dates is supplied to site, provide revised unit(s) operating on a new refrigerant at no additional cost to the Owner; cover all costs of any electrical, structural, mechanical, architectural, etc. changes required to accommodate the new refrigerant.

1.6. PERMITS, FEES AND INSPECTIONS

1.6.1. Obtain all permits, make submissions, pay all fees and arrange for all inspections required for the Work of this Division.

1.7. EXAMINATION OF SITE

1.7.1. Before submitting Bids, examine the site to determine the conditions which may affect the proposed Work. No claims for extra payment will be considered because of failure to fulfil this condition.

1.8. DRAWINGS, CHANGES AND INSTALLATION

1.8.1. The Drawings show the general character and scope of the Work and not the exact details of the installation. Install all equipment and systems complete with all accessories required for a complete and operational installation.

1.8.2. The location, arrangement and connection of equipment and material as shown on the Drawings represents a close approximation to the intent and requirements of the Work. The right is reserved by the Engineer’s Representative to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no additional cost.

1.8.3. In order to show more clearly the arrangement of the Work, plans and sections do not show every valve, thermometer, pressure gauge or other system accessory. Refer to the Mechanical Standard Details and to the Specifications to determine the requirements.

1.8.4. Install equipment in accordance with the manufacturer's written installation requirements. In the event of conflicts between the Drawings or Specifications and the manufacturer's written installation requirements, notify the Engineer's Representative for resolution.

1.8.5. Certain Details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details are applicable to every occurrence.

1.8.6. Conceal all piping and ductwork in finished areas in ceiling spaces and shafts or furred into walls. Do not install exposed piping or ductwork in such areas unless specifically reviewed and accepted by the Engineer's Representative. Do not install piping in outside walls.

1.8.7. Do not install vent pipes, exhaust hoods or other mechanical equipment mounted on the roof, or housing for such equipment, closer to the edge of the roof than a distance equal to the height of the pipe, hood or equipment, unless specifically reviewed and accepted by the Engineer's Representative.

1.8.8. The location and size of existing services shown on the Drawings are based on the best available information. Site verify the actual location of existing services before commencing Work. Pay particular attention to underground services.

1.8.9. Make changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other Trades, or to accommodate existing conditions, at no additional cost.

1.8.10. Leave areas clear of piping and ducts where space is indicated as reserved for future equipment and equipment for other Trades.

1.8.11. Allow adequate space and provisions for the removal of coils and servicing of equipment, with minimum inconvenience to the operation of systems.

1.8.12. Where equipment is shown to be 'roughed-in only,' obtain accurate information from the Engineer's Representative before proceeding with the Work.

1.8.13. Before fabricating ductwork or piping for installation, make certain that such items can be installed as shown on the Drawings without interfering with the structure or the Work of other Trades. Submit any problems that cannot be solved in agreement with the other Trades affected, for resolution. If ductwork or piping is prefabricated prior to the investigation and reaching of a solution to possible interference problems, make necessary changes in such prefabricated items at no additional cost.

1.8.14. Location of diffusers, grilles, registers, thermostats, sprinklers and all other equipment shown on plans is diagrammatic. Layout of each device in finished areas is critical in terms of symmetry and location. Refer to Architectural Drawings and to Supplemental Instructions in all regards. Revise any Work not installed in the correct location (at the sole discretion of the Engineer's Representative) at no additional cost. Mark-out fully co-ordinated Work with all other trades, in sufficient time for review by Engineer's Representative prior to rough-in. Precisely locate all mechanical and sprinkler services.

1.8.15. Prepare dimensioned layouts of each room prior to rough-in for review by the Architectural Consultant. Do not proceed with any Work until the Engineer's Representative has reviewed the layout.

1.9. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

1.10. BID FORM AND SUBMISSIONS OF BIDS

1.10.1. Submit with the bid, all information called for on the Bid Form. Bids not completed in full may, at the discretion of the Owner, be rejected.

1.10.2. Show alternative and unit prices for optional equipment or systems called for as additions to or deductions from the Bid amount.

1.10.3. Where only one name appears in the Specification, include the specified equipment in the Bid.

1.10.4. Where two or more names are shown in the Specifications as alternatives or equal to, this Division can select which manufacturer is to be carried, provided the choice is shown on the Bid Form. Where the choice is not indicated, supply the equipment described in the Specification or first named on the Bid Form.

1.10.5. Substitute equipment may be offered as a price deduction to the Bid price. Acceptance of substitute equipment is at the discretion of the Owner whose decision is final.

1.10.6. Only propose alternative and/or substitute equipment that is equal in performance and quality to that specified. Include the cost of all changes required to accommodate alternative and/or substitute equipment, in the price shown on the Bid Form, including but not limited to space, power, structural or any other requirements that are different from the equipment specified.

1.10.7. The Owner reserves the right to accept or reject any substitution without question.

1.10.8. Include the cost of premium time in the Bid price for Work provided during nights, weekends or other times outside normal working hours, necessary to maintain all mechanical services in operation and to meet the Project schedule.

1.11. MATERIALS

1.11.1. Make and quality of materials used in the construction of this Work are subject to the approval of the Engineer's Representative.

1.11.2. Supply only new materials and equipment, free from defects and as specified by the manufacturer's name and catalogue reference.

1.11.3. Where a manufacturer's equipment has been specified by name and/or model number, ensure that the performance and quality of equipment provided by an acceptable manufacturer, meets the specified equipment performance, is inclusive of all standard and specified optional features, and can be installed in the planned location with access and maintenance clearances in accordance with the manufacturer's written installation recommendations. Provide all required piping, duct and electrical connections at no additional cost.

1.12. CO-OPERATION WITH ENGINEER'S REPRESENTATIVE

1.12.1. To assist in the successful execution of the Project, the Contractor will receive an initial job report that summarizes the expectations of the Engineer's Representative and the Contractor. This job report covers topics such as progress billings, shop drawing requirements, Change Order pricing, the commissioning process, installation drawings, the Specifications, as-built drawings and operations and maintenance manuals, along with a number of other items. This job report is intended to reiterate key items from the Contract Documents and is not intended to impose new requirements.

1.12.2. At the appropriate time during construction, submit the applicable documentation listed below. The Engineer's Representative will review the information and identify when the information is complete. The Engineer's Representative's general review letter (required for building occupancy) will only be issued when the information requested below is submitted by the Contractor and deemed to be complete by the Engineer's Representative.

1.12.3. For mechanical systems occupancy, provide a PDF copy of the following documents to the Engineer's office for review:

.1 CAN/ULC-S1001 "Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems" reports for mechanical systems

.2 Fire alarm verification certificate

.3 Sprinkler System Engineer's letters of assurance and occupancy, signed and sealed by P.Eng.

.4 Contractor's letter verifying that all fire fighting access routes have been provided and are accessible

.5 Contractor's letter confirming ventilation supply air and return air available for each room

.6 Report confirming sanitary and lab exhaust systems operational

.7 Stair pressurization start-up report

.8 Fuel oil system completion certificates, including authority having jurisdiction inspection certificates

.9 Contractor's letter verifying fire stops and smoke seals installed in accordance with Mechanical Specification

.10 Contractor's letter verifying fire damper, smoke damper, and / or combination smoke / fire damper installations are in accordance with their listings and the Mechanical Specification, and fire damper test confirmation letter

.11 Contractor's letter verifying smoke control system is installed, operational and commissioned per Mechanical Contract Documents and Building Code requirements

.12 Contractor's letter verifying smoke control venting to aid firefightering is installed, operational and commissioned per Mechanical Contract Documents and Building Code requirements

.13 Contractor's letter verifying carbon monoxide detection and exhaust system is installed, operational and commissioned per Mechanical Contract Documents and Building Code requirements

.14 Start up report(s) for heating systems, air handling unit(s), heating boiler(s), fan coil unit(s), heat pump(s), fan(s), etc.

.15 Contractor's letter confirming that emergency power generation ventilation system is installed, operational and commissioned

.16 Start up report(s) for ventilation systems, air handling unit(s), fan coil unit(s), heat pump(s), fan(s), exhaust fan(s), etc.

.17 Start up report(s) for cooling systems including chillers, cooling towers, air handling unit(s), fan coil unit(s), heat pump(s), split a/c unit(s), etc.

.18 Plumbing system pressure testing, flushing, water quality test, and chlorination report(s)

.19 Final plumbing inspection certificate

.20 Pressure test report on all piping systems

.21 Contractor's letter verifying that all plumbing fixtures are installed and operational

.22 Test reports and certificates from local building inspection authority confirming that the following items are installed, pressure tested and operational: building drains, sanitary and storm building sewers, drainage system and venting system, pipes, fittings, fixtures, etc.

.23 Backflow preventer test reports

.24 Contractor's letter verifying grease interceptor(s) installed and tested in accordance with Mechanical Contract Documents and Building Code

.25 Contractor's letter verifying oil interceptor(s) installed and tested in accordance with Mechanical Contract Documents and Building Code

.26 Contractor's letter verifying acid neutralization system installed and commissioned in accordance with Mechanical Contract Documents and Building Code

.27 Contractor verification of accessibility of the fire dampers, fixtures, cleanouts, valves, plumbing appliances, devices and equipment

.28 Cyber Security Report Letter

.29 Air balancing report

.30 Hydronic (Piping) balancing report

.31 Pressure testing of refrigerant systems report

.32 Where the Owner has hired a third party commissioning agent, all documentation and completion of the commissioning process submitted up to the initial BAS commissioning stage where the system is ready for season performance testing, where relevant.

1.12.4. For mechanical systems financial close, provide the following additional documents to the Engineer's office for review:

.1 Copies of as-built drawings

.2 Operating and maintenance manual

.3 Warranty letter

1.13. SUBSTANTIAL PERFORMANCE

1.13.1. The Owner will not deem the Project "ready for use" as defined in the provincial or territorial lien legislation until the following minimum items are complete:

.1 Everything required in the clauses above for occupancy.

.2 All mechanical items commissioned and accepted by Engineer's Representative as noted in Specification Section 20 08 00.00 – COMMISSIONING.

.3 Submission of final, reviewed Operating and Maintenance Manuals including final reviewed Shop Drawings turned over to the Engineer's Representative and Owner as outlined in Section 20 08 03.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.

.4 Submission of final, reviewed as-built documentation to the Engineer's Representative and Owner, as outlined in Specification Section 20 05 02.00 – AS-BUILT DRAWINGS. Note that this includes all final balancing reports.

1.14. CO-OPERATION WITH OTHER DIVISIONS

1.14.1. Pay particular attention to the proximity of electrical conduit and cable to mechanical piping and equipment.

1.14.2. Maintain at least 150 mm (6 in.) separation between pipes transporting hot fluids and pipes carrying cold fluids, unless approval from the Engineer's Representative is obtained.

1.14.3. Do not allow Electrical conduits to touch or be supported from piping or ductwork.

1.14.4. Install all materials in the spaces shown without encroaching upon space for materials installed under other Sections or Divisions. Where the space allocated to another Section or Division is encroached upon, relocate the materials to their proper space allocation in such a manner to complete the Work using space allocated to the various Sections and Divisions. Relocate materials and Work involved at no additional cost.

1.14.5. Supply all items to be built in ample time for rapid progress of the Work. Schedule and proceed with Work as required to satisfy the construction schedule.

1.14.6. Confirm the available voltage for all single phase and three phase motors or other similar electrically driven equipment with the Electrical Division prior to ordering the equipment. Report any discrepancy between the requirements identified within the Contract Documents and those of the Electrical Division to the Engineer's Representative and supply equipment to suit the appropriate power requirements. Bear all costs associated with failure to perform this coordination prior to ordering of the motors or equipment.

1.15. TEMPORARY USE OF EQUIPMENT

1.15.1. Where systems, or a part thereof, are operated during construction, maintain the system and equipment in proper operating condition.

1.15.2. Prior to application for Substantial Performance of the Work as certified by the Engineer's Representative, return the systems and/or equipment to new condition by replacing all consumables such as air or water filters, belts in belt driven equipment, etc. with new components. Clean the air side of all coils in the air handling systems, lubricate all bearings according to manufacturer's written factory standards and adjust the thermostatic control system according to Specifications. Clean all duct systems to NADCA Standards.

1.16. EXISTING SERVICES AND EQUIPMENT

1.16.1. Provide temporary filters, 1 in. thick disposable media type, over all return air openings in the base building HVAC systems that remain in operation during construction. Maintain and replace the temporary filter media as required to prevent construction dust from fouling the base building equipment. Remove same at the completion of construction. Replace filters in all base building air handling equipment i.e., Air Handling Units, Induction Units, Fan Coil Units, etc., after construction is completed.

1.16.2. Reuse existing materials and equipment wherever possible. Provide new materials and equipment as required to ensure a complete installation. Package and turn-over to Landlord all existing equipment, materials and associated controls not used in this contract. Include in the bid for all shipping and placement in a designated on-site storage location. Remove any equipment or material not wanted by the Landlord from the site.

1.16.3. Schedule all changes and connections to existing services at a time approved by the Engineer's Representative so as to avoid any interruption of such services during normal working hours. If necessary, make changes and connections to existing services outside of normal working hours, without additional cost.

1.16.4. Prior to operating any existing or new equipment during any stage of construction, receive written approval from the Landlord and Engineer's Representative.

1.16.5. Whenever existing services or equipment are to be removed, remove all associated piping and ducts back to the main, nearest pipe or duct and securely cap or plug open ends in an approved manner. If necessary to facilitate installation of new Work, remove existing services and equipment and then replace without additional cost.

1.16.6. Whenever it becomes necessary to relocate existing piping, ducts or equipment to make possible installation of the Work under this Contract, make such relocation without additional cost.

1.16.7. Where connections are made to existing services, replace and make good existing insulation.

1.17. INTERRUPTION OF SERVICES

1.17.1. Perform all shutdown, draining, filling and chemical treatment for any portion of the existing base building systems to the satisfaction of the Landlord's building operations staff and co-ordinate with the Landlord for time and duration of interruptions. Comply with all of the Landlord's instructions and include for all costs of this Work, including Work performed by the Landlord's Chemical Treatment Supplier, in the bid price.

1.17.2. Schedule interruptions of the mechanical services to any part of the building at a time agreeable to the Landlord. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.

1.17.3. Obtain approval from the Engineer's Representative for testing and operation of major equipment to avoid excessive utility charges. Such testing is to be generally carried out after normal working hours or on weekends.

1.17.4. Perform all such overtime Work at no additional cost.

1.18. STATEMENT OF PRICES

1.18.1. For the purpose of progress applications, submit a summary statement of estimated prices for the various portions of the Work, including labour, materials and equipment shown separately. The total price of all portions of the Work must equal the total price of the Work covered under Divisions 20, 21, 22 and 23.

1.18.2. Submit the summary of Work for this Contract to the Engineer's Representative for review and approval. Provide sufficient detail in the summary to enable the Engineer's Representative to evaluate the progress of Work and identify all major equipment, components and sub trades.

1.19. METRIC CONVERSIONS

1.19.1. Take particular care with imperial versus SI metric conversions. This applies to all services including, but not limited to, equipment, pipes, ductwork and site services in both new and existing installations.

1.19.2. Conform to CAN/CSA-Z234.1 "Metric Practice Guide."

1.20. ALTERNATIVE AND IDENTIFIED PRICES

1.20.1. If alternative and unit prices have been requested, include on the Bid Form. Prices not on the Bid Form at time of submission will not be accepted. Refer to the Specifications and the Drawings for details.

Equipment	PURCHASE PRICE
	$
	$
	$
	$

1.21. DEMOLITION

1.21.1. The Drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services, follow the service through to ensure other areas of the building are not affected. Open shafts, walls and ceilings as required to examine the services.

1.21.2. If there are no isolating valves readily available to isolate sections of pipe that requires removal, add valves as required. The cost of these valves will be paid for from the Cash Allowance Section. Co-ordinate with the Engineer's Representative to shut-down the system. Install caps on all services. Add caps to all valves at the termination point of existing services.

1.21.3. Where valves are removed, remove valve tags, revise existing charts and hand tags over to Owner.

1.22. SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

1.22.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.

1.22.2. There may be access restrictions to the site (location, time of day, days of week). Refer to Front End Specifications for more information and conform to all requirements stated within.

1.22.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. In particular:

.1 No open flames without prior written approval of the Owner.

.2 No smoking.

.3 Keep the site clean at all times.

1.23. HOUSEKEEPING PADS, CURBS AND SUPPORT PIERS

1.23.1. Provide dimensioned drawings for final sizes and locations for housekeeping pads, support piers, and curbs around all floor penetrations for pipes and ducts. Submit for review by Division 3 and the Engineer's Representative. Extend edge of equipment housekeeping pad 100 mm (4 in.) beyond equipment frame and hold down bolts. Refer to the Drawings and Details for additional information.

.1 Mechanical Division shall furnish and install curbs and housekeeping pads.

.2 Mechanical Division shall furnish and install equipment support piers.

.3 Choose an item. shall furnish and install equipment support piers.

1.23.2. Provide housekeeping pad and curb heights as follows:

.1 Air handling equipment with cooling coils: 150 mm (6 in.).

.2 Air handling equipment with heat wheels: 200 mm (8 in.).

.3 All other equipment: 100 mm (4 in.).

.4 Curbs around floor penetrations: 50 mm (2 in.).

1.24. ASHRAE 90.1

1.24.1. Provide mechanical equipment that complies with the minimum efficiency standards set out in ASHRAE 90.1 "Energy Standard for Buildings Except Low-rise Residential Buildings" and the National Energy Code of Canada for Buildings. Submit all necessary information to substantiate conformance.

1.25. HOISTING FACILITIES

1.25.1. Provide hoisting facilities for the Work of this Division.

1.25.2. Hoisting facilities provided by the General Contractor may be available for Subcontractor's use. If the General Contractor's hoisting facilities are inadequate, provide hoisting facilities for the Work of this Division. Coordinate requirements with the General Contractor prior to submission of Bid.

1.26. LEED REQUIREMENTS

1.27. INTELLECTUAL PROPERTY

1.27.1. The Contractor acknowledges, represents, warrants and agrees that the Owner, its Consultants, and the Engineer's Representative are not responsible, and are hereby indemnified against any action as a result of patent infringement made through the review, acceptance, or receipt of materials, equipment, Work, etc. provided by the Contractor or any of their Suppliers or manufacturers in the execution of this Contract.

1.28. MATERIALS AND EQUIPMENT

1.28.1. Use new materials and equipment as specified or shown that are free from defects that impair strength, durability, or aesthetics.

1.28.2. Manufacture in Canada wherever possible.

1.28.3. Labelled and/or Listed as required by the Authority Having Jurisdiction or Code.

1.28.4. Mechanical systems are designed and coordinated based on the manufacturer and model number and/or parameters indicated on the Equipment Schedules. Accept all costs for differences in physical properties or performance between scheduled equipment and acceptable alternative equipment manufacturers or models identified in these Specifications. Differences may include, but are not limited to, size, layout, arrangement of components, connection sizes, maintenance access, locations and/or quantity of service connections, and performance differences such as noise, power consumption, flow rates, etc.

.1 Electrical coordination: accept all extra costs to revise the electrical provisions, including but not limited to feeder/wiring sizes, breaker sizes, fuse sizes, starters and equipment, to supply power to the non-basis of design piece of equipment.

1.28.5. Be responsible for all design costs associated with differences between scheduled equipment and alternate manufacturers or models identified in these Specifications.

1.29. CYBER SECURITY

1.29.1. Coordinate with Owner's Information Technology representatives, obtain a copy of Owner's cyber security policy and provide all applicable cyber security configurations.

1.29.2. Definitions

.1 Cyber Assets: Systems (including hardware, software, and data) and communication networks (including hardware, software, and data).

.2 Critical Cyber Assets: Cyber assets that perform critical system functions. The loss or compromise of these cyber assets would adversely affect the operational reliability of the system.

.3 Cyber Attack: The use of electronic means to interrupt, manipulate, destroy, or gain unauthorized access to a computer system, network, or device.

.4 Cybercrime: Any crime where cyber – the internet and information technologies, such as software, firmware, computers, tablets, personal digital assistants or mobile devices – has a substantial role in the commission of a criminal offence.

.5 Cyber Hygiene: Practices and steps that users of computers and other devices take to maintain system health and improve online security. These practices are often part of a routine to ensure the safety of identity and other details that could be stolen or corrupted.

.6 Cyber Incident: Any unauthorized attempt, whether successful or not, to gain access to, modify, destroy, delete, or render unavailable any computer network or system resource.

.7 Cyber Security: Technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access.

.8 Cyber Threat or Cyber Security Threat: Malicious act that seeks to damage data, steal data, or disrupt digital life in general. Cyber threats include computer viruses, data breaches, Denial of Service (DDoS / DoS) attacks and other attack vectors.

.9 Cyber Threat Actors: Broad term for any states, groups, or individuals who, with malicious intent, aim to take advantage of vulnerabilities, low cyber Security awareness, and technological developments to gain unauthorized access to information systems in order to access or otherwise affect victims' data, devices, systems and networks.

.10 IP Multicast: Technique for one-to-many and many-to-many real-time communication over an IP Infrastructure network.

.11 Endpoint: Remote computing device that communicates back and forth with a network to which it is connected. Such as a server, desktop, or laptop.

.12 Network Certificates: Also known as a Digital Certificates, which are an electronic "password" that allows a person or organization to exchange data securely over the internet using the public key infrastructure (PKI). Digital Certificates are also known as a public key certificate or identity certificate. There are 3 Main types of certificates:

.1 Secure Socket Layer Certificate (SSL) Digi-SSL

.2 Software Signing (Code Signing Certificate) Digi-Code

.3 Client Certificate (Digital ID) Digi-ID

.13 Social Engineering: Exploitation methods that target human vulnerabilities, such as carelessness and trust.

.14 Technical Vulnerabilities: Weaknesses or flaws in the design, implementation, operation, or management of an information technology system, device, or service.

1.29.3. Cyber Security Measures

.1 Implement at minimum the following multi-layered Cyber Security measures to limit and / or reduce the Owner's potential risk from a cyber threat event; such as a Cyber Security data breach or Cyber Security attack.

.2 Password Management

.1 Employ password management best practices such as:

.1 Do not use default passwords.

.2 Use strong and unique passwords for all applications. Use a minimum of 8 characters where there is no password policy inherent in the software; use a mixture of uppercase and lowercase letters, numbers, and include at least one special character (! @ # ?]).

.3 Reset passwords at regular intervals.

.4 Configure two-factor authentication for all accounts where possible in the system software.

.5 Do not use System Admin logins for simple tasks; create separate User accounts with rights levels appropriate for the job function. Create and define user accounts as appropriate such as Role based, Individual logins or assigned roles.

.6 Use different passwords for every account.

.7 Enforce secure password policies within the business environment.

.8 Have interface lock after a predefined # of failed login attempts for a pre determined time interval.

.3 Port and Interface Management

.1 Employ Port Management techniques such as:

.1 Restrict access on network switch ports to assigned devices addresses.

.2 Lock down all open, unused and unsecure ports on the networking devices such as switches, routers, and firewalls.

.3 Shut off all unused communication services and hardware interfaces.

.4 Advise Owner on use of 3rd party port security monitoring.

.4 Physical and Virtual Networks

.1 Provide a dedicated VLAN for network connected systems where a dedicated LAN has not been provided.

.5 Encryption

.1 Use minimum TLS 1.2 for all network attached equipment and use TLS 1.3 where available.

.6 Network Certificates

.1 Ensure Network Certificates are up to date and not expired for all equipment and systems.

.7 Firmware & Software Update Management

.1 Use the latest stable Firmware / Software version on all devices / equipment as well as implement a Firmware / Software Update management process and procedure.

.8 Manufacturer's System Hardening Guides

.1 Provide the Manufacturer's System hardening guides for the equipment being installed and implement as many recommendations / features as possible.

.9 External Memory

.1 Restrict the use of external memory. Restrict or eliminate the use of devices such as external USB Thumb drives unless expressly allowed by the Owner's Information Technology representatives.

.10 Log Off

.1 Enable auto-log off timer for all software, websites and logins. Set auto-log off timer on local Workstation(s) being used to access the equipment with a reasonable timer in the case that an employee leaves the workstation unattended.

.11 Anti-Virus Software

.1 Enable and configure anti-virus software on PC endpoints in accordance with the Owner's Information Technology requirements, unless it is to be installed and configured by the Owner.

.12 Filtering Techniques

.1 Apply filtering techniques including the types listed below where possible:

.1 Web Filtering: A Web filter adds another layer to anti-phishing defences by blocking the web based component of phishing and malware attacks.

.2 Multicast Message Filtering: Filters the packets sent to multicast groups users are not subscribed to.

.3 Content Filtering: Is the use of a program to screen and / or exclude access to web pages or email deemed objectionable. A content filter will then block access to this content.

.13 Back up Regularly

1. Provide backup schedule in the closeout submittals and configure system for automatic backups wherever possible.
2. Identify files that require manual backup and the backup procedure. This helps to protect against many types of data loss, especially if a Cyber Threat Actor gains access.

1.29.4. IT Devices and Systems

.1 Apply the Cyber security measures listed in the clauses above in part or in full, as possible, to a wide range of Information Technology (IT) Devices including:

.1 Firewalls

.2 Routers

.3 Network switches (Core and Edge Devices)

.4 Servers and databases

.5 Workstation computers

.6 Network connected system devices and controllers

.7 Wireless Access Points and wireless controllers

.8 Mobile phones and tablets

.9 Any IT System or endpoint connected to the network

1.29.5. Operational Technology (OT) Devices and Systems

.1 Apply the Cyber security measures listed in the clauses above, in part or in full, as possible, to a wide range of OT Network devices including:

.1 Industrial Control Systems such as:

.1 (PLC's) Programmable Logic Controllers are an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices.

.2 (SCADA) Supervisory Control and Data Acquisition is a control system architecture comprising of computers, networked data communications and graphical user interfaces (GUI) for high level process supervisory management.

.3 (DCS) Distributed Control System is a computerized control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system.

.4 (CNC) Computer numerical Control is the automated control of machining tools (Drills, boring tools, lathes) and 3D printers by means of a computer.

.2 Building Management Systems (BMS) and Building Automation Systems (BAS)

.3 HVAC equipment

.4 Lighting controls for both internal and external applications

.5 Energy monitoring and metering equipment

.6 Transportation and parking systems

.7 Scientific equipment

.8 Any other OT System or endpoint that can be connected to the network

1.29.6. Report Cybercrime

.1 Advise the Owner and / or their representatives of any indication of a Cyber Incident of a criminal nature when performing any work on a network connected system.

1.29.7. Cyber Security Report Letter

.1 Provide a Cyber Security Report Letter in the closeout documents to the client stating which Cyber Security measures have been implemented, when implementing any and / or all of the Cyber Security Measures mentioned in this Specification.

1.30. LIFE SAFETY INTEGRATION TESTING

1.31. Provide testing of the integration of all life safety and fire protection systems.

1.31.1. The Integrated Testing Coordinator (ITC) will complete an Integration Testing Plan (ITP). Carry out the testing as described by the ITC in the ITP, and in accordance with CAN/ULC-S1001 "Integrated Systems Testing of Fire Protection and Life Safety Systems" as it relates to any mechanical systems.

1.31.2. The ITC and development of the ITP are not the responsibility of this Contractor.

1.31.3. The testing of the integrated systems shall include, but not be limited to the following systems and all associated components:

.1 Fire Alarm (e.g. mechanical systems integrated with or controlled by fire alarm system – dampers, fan start up, fan shut down, make up air, pressurization, etc.)

.2 Elevators

.3 Emergency Generators and/or Inverters (e.g. combustion air, cooling air, cooling, dampers, fuel, alarms, etc.)

.4 Sprinkler Systems

.5 Standpipe Systems

.6 Fire Pumps

.7 Water Supplies

.8 Water Supply Control Valves

.9 Heat Tracing for Life Safety Systems

.10 Fixed Fire Suppression Systems

.11 Cooking Equipment Fire Suppression Systems

.12 Automatic Door Operators for Stair Relief

.13 Hold-Open Devices (e.g. smoke control system integration)

.14 Smoke Control Systems (Passive and / or Active)

.15 Venting to Aid Firefighting

.16 Hazardous Protection Monitoring

.17 Gas / CO Detection Systems

.18 Prevention of Smoke Recirculation (AHUs)

1.31.4. Coordinate with all other trades to carry out the appropriate testing.

1.31.5. Be responsible for carrying out and coordinating the testing Work associated with the ITP. Coordinate all Work with the ITC and include but not be limited to the following:

.1 Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.

.2 Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.

.3 Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001.

.4 Provide all other documentation requested by the ITC as it relates to the mechanical systems in conformance with CAN/ULC-S1001.

1.32. VALUATION OF CHANGES

1.32.1. Further to Contract requirements, use the following method in determining the value of a change to the Work, by either Change Order or Change Directive:

.1 Estimate and acceptance in a lump sum, unless the Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.

1.32.2. Provide the Engineer's Representative with a detailed cost analysis of the proposed change including:

.1 Quantity of each material.

.2 Unit cost of each material.

.3 Labour units based on Mechanical Contractors Association of America (MCAA) Labour Estimating Manual.

.4 Labour (hours) involved.

.5 Suppliers' quotation or credit memo for equipment noted in proposed change, with detailed breakdown.

.6 Sub-trade quotations including a complete cost breakdown of the proposed change meeting the requirements of this section.

.7 Sub-trade's suppliers' quotation or credit memo for equipment noted in proposed change, with detailed breakdown.

.8 Mark-ups, if applicable.

.9 Value of GST or HST, as applicable.

.10 Proposed change in contract time, if any.

.11 S+A proposed change number in every quotation to facilitate record keeping.

1.32.3. Comply with requirements of Contract Documents for all materials included in quotations for proposed changes.

1.32.4. List material and labour separately for each item/clause of the proposed change, on the detailed cost breakdown.

1.32.5. Not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-2020 GC 6.2.

1.32.6. Inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the Work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.

1.32.7. Charge special equipment rental rates at cost. Provide an official quotation of the equipment rental with the proposed change quotation as backup, otherwise special equipment rentals will not be accepted by the Owner/Consultant.

1.32.8. The maximum percentage fee for mark-ups is as stated in the Division 0/1 specifications or Contract Supplementary Conditions.

1.32.9. All changes, change notices, proposed changes, revisions to contract, Supplemental Instructions, Change Directives or any additional costs or deletes to the stipulated lump sum Contract Price are subject to review and scrutiny by a qualified third party or individual.

1.32.10. Use material costs based on a discount to nationally available pricing guides (i.e. Trade Service, Allpricer, etc.) to reflect a value with a fair and reasonable markup to the actual cost of the materials purchased from distributors. The Owner and/or Engineer's Representative reserve the right to negotiate material pricing to a value that is fair and reasonable to the Owner. Indicate on the Bid Form or Supplementary Bid Form: which pricing guide is proposed to be used and discount rate compared to list price.

1.32.11. Base the hourly labour rate for all changes on a Journeyperson rate as listed on the Bid Form and/or Supplementary Bid Form. The Owner and/or Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be inclusive of overhead, markup and profit.

1.32.12. At the request of the Owner or the Engineer's Representative, submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.

1.32.13. When pricing additional work for proposed changes, only price new materials that are required for the proposed change. Where existing materials and/or infrastructure can be re-used for the proposed change, utilize these items in the valuation of the change at no extra cost.

1.32.14. Where a proposed change includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.

1.32.15. When pricing proposed changes containing both additions and credits, and where no work and/or materials have been installed on site, only price the net new materials and net new labour that are required for the proposed change. Utilize equal per unit labour and material costs for credits and additions.

1.32.16. Utilize equal per unit labour and material costs for credits and additions.

1.33. STATEMENT OF PRICES

1.33.1. To form a basis for progress payments, submit a sample progress draw for the various portions of the work. Provide sample progress draw format matching that shown in the example progress draw below. As part of the sample progress draw, include a breakdown which illustrates all categories shown on the example progress draw which are relevant to the project. Break down the categories to clearly illustrate the value of the material being supplied as the first subcategory and the value of the labour being supplied as the second subcategory, as shown on the example progress draw. Provide further material and labour breakdowns by floor, area, or phase if the project sequencing or schedule focuses on distinct areas, one at a time. The Engineer's Representative reserves the right to request that additional categories be added to the progress draw if the Engineer's Representative feels that doing so will aid in assessing the Contractor's progress on site, thereby expediting Contractor payment. Progress draws not including the categories shown on the example progress draw where relevant to the project and / or not providing separate labour value and separate material value subcategories will be rejected.

1.33.2. Ensure that the total price of all portions of the work equals the total price of the work covered under the Mechanical Division. Present cost for as-built drawings and O&M manuals as separate line items as shown below. Present line items from Section 20 08 00.00 – COMMISSIONING as shown below.

1.33.3. List and track each of the approved changes on separate lines on the progress draw.

1.33.4. Amortize costs of temporary facilities and utilities over the duration of the Work. Claims for 'mobilization,' 'bidding costs,' or similar lump sums at or before start of Work are not acceptable.

EXAMPLE PROGRESS DRAW

Mechanical Contractor Name

Billing Application Mechanical Division

Project Name

Application Number – xx **Date – xxxx to xxxx**

Description	Contract Value	%	Billed To Date	%	Prev. Billed	%	This Billing	Balance to Complete
Permits	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Demolition & removals	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Plumbing piping – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Plumbing piping – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Plumbing fixtures – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Plumbing fixtures – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Plumbing equipment – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Plumbing equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Drainage piping – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Drainage piping – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Drainage pumps – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Drainage pumps – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire protection piping – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire protection piping – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire protection valves / equipment – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire protection valves / equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
HVAC piping – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
HVAC piping – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
HVAC ductwork – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
HVAC ductwork – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
HVAC equipment – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
HVAC equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Building Automation System raceways and wiring – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Building Automation System raceways and wiring – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Building Automation System equipment – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Building Automation System equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Heat tracing – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Heat tracing – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Gas service – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx

Gas service – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Gas piping – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Gas piping – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Water service – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Water service – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fuel oil system – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fuel oil system – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Excavation and backfill – Materials	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Excavation and backfill – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Shop Drawings (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Installation review and equipment verification (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Plumbing and drainage system testing (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Testing of piping systems (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Assistance with Independent Contractor balancing of piping systems (0.25 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Testing of air systems (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Assistance with Independent Contractor balancing of air systems (0.25 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
System start-up (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Commissioning / Testing (3% of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Operating & Maintenance Manuals (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Training (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
As-Built Drawings (0.5 % of contract value)	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Demobilization / Clean-up	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	Xxx	xxx,xxx.xx	xxx,xxx.xx
Subtotal	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Additions to Contract								
CO # / PC # / CCN #	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
Cash Allowance #	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
	---		---		---		---	---
Subtotal	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
	---		---		---		---	---
	---		---		---		---	---
Total Contract	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx

Less Holdback	xxx,xxx.xx	xxx,xxx.xx	xxx,xxx.xx	
	----------	----------	----------	
Total	xxx,xxx.xx	xxx,xxx.xx	xxx,xxx.xx	

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

20 05 02.00 As-built drawings

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.1.2.

1.2. RECORD OF REVISIONS ON SITE

1.2.1. Print and maintain two complete sets of white prints to mark the Project progress, changes and deviations

1.3. SUBMITTALS

1.3.1. Submit as-built drawings in CAD format and PDF format for underground services for review prior to slab pour.

1.3.2. Submit as-built drawings in CAD format and PDF format for all other areas of the building prior to request for occupancy.

1.3.3. Comply with Section 20 05 03.00 - SHOP DRAWINGS for all submittals.

2. Execution

2.1. DOCUMENTATION REQUIREMENTS

2.1.1. As the Project progresses record all changes and deviations.

2.1.2. Maintain an accurate dimensional record of revisions. Specifically record:

.1 Underground piping invert elevations and pipe locations dimensioned to column lines after review and acceptance by the Authority Having Jurisdiction.

.2 Inverts of underground piping at building exit and entry, below floor slab at each branch connection, riser base, and change in direction as well as a least 3 points on long straight runs.

.3 Above ground piping revisions.

.4 Duct revisions.

.5 Equipment revisions.

.6 Locations of access doors and panels. Identify the equipment and components they serve.

.7 Locations of valves.

2.1.3. Keep revisions up-to-date during construction including Change Orders, Change Directives, and Supplemental Instructions. Documentation shall be available for review at all times.

2.1.4. Final as-built documents shall not contain markings or corrections electronically or by hand (i.e. marker, pen, pencil, etc.). Drawings submitted that contain mark-ups will not be accepted.

2.2. SUBMISSION REQUIREMENTS

2.2.1. Transfer “as-built” information and any additional submittal comments to the final software submission requirement (i.e. Autodesk AutoCAD).

.1 Conform to the Owner/Engineer’s Representative’s standards.

.2 The Mechanical Contractor may request from the Engineer’s Representative the most current electronic documentation in AutoCAD. Documents to be forwarded via a secure file transfer (at a nominal charge of $500.00).).

.3 Clearly label electronic files with Engineer’s Representative and Owner, Contract number, file names and the Drawing number.

2.2.2. Submit the documents in PDF along with the submission of the completed electronic source software documentation on an approved electronic storage device for review by the Engineer’s Representative.

2.3. AUTOCAD SPECIFIC SUBMISSION REQUIREMENTS

2.3.1. Make special effort to ensure that drafting is accurate, i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and that entities are placed on correct layers.

2.3.2. Use the standard fonts available in the software. Do not use custom fonts, shape files, etc.

2.3.3. Provide all drawings in the same scale of measurement and units as issued on Bid Documents.

END OF SECTION

20 05 03.00 Shop Drawings

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

2. Products

2.1. SHOP DRAWINGS

2.1.1. Submit Shop Drawings organized by Specification Section. Ensure shop drawing package for a given Specification Section is complete, including all equipment, products, materials, and systems to be used as part of that Specification Section, and submit as a single shop drawing package. Do not submit numerous separate Shop Drawings for the same Specification Section. Do not combine more than one Specification Section into one submission. Incorrect submissions will be returned without review.

2.1.2. Submit Shop Drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:

.1 S+A Project number and Contractor Shop Drawing Identifier in Subject Line

.2 Attachments shall be limited to 20MB

.3 Provide FTP hyperlink for all attachments in excess of 20MB with appropriate information for downloading the file (as required)

.4 Shop Drawing Submission to the following email address:

.1 ContractAdmin.Toronto@smithandandersen.com

2.1.3. Shop drawings submitted directly to Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.

2.1.4. Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number as noted in the documents of the specific pump, fan, etc. for which it was prepared.

2.1.5. Each Shop Drawing for non-catalogue items shall be prepared specifically for this Project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.

2.1.6. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation. The Engineer's Representative may also request that this information be added to the maintenance and operating manual.

2.1.7. Provide a cover sheet with the Project name, issue date, issue number, Specification section number, title of section and with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

3. Execution

3.1. SUBMISSIONS

3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that they have checked the submission for conformance with all requirements of the Drawings and Specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the Work of other trades. Ensure that electrical co-ordination is complete before submitting Shop Drawings for review.

3.1.2. Scanned PDF versions are not acceptable.

3.1.3. Manufacturing of equipment, installation of equipment or connecting services shall not start until after final review of Shop Drawings by the Engineer's Representative has been completed.

END OF SECTION

20 05 29.00 Hangers and Supports

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.1.2. Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workpersonlike installation.

1.1.3. Hangers, supports, anchors, guides, and restraints shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings in accordance with Section 20 05 03.00 – SHOP DRAWINGS.

1.2.2. The Mechanical Division shall prepare detailed Shop Drawings showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall bear the signed seal of a Professional Engineer licensed to practice in the appropriate discipline and Place of the Work. The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the Project Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division. No anchor points shall be permitted without reviewed Shop Drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Engineer's Representative.

2. Products

2.1. MATERIALS

2.1.1. Provide hangers and supports manufactured by Anvil ASC Engineered Solutions, Taylor Pipe Supports, or E. Myatt & Co.

2.1.2. All pipe hangers and supports shall be manufactured to the latest requirements of ANSI MSS-SP-58 "Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation." Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME B31 "Code for Pressure Piping."

2.1.3. All hangers, supports, brackets and other devices installed exterior to the building or in corrosive environments (pool mechanical rooms, pools, pool change rooms, etc.) shall be galvanized to prevent failure from environmental corrosion. If galvanized components cannot be used submit samples of proposed substitute for review prior to installation.

3. Execution

3.1. INSTALLATION

3.1.1. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent undue stress to building structural components.

3.1.2. Piping shall be supported from walls, beams, columns, and slabs using approved structural attachments. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies shall receive approval prior to installation. Prior approval shall be given for any cutting or drilling of building structural steel. Damage or modification to the structure through welding, cutting, or drilling shall not be permitted if it reduces the integrity of the building structure as deemed by the Structural Engineer's Representative. It shall be the responsibility of the Mechanical Division to supply anchor bolts and base diagrams for equipment and pipe supports showing exact location of attachments.

3.1.3. All drilling for hangers, rod inserts and Work of similar nature shall be done by this Division.

3.1.4. Auxiliary structural members shall be provided under the Mechanical Section concerned where piping, ducts or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Auxiliary structural members shall be the same material and finish as the primary structure (i.e. prime painted, galvanized, etc.). Submit details for review as requested.

3.1.5. Depending on the type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts. Submit proposed hanger details for review and acceptance by the Structural Engineer's Representative. Make adjustments as necessary to satisfy the requirements of the Structural Division.

3.1.6. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer's Representative. Drawings of the proposed method of suspension must be submitted for review.

3.1.7. Hanger rods shall be subject to tensile loading only. Suspended piping shall be supported by adjustable hanger rods sized as follows:

Pipe Size	Hanger Rod Diameter
50 mm (2 in.) and under	9 mm (3/8 in.)
65 mm (2-1/2 in.) and 75 mm (3 in.)	12 mm (1/2 in.)
100 mm (4 in.) and 125 mm (5 in.)	16 mm (5/8 in.)

3.1.8. Unless otherwise specified or shown, hanger spacing for all services shall be as follows:

Nominal Pipe Diameter	Maximum Span
Up to and including 38 mm (1-1/2 in.)	2.1 m (7 ft.)
50 mm (2 in.) to 125 mm (5 in.)	3 m (10 ft.)

3.1.9. In addition, provide a hanger within 600 mm (2 ft.) on each side of valves, fitting or tees on pipes 38 mm (1½ in.) diameter and larger.

3.1.10. Hanger spacing for plumbing and drainage services shall be in accordance with the plumbing code or municipal by-laws as applicable.

3.1.11. All horizontal piping 50 mm (2 in.) diameter and larger shall be supported by adjustable wrought iron clevis type hangers. Smaller piping shall be supported by adjustable split ring hangers or clevis type hangers.

3.1.12. Suspending one hanger from another shall not be permitted.

3.1.13. For insulated ducts, ensure supports are on the outside of the insulation so as to not be directly connected to the duct creating a vapour barrier issue. Provide high density insulation in the area of the supports and spread the load.

3.1.14. The shield width shall be minimum 1/4 of the pipe circumference. The length and gauge shall be as follows:

.1 150 mm (6 in.) long and 14 US gauge for pipe larger than 25 mm (1in.) up to 50 mm (2 in.) diameter

3.1.15. Hangers and riser clamps in contact with copper pipe shall be copper coated construction or plastic coated. Taped hangers and riser clamps shall not be accepted.

3.1.16. Other means of support shall be as shown or as specified hereunder.

3.1.17. For special equipment supports refer to equipment sections. Where no support method is identified, secure wall mounted equipment to metal framing or masonry, with steel toggle or expansion fasteners, machine screws or sheet metal screws as applicable. Plastic, fibre or soft metal inserts shall not be acceptable. Wall mounted equipment shall not exceed 45.5 kg (100 lbs) in weight or 250 mm (10 in.) in depth unless reviewed or detailed by the Engineer's Representative. Where framing does not permit direct attachment, provide metal strut sub-framing or minimum 19 mm (3/4 in.) fire retardant treated plywood backboards, unpainted, attached to the framing. Provide attachments for backboards at 600 mm (24 in.) on centres with no less than 4 attachments.

END OF SECTION

20 05 33.00 Electric Tracing

1. General

WORK INCLUDED

Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

Conform to Section 26 05 01.00 - GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

SUBMITTALS

Submit detailed Shop Drawings for all Products being supplied and include electric tracing cable layouts, calculations, power requirements, connection quantities and locations, and control information. Demonstrate compliance with Specification.

Submit Shop Drawings in accordance with Section 20 05 03.00 - SHOP DRAWINGS.

Products

MATERIALS

Electric tracing cable shall be Raychem or Thermon, for 120 volt, 1 phase supply.

Tracing cable shall be self-regulating type to CSA Standard C22.2 No. 130 “Requirements for electrical resistance trace heating and heating device sets.”

Thermostat shall be minimum 20 amp rating with adjustable control from 0 deg. C. (32 deg. F.) to 49 deg. C. (120 deg. F.) with remote bulb, 3 m (10 ft.) of copper capillary. Where thermostat is mounted in conditioned areas, enclosure shall be dust and moisture resistant and where mounted in non-conditioned areas, enclosure shall be weather-proof. Thermostat shall have CSA Type 4X enclosure.

Contactors, where required, shall be with 120 V coil and pilot light in cover. Provide control transformer as required.

The following minimum watts/linear foot shall be maintained for pipe freeze protection applications. The table below is based on a -29 Deg. C. (-20 Deg. F.) minimum ambient temperature.

.Up to and including 75 mm (3 in.) pipe	5 watts/ft. nominal
100 - 150 mm (4-6 in.) pipe	2. 8 watts/ft. nominal

Provide thermal insulation for pipes as specified in Section 20 07 00.00 – INSULATION.

Include the following accessories:

power connection and end seal kits

splice, and tee kits

"Electric Traced" caution labels

aluminum tape for plastic pipe (where required)

glass cloth adhesive tape

contactors, relays, power distribution components

mounting clips/hardware for installation of the cables on the bottom of the slab

Execution

INSTALLATION

Completely cover the pipe with cable for the full length shown, and without gaps. Ensure that valve body and bonnet are completely protected.

Install heating cables after pipe installation and testing is complete. Attach cable as recommended by the manufacturer with pipe straps, ensuring cables do not touch or cross.

For slab and soffit heating installations, install the cable tight to the bottom of the slab as per the manufacturer’s written installation instructions using equipment supplied by the manufacturer.

Install soffit and slab heating cables at a maximum spacing of 375 mm (15 in.) between the runs of cable unless otherwise specified by the manufacturer to suit the required outside air design temperature. Spacing to be confirmed through the Shop Drawings.

Strap thermostat bulb to pipe clear of cable, and mount thermostat on wall or roof with brackets. Hang capillary on straps. Retain the services of the manufacturer to inspect and approve the entire installation before the pipe or slab/soffit is concealed and/or insulated. Check for breaks with a 2500 volt DC megger. Provide report for inclusion in the operating manuals. The cost of inspection shall be included in the Contract Price. This Contractor shall provide pre-commissioning and final commissioning.

The installation by this Section shall be complete requiring power supply only by the Electrical Division. Provide all wiring between the electric tracing and the electrical junction box and make final connections.

END OF SECTION

20 05 48.00 Vibration and Noise Control

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Shop Drawings: Supply Shop Drawings of the vibration and noise control equipment being supplied in accordance with Section 20 05 03.00 - SHOP DRAWINGS. Provide Shop Drawings showing completely the various acoustic assemblies. Include on the Shop Drawings the equipment weight at each isolator and the isolator proposed to be used complete with its weight rating. Submit Shop Drawings after all major equipment (e.g. chillers, cooling towers, etc.) has been reviewed and isolators have been coordinated.

1.3. PERFORMANCE REQUIREMENTS

1.3.1. Adequately isolate all equipment to maintain acceptable noise levels in the occupied area of the building as specified below. Take noise measurements over the complete audible frequency range in each of the occupied zones under, above and beside Mechanical Equipment Rooms, and where indicated by the Engineer's Representative. Noise levels due to mechanical equipment, ductwork, grilles, registers, terminal devices, diffusers, etc., shall not exceed sound pressure levels in all 8 octave bands corresponding to the NC levels per ASHRAE handbook as indicated.

2. Products

2.1. MATERIALS

2.1.1. All equipment provided for vibration isolation or noise control shall be new and manufactured specifically for the purpose intended.

2.1.2. All vibration isolation devices shall be Vibro-Acoustics, Kinetics Noise Control, VMC Amber Booth, Isotech, or Mason Industries and shall be one manufacturer throughout the Project.

2.1.3. Provide vibration isolation devices for all motorized or electrical equipment. Static deflection of isolators shall be as given in the Vibration Isolation Schedule and/or as specified below. The Vibration Isolation Schedule shall take precedence.

2.1.4. Provide silencers in accordance with the Silencer Schedule and/or as shown on Drawings to maintain acceptable noise levels.

2.2. VIBRATION ISOLATION

2.2.1. Type SPNH (Spring and Neoprene Hangers) - Vibro-Acoustics Model SHR, Kinetics Model SRH, Mason Industries Model 30N, or ISOTECH Model IHSE, IHAE or IHBE.

.1 Type SPNH shall consist of a steel spring and welded steel housing. Spring diameter and hanger box hole shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 19 mm (3/4 in.) larger

than the diameter of the hanger rod. When installed, the spring element shall not be cocked, and the hanger box shall be allowed to rotate through a full 360 degree arc without encountering any obstructions.

.2 Type SPNH shall include the addition of a neoprene element in series with the spring. The neoprene element shall have a deflection of not less than 9 mm with a strain not exceeding 15 %. Unless otherwise specified, the static deflection of SPNH hangers under actual load conditions shall be 50 mm (2 in.).

2.2.2. All spring mounts shall be complete with levelling devices 6 mm (1/4 in.) thick ribbed neoprene sound pads and completely colour coded stable springs.

2.2.3. All vibration isolators shall have either known undeflected heights of calibration markings to that, after adjustment, verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to design.

2.2.4. Neoprene mounting sleeves for hold down applications of equipment with vibration isolators shall be Uniroyal Type 620/660 or as approved.

2.2.5. Acoustic Sealant: Non-hardening, non-skinning permanently flexible, to CAN/CGSB-19.21 “Sealing and Bedding Compound, Acoustical.” Tremco, CGC Acoustic Sealant or approved equivalent.

2.3. INTERNAL ACOUSTIC DUCT LINING

2.3.1. Fiberglass duct lining manufacturer: Certainteed, Owens-Corning, Knauf Insulation, or Johns Manville.

2.3.2. Natural fibre duct lining manufacturer: Bonded Logic.

2.3.3. Provide acoustic duct lining with a minimum density of 24 kg/m3 (1.5 lbs/ft3).

2.3.4. Provide acoustic duct lining that complies with the requirements of NFPA 90A “Standard for the Installation of Air-Conditioning and Ventilation Systems” and the “Duct Liner Materials Standard” of the Thermal Insulation Manufacturer’s Association.

2.3.5. Provide internal acoustic duct lining that incorporates means to prevent fiber entrainment in the air stream, such as airstream surface and long edges complete with acrylic polymer surface coating.

3. Execution

3.1. INSTALLATION

3.1.1. Obtain one copy of all Shop Drawings of equipment to be isolated showing weights, shaft centres and all dimensions.

3.1.2. On system start-up, inspect the complete installation and provide a report in writing.

3.1.3. Furnish and install neoprene mounting sleeves for hold-down bolts to prevent any metal to metal contact.

3.1.4. Unless otherwise indicated, all equipment mounted on vibration isolators shall have a minimum operating clearance of 50 mm (2 in.) between the bottom of the equipment or inertia base (and height-saving bracket) and the concrete housekeeping pad (or bolt heads) beneath the equipment. The clearance shall be checked by the Contractor to ensure that no material has been left to short-circuit the vibration isolators. There shall be a minimum 100 mm (4 in.) clearance between isolated equipment and the walls, ceiling, floors, columns and any other equipment not installed on vibration isolators.

3.1.5. Piping, ductwork, conduit or mechanical equipment shall be supported from building structure, not hung from or supported on other equipment, pipes, or ductwork.

3.1.6. All wiring connections to mechanical equipment on isolators shall be made with a flexible conduit installed in a slack “U” shape.

3.1.7. Elastomeric isolators that will be exposed to temperatures below 0 deg. C. (32 deg. F.) shall be fabricated from natural rubber instead of neoprene.

3.1.8. Springs shall be designed and installed so that ends of springs remain parallel and all springs installed with adjustment bolts.

3.1.9. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

3.1.10. Fans and air handling units shall be levelled with fans operating before the flexible connectors are attached.

3.2. EQUIPMENT ISOLATION

3.2.1. Ceiling Suspended Centrifugal Fans, and axial flow fans shall be mounted on Type SPNH spring isolators. Static deflection of the isolators shall be 50 mm (2 in.) unless shown otherwise on the Vibration and Isolation Schedule. Fans shall be suspended from above only if expressly noted as such on the Drawings and Schedules. Thrust restraint shall be by pre-compressed springs.

.1 If the fan to be suspended is not furnished with integral structural frame and external mounting lugs of suitable strength and rigidity, install approved structural base with lugs in the field.

3.2.2. Fan coil units or heat pumps suspended from overhead structure shall be hung on Type SPNH spring isolators. Unless otherwise specified in the Vibration and Isolation Schedule, the static deflection of the isolators shall be 50 mm (2 in.).

3.2.3. Suspend all piping in Mechanical Rooms on Type SPH or SPNH isolators as required. Where piping is supported from the floor, weld brackets to the piping and support on Type SPNM isolators. Isolators do not replace constant support hangers or mounts.

3.2.4. The first isolator both upstream and downstream of equipment on springs shall have a static deflection of 1.5 times the deflection of the vibration isolated equipment to a maximum of 50 mm (2 in.). All other piping supports shall have a static deflection of 25 mm (1 in.) minimum.

3.2.5. Where a pipe connects to multiple pieces of equipment in the Mechanical Room the pipe isolators for the entire run shall be chosen to suit the connected equipment of the greatest static deflection.

3.2.6. Piping attached to either coil sections separated from the fan sections of air handling units by flexible connections, or to air handling units with internal isolators meeting the requirements of these Specifications is exempt from these requirements and is not considered connected to vibrating equipment.

3.2.7. No rigid connections between equipment and the building structure shall be made that degrades the specified noise and vibration control system.

3.2.8. Any conflicts with other trades which result in rigid contact with the equipment or piping due to inadequate space or other unforeseen conditions shall be brought to the Engineer’s Representative’s attention prior to installation. If not brought to the attention of the Engineer’s Representative prior to installation corrective Work necessitated by conflicts shall be at the Contractor’s expense.

3.2.9. Locate isolation hangers with the housing a minimum of 50 mm (2 in.) below but as close as possible to the structure. Where isolator hangers would be concealed by a non-accessible acoustical sub-ceiling, install the hangers immediately below the sub-ceiling for access.

3.2.10. Ducts shall be connected to fans, fan casings and fan plenums by means of flexible connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection.

.1 Flexible connections are not permitted on NFPA 96 “Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations” kitchen exhaust systems.

.2 Flexible connectors shall be in accordance with Section 23 31 13.00 - DUCTWORK AND SPECIALTIES.

3.3. ACOUSTICAL LINING OF DUCTS

3.3.1. Acoustically line ductwork where shown on the Drawings and as Specified.

3.3.2. Provide a minimum of 25 mm (1 in.) thick acoustical duct lining in all internally lined sheet metal ducts, unless otherwise specified or shown on the Drawings.

3.3.3. In addition, internally line all low or medium pressure supply air ductwork in mechanical rooms, fan rooms, or equipment rooms.

3.3.4. Install acoustic lining using both pins and a minimum of 50 % coverage of a fire-resistant adhesive. Install pins on maximum 450 mm (18 in.) centres on all sides and tack weld to the duct or plenum. Mechanical fasteners that pierce the duct are unacceptable. Seal all edges of acoustic lining to prevent air erosion with sheet metal nosing that overlaps the insulation by 19 mm (3/4 in.) minimum. Coat all ends of the liner with a fire resistant cementing material to prevent delamination, leakage or erosion. Firmly butt all joints and coat ends with an adhesive to ensure that the lining is smooth across all joints.

3.3.5. Where acoustical duct lining is installed, increase the dimensions of the sheet metal to include the thickness of the lining material. Dimensions shown on the Mechanical Drawings are the clear internal dimensions after the liner has been installed.

END OF SECTION

20 05 63.00 Access Doors and Accessibility

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings showing size, type and location of all access doors, for review, before installation in accordance with Section 20 05 03.00 – SHOP DRAWINGS.

1.2.2. Have Balancing Contractor review proposed access door sizes and locations to ensure that sufficient access is available. Confirm in writing that this review has occurred.

2. Products

2.1. MATERIALS

2.1.1. Provide access doors that comply with Section 08 31 00 - ACCESS DOORS AND PANELS from the Architectural Specification.Where the Architectural Specification section is silent on a required access door type, comply with the Part 2 clauses in this section.

2.1.2. Provide access doors by Acudor, Bauco or Mifab Manufacturing Inc. Steel thickness (US Guage) indicated as minimum acceptable.

2.1.3. For doors in solid walls, provide a 16 US gauge, prime painted steel door panel, rust resistant concealed hinges, flanged frame, and screwdriver operated lock. Acudor Model UF-5000 or Mifab Model UA.

2.1.4. For doors in drywall partitions or ceilings, provide a minimum 22 US gauge, prime painted steel recessed door panel for the acceptance of a drywall insert, concealed hinges, drywall bead frame, and screwdriver operated lock. Bauco Plus II, Acudor model DW-5015 or Mifab Model CAD-DW.

2.1.5. For doors in drywall partitions or ceilings, provide 16 US gauge, prime painted steel flush door panel, concealed hinges, drywall bead frame, and screwdriver operated lock. Acudor model DW-5040 or Mifab Model MDW.

3. Execution

3.1. INSTALLATION

3.1.1. Provide access doors of minimum 600 mm x 600 mm (24 in. x 24 in.) size. Custom size access doors may be required to allow combining access doors in close proximity and to ensure maintenance and accessibility of all parts requiring periodic maintenance.

3.1.2. Ensure all parts of the installation requiring periodic maintenance are accessible. Wherever valves, dampers and other appurtenances are concealed by building construction, provide access doors and install under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.). Be responsible for the proper location of the access doors.

3.1.3. For all mechanical equipment located above drywall and other inaccessible ceilings, provide access doors that will allow for full removal and replacement.

3.1.4. Wherever possible, locate items requiring access in easily accessible areas (i.e. exposed or T-bar ceilings).

3.1.5. Group items in order to minimize the number of access doors required.

3.1.6. Install each access door to provide complete access to equipment for maintenance and servicing.

3.1.7. Make any changes to locations of access doors as directed by the Engineer's Representative.

3.1.8. Show the final installed locations of all access doors on the as-built drawings.

END OF SECTION

20 05 83.00 Sleeves and Escutcheons

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Firestopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers, etc.) with the exception of sleeves shown for future use installed in fire or smoke rated partitions shall be the responsibility of Mechanical Division. All other firestopping and smoke seals of mechanical services are part of Mechanical Division.

2. Products

2.1. MATERIALS

2.1.1. Sleeves passing through stud partitions shall be 0.75 mm (0.0299 in. - 22 GSG) steel.

2.1.2. Sleeves passing through concrete or masonry partitions and floors shall be Schedule 40 steel pipe.

2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal where additional protection is provided to prevent water from passing freely (i.e. housekeeping pad).

2.1.4. Firestopping and smoke seal systems shall be in accordance with CAN/ULC-S115 “Standard Method of Fire Tests of Firestop Systems,” CAN/ULC-S101 “Standard Methods of Fire Endurance Tests of Building Construction and Materials,” ASTM E119 “Standard Test Methods for Fire Tests of Building and Construction Materials” and ASTM E814 “Standard Test Method for Fire Tests of Penetration Firestop Systems

.1 Unless noted otherwise “F” and “T” ratings are required.

.2 Systems shall be asbestos free and maintain an effective barrier against flame, smoke, and gases in accordance with CAN/ULC-S115 and shall not exceed opening sizes for which they are intended.

.3 Firestopping and smoke seals at openings around mechanical services shall be an elastomeric seal for sound and vibration control.

.4 Fire resistance rating of firestopping assembly shall not be less than the fire resistance rating of surrounding floor or wall assembly.

.5 Service penetration assemblies shall be ULC certified in accordance with CAN/ULC-S115 and listed in ULC Guide No. 40 U19.

.6 Service penetration firestop components shall be ULC certified in accordance with CAN/ULC-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15.

.7 Firestopping and smoke seals shall be by Hilti, Tremco/Royal Quickstop, STI Firestop or 3M.

.8 Firestop Products shall be mold and mildew resistant.

2.1.5. Escutcheons shall be satin finish stainless steel or satin finish chrome or nickel plated brass, with non-ferrous set screws. Do not use stamped steel split plates. Split cast plates with screw locks may be used. For escutcheons for plumbing fixtures refer to Section 22 42 00.00 - FIXTURES AND TRIM.

2.1.6. Cover exposed duct sleeves in finished areas with 1.42 mm (0.0561 in. - 18 GSG) galvanized sheet steel in the form of duct collars. Fix in position with non-ferrous metal screws.

2.1.7. Counter flashing for roof penetrations shall be commercial quality galvanized sheet steel to ASTM A653/A653M “Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process,” 0.70 mm (0.0276 in. - 24 GSG) minimum thickness, Z275 275 zinc coated by hot dip process.

3. Execution

3.1. INSTALLATION

3.1.1. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers.

3.1.2. Sleeves shall be sized to maintain insulation and vapour barrier around all pipes and ducts for all service penetrations. Coordinate thickness requirements with Section 20 07 00.00 - INSULATION.

3.1.3. For sleeves through barriers without a fire resistance rating, for non-insulated pipe, fill the annular space between the service and the sleeve with insulation as specified in Section 20 07 00.00 - INSULATION and caulk around the edges with sealant.

3.1.4. Firestopping and smoke seal material and components shall be installed in accordance with the ULC Listing and manufacturer’s written instructions. Examine the sizes and conditions of the cavities to be filled to determine the correct thicknesses and installation of materials. All substrates and surfaces in contact with firestopping materials shall be dry and prepared in accordance with the Manufacturer’s written instructions at appropriate ambient conditions.

3.1.5. Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.

3.1.6. Provide escutcheons at all penetrations of piping into finished areas, and at insulated pipes, make the escutcheons large enough to fit around the insulation.

3.1.7. Extend sleeves a minimum of 50 mm (2 in) above floor and seal water tight to prevent seeping to the floor below. Sleeves passing through housekeeping pads are permitted to be flush with the top of the housekeeping pad.

END OF SECTION

20 05 88.00 Cutting and Patching

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.1.2. Openings required for mechanical services for new construction shall be in accordance with Section 20 05 83.00 - SLEEVES AND ESCUTCHEONS. This Section shall apply for openings required in existing construction or where sleeves for mechanical services have been omitted in new construction in error.

1.1.3. Include for all cutting and patching for all mechanical services for holes and openings with dimensions up to 200 mm (8 in.) in size and related patching.

2. Products

2.1. MATERIALS

2.1.1. All services and materials used for the cutting and patching shall shall be carried out by professional workers experienced in the cutting and patching Work to be done

3. Execution

3.1. INSTALLATION

3.1.1. Locate all openings in non-structural elements requiring cutting and patching in cooperation with the applicable Trades in a timely manner to avoid unnecessary cutting. All openings shall be shown on drawings and submitted to the Engineer’s Representative for review. No holes through structure shall be permitted prior to review by the Structural Engineer’s Representative.

3.1.2. Core drilling for individual services shall be by this Division. Cut all openings no larger than is required for the services.

3.1.3. Locate all openings in structural elements requiring cutting and patching (concrete walls or floors) and x-ray the structure to obtain Structural Engineer’s Representative’s approval prior to cutting or core drilling of structure. Make adjustments to location of openings as required to minimize cutting of rebar and completely avoid electrical conduit.

.1 Cut holes through slabs or walls only.

.2 Do not cut holes through beams.

.3 Holes to be cut are 200 mm (8 in.) diameter or smaller only.

.4 Maintain at least 100 mm (4 in.) clear from all beam faces. Space at least 3 hole diameters on Centre.

.5 For holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.

.6 For holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.

.7 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity.

3.1.4. Obtain written approval from the Landlord and the Structural Engineer's Representative before cutting or core drilling openings or holes.

3.1.5. Patch all openings after services have been installed to match the surrounding finishes.

END OF SECTION

20 07 00.00 Insulation

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Provide Shop Drawings with technical data on all types of insulation to be installed, in accordance with Section 20 05 03.00 – SHOP DRAWINGS.

2. Products

2.1. GENERAL

2.1.1. Provide insulation and jacket systems that are fire retardant, with a flame-spread rating not to exceed 25 and a smoke developed classification not to exceed 50, when tested in accordance with CAN/ULC S102 “Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.”

2.1.2. For indoor applications, provide insulation systems (insulation, jackets, adhesives, coatings, etc.) that are Certified under the UL GREENGUARD Certification Program for low chemical and particle (volatile organic compounds (VOC)) emissions.

2.2. PIPE INSULATION

2.2.1. Type P1 - Inorganic mineral fibre: glass wool, rock wool, slag wool.

.1 To ASTM C547 “Standard Specification for Mineral Fiber Pipe Insulation.”

.2 Rigid, pre-formed, with pressure sensitive longitudinal adhesion strip.

.3 Reinforced all service jacket (ASJ) vapour retarder.

.4 Suitable for temperature range of pipe application in question.

.5 Acceptable manufacturers:

.1 Johns Manville

.2 Knauf

.3 Manson

.4 Owens-Corning

2.3. DUCT INSULATION

2.3.1. Type D1 - Inorganic mineral fibre blanket:

.1 To ASTM C553 “Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.”

.2 Flexible blanket, with foil scrim kraft (FSK) facing jacket vapour barrier.

.3 Density: 24 kg/cu.m. (1.5 lbs/cu.ft.).

.4 Suitable for temperature range of duct application in question.

.5 Acceptable manufacturers:
- .1 Johns Manville
- .2 Knauf
- .3 Rockwool

2.4. JACKETS

2.4.1. All service jacket (ASJ)

.1 As indicated in insulation types above.

2.4.2. Foil skim kraft (FSK)

.1 As indicated in insulation types above.

2.4.3. Insulation Jacketing System:

.1 Multi-layered, reinforced laminate jacketing tape with acrylic pressure sensitive adhesive.

.2 Zero permeability; self-adhesive; UV and weather resistant.

.3 Colour: Natural aluminum or white, as chosen at Shop Drawing stage.

.4 Finish: flat or embossed, as chosen at Shop Drawing stage.

.5 Acceptable manufacturers:
- .1 3M – VentureClad Insulation Jacketing System 1577 Series

2.5. SECUREMENT

2.5.1. Banding

.1 Aluminum or Stainless steel.

2.5.2. Tie Wire

.1 Stainless steel.

.2 Minimum 1.3 mm (16 gauge).

.3 Twisted ends.

2.5.3. Corner beads and channels at floor line:

.1 Minimum 0.4 mm (28 gauge) galvanized sheet metal.

2.5.4. As per insulation / jacket manufacturer's written installation instructions.

2.6. CEMENTS AND ADHESIVES

2.6.1. Where cements or adhesives are required, provide those that are compatible with insulation and jacket, per insulation and jacket manufacturer's written recommendations / instructions.

2.6.2. Vapour barrier dam

.1 CHIL-PERM CP-30 with fibreglass cloth reinforcing.

3. Execution

3.1. INSTALLATION

3.1.1. Install insulation in accordance with the manufacturer's written installation instructions unless noted otherwise.

3.1.2. Insulation thicknesses and conductivities shall meet or exceed the minimum standards set out in ASHRAE 90.1 “Energy Standard for Buildings except Low-rise Residential Buildings” and in National Energy Code of Canada for Buildings (NECB), (refer to Table 2 below), and as specified herein for the services covered.

3.1.3. Apply insulation to clean, dry surfaces only while ambient temperature is at least 10 Deg. C. (50 Deg. F.).

3.1.4. Commence application of insulation following required testing of piping, ductwork, and apparatus where such items are to be covered. Do not commence insulation installation until testing report is submitted to Engineer’s Representative and is reviewed by Engineer’s Representative without requesting a resubmit.

3.1.5. Where pipes and ducts are specified to be insulated, insulate complete piping system and duct system with no gaps in insulation.

3.1.6. Protect insulation and pipe from moisture ingress where insulation is installed exterior to the building.

3.1.7. Utilize oversized hangers and pipe supports where pipes are installed exterior to the building and are to be insulated. Hangers and supports to support assembly on the outside of the insulation, so as to protect insulation and pipe from water damage due to ambient conditions.

3.1.8. Where vapour barrier dams are called for, terminate the insulation and seal the vapour barrier to the pipe or ductwork using a mesh embedded in a vapour barrier mastic. Provide dams at valves, fittings used for servicing, groups of other types of fittings, irregular shaped objects at floor and wall penetrations, and at 15 m (50 ft.) intervals of straight pipe or straight ductwork for the following services: water piping that is less than 26.7 deg. C. (80 deg. F.), including but not limited to the following:

.1 Domestic cold water piping

3.1.9. Terminate insulation on pipes passing through fire rated walls or floors, and fit tight to the fire stop material.

3.1.10. Do not use staples to secure joints of insulation jackets.

3.1.11. Where tie wires are used, install on maximum 305 mm (12 in.) centres.

3.1.12. Install insulation jackets with minimum 50 mm (2 in.) laps.

3.1.13. Provide insulation and jacket systems in accordance with Table 1 below:

TABLE 1: INSULATION AND JACKET SYSTEMS

Pipe Application	**Insulation**	**Thickness**	**Jacket**
Piping services that will be painted	See table contents below	See table contents below	Do not use PVC.
Pipe insulation exposed to view / not concealed, where NOT being painted	See table contents below	See table contents below	Canvas pasted on or PVC
Pipes that are electrically heat traced	Do not use Type P3	See table contents below	See table contents below
Domestic hot water piping	Type P1	Per Table 2	Per insulation type
Domestic cold water piping	Type P1 or P3	Per Table 2	Per insulation type

Drainage piping 75 mm (3 in.) and smaller as indicated below: Sanitary drainage: sanitary drainage pipes from urinals, direct and indirect drains from drinking fountains, floor drains from air conditioning apparatus, all horizontal drainage carrying chilled condensate, all piping passing through areas with relative humidity of 70% or higher, and sanitary drainage pipe from barrier free lavatories.	Type P1 or P3	12 mm (1/2 in.)	Per insulation type
Electrical heat traced piping – insulated for the entire length of piping	As specified for the service being traced; for services not specifically designated, insulate as specified for heating water	For pipes 250 mm (10 in.) and smaller: minimum 38 mm (1-1/2 in.) or thicker as required for the service in question. Provide thicker insulation as required by heat tracing manufacturer's installation requirements.	As specified for the service being traced
Duct Application	**Insulation**	**Thickness**	**Jacket**
Flexible duct connections do not require insulation except where a factory applied insulation has been specified with the flexible duct connection.	See ductwork spec	See ductwork spec	See ductwork spec
Ductwork internal to the building within conditioned spaces	Type D2	25 mm (1 in.)	Per insulation type
Apparatus casings	As per connected ductwork, see table above	As per connected ductwork, see table above	As per connected ductwork, see table above

Outside air plenums and mixed air plenums.	See indoor ductwork above	Thickness to suit minimum RSI-2.12 (R-12) for plenums exposed to outside air.	See indoor ductwork above
Outdoor air ductwork and mixed air ductwork, including ducts to and from independent heat recovery units (ERW, HRV, etc.).	See indoor ductwork above	Thickness to suit minimum RSI-2.12 (R-12).	See indoor ductwork above
Exhaust, relief, supply, and return air: ductwork, plenums and/or casings, through non-air conditioned or unheated internal space.	Per indoor ductwork	Use 50 mm (2 in.) thickness.	Per indoor ductwork
Equipment Application	**Insulation**	**Thickness**	**Jacket**
Radiant heating panels	Type E1	25 mm (1 in.)	Per insulation type
Cold water service: valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges, and other irregular shaped objects	Type E6	To suit service, per Table 2	Per insulation type

3.1.14. Hot Services

.1 On hot services, insulate valves, fittings, couplings, unions, flanges and all other appurtenances through which the fluid passes, using mitred sections of preformed insulation of a thickness equal to the adjoining pipe insulation, and securely wire in place.

.2 For domestic hot water piping, apply insulation with all joints butted firmly together, and bond securely, sealing flaps by pasting down to give a smooth finish.

.3 Provide removable sections at access doors/manholes and all components requiring servicing.

3.1.15. Cold Services

.1 Protect insulation by means of sheet steel shields at each hanger or support on the following:

.1 All sizes of chilled water

.2 Domestic cold water piping 75 mm (3 in.) and larger

.2 Provide Type P5 closed cellular glass insulation inserts the full length of shields at all hangers and supports.

.3 For domestic cold water piping less than 75 mm (3 in.) where hangers on cold water lines penetrate vapour barrier, ensure that the penetration is properly sealed with insulation and vapour barrier continued up hanger a further 75 mm (3 in.).

.4 Where sheet metal shields are used, refer to Section 20 05 29.00 - HANGERS AND SUPPORTS.

.5 On cold water service valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges and other irregular shaped objects, cut and mitre insulation as necessary. Bond and seal edges of insulation to the adjacent surfaces.

.6 Refer to the Table 2 for required insulation thicknesses.

3.1.16. Ductwork and Equipment

.1 Butt join insulation and attach with pins and speed washers, one per 0.186 sq.m. (2 sq.ft.), but not more than 450 mm (18 in.) apart in any direction. Apply fire resistive adhesive in 100 mm (4 in.) wide strips on 300 mm (12 in.) centres. Seal all joints with adhesive and apply vapour barrier tape. Install pins of suitable length for the thickness of insulation and clip flush after final installation of washers. Tack weld pins to sheet metal.

.2 Coordinate with Sheet Metal Contractor to ensure duct insulation is applied prior to ductwork being installed to underside of slabs, beams or other services or behind other duct risers and shafts.

3.1.17. Except where other methods of fire rating are shown on the Drawings, where fire wrap systems for pipes are acceptable to the local authority having jurisdiction, install fire wrap system, in accordance with the CCMC listing and the manufacturer’s written instructions.

3.1.18. TABLE 2: MINIMUM PIPE INSULATION THICKNESS/PERFORMANCE (BASED ON ASHRAE 90.1 AND NATIONAL ENERGY CODE FOR BUILDINGS)

.1 Domestic and Service Hot Water Systems[c]

Fluid Design Operating Temp. range deg. C. (deg. F.)	Insulation Conductivity		Nominal Pipe Diameter - mm (in.)					
	Conductivity [W/(m-K)] [(Btu-in.)/ h-sq.ft. – deg. F.]	Mean Rating Temp deg. C. (deg. F.)	Runouts[b] Up to 51 (2.0)	Less than 25 (1)	25-32 (1 to 1-1/4)	38-75 (1-1/2 to 3	100-150 (4-6)	200 (8) and up
41-60	0.040	38	25.4	25.4	38.1	38.1	38.1	38.1
(105-140)	(0.28)	(100)	(1.0)	(1.0)	(1.5)	(1.5)	(1.5)	(1.5)

.2 Cooling Systems (Chilled Water, Chilled Glycol, Brine and Refrigerant) and Domestic Cold Water

Fluid Design Operating Temp. range deg. C. (deg. F.)	Insulation Conductivity		Nominal Pipe Diameter - mm (in.)					
	Conductivity [W/(m-K)] [(Btu-in.)/ h-sq.ft. – deg. F.]	Mean Rating Temp deg. C. (deg. F.)	Runouts[b] Up to 51 (2.0)	Less than 25 (1)	25-32 (1 to 1-1/4)	38-75 (1-1/2 to 3	100-150 (4-6)	200 (8) and up
5-16	0.039	24	25.4	25.4	25.4	25.4	25.4	25.4
(40-60)	(0.27)	(75)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Below 4.4	0.038	10	25.4	25.4	38.1	38.1	38.1	38.1
Below (40)	(0.26)	(50)	(1.0)	(1.0)	(1.5)	(1.5)	(1.5)	(1.5)

[a] Piping installed exterior to the building shall meet the minimum insulation requirements of Runouts for Heating Systems with a fluid design operating temperature above 177 Deg. C. (350 Deg. F.) or the thickness required by the fluid design operating temperature range, whichever is most stringent.

[b] Runouts to individual terminal units not exceeding 3.7 m (12 ft.) in length located within Partitions within Conditioned Spaces.

[c] Applies to recirculating sections of service or domestic hot water systems and first 2.4 m (8 ft.) from storage tank for non-recirculating systems.

END OF SECTION

21 25 00.00 Portable Fire Extinguishers

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03.00 - SHOP DRAWINGS.

2. Products

2.1. MATERIALS

2.1.1. Portable fire extinguishers shall be rated and identified in accordance with CAN/ULC-S508 “Standard for the Rating and Fire Testing of Fire Extinguishers.” All ratings identified below shall be considered as a minimum.

2.1.2. Provide 6A80BC rating, 4.53 kg (10 lbs.) multi-purpose dry chemical powder type and ULC labelled in Mechanical and Electrical Rooms, as well as in bike / scooter storage spaces.

2.1.3. Provide 4A80BC rating, 4.53 kg (10 lbs.) multi-purpose dry chemical powder type and ULC labelled (ammonium phosphate) in general areas.

3. Execution

3.1. INSTALLATION

3.1.1. Spacing of extinguishers shall conform to the Authority Having Jurisdiction. Maximum spacing for Class B fires in ordinary hazard occupancies shall be 9 m (29.5 ft.) for 10 BC extinguisher and 15 m (49.2 ft.) for 20 BC extinguishers, but in no case shall there be less than one extinguisher in each electrical room, kitchen or mechanical room. Maximum spacing for Type A extinguishers in Class A fires shall be 22.9 m (75 ft.).

END OF SECTION

22 05 76.00 Cleanouts

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03.00 - SHOP DRAWINGS.

2. Products

2.1. MATERIALS

2.2. FINISHED AREAS

2.2.1. Cleanouts in finished areas with membrane floors shall be coated cast iron body with adjustable nickel bronze frame and round scoriated gas tight access cover with secondary gas tight plug. J.R. Smith 4020-F-C, Zurn ZN 1400-KC, Mifab C1100C-R-1-34, Watts CO-100-C-R-1-34G.

2.3. NON-FINISHED AREAS

2.3.1. Cleanouts in non-finished areas shall be all coated cast iron body with heavy duty cast iron or ductile iron top. J.R. Smith 4220-F-C, Zurn Z-1400-KC, Mifab C1100-XR-4-34, Watts CO-100-C-R-1-34G.

2.3.2. Cleanouts at the base of each vertical stack and rain water leader shall be either Daisy or Barrett type.

3. Execution

3.1. INSTALLATION

3.1.1. Cleanouts in furred ceiling spaces shall extend up through floor slab above, except where the Engineer’s Representative gives specific approval to its location in the ceiling space.

3.1.2. Cleanouts shall be installed in horizontal drains at each change of direction and as required.

END OF SECTION

22 11 13.00 Pipes, Valves and Fittings (Plumbing System)

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03.00 - SHOP DRAWINGS.

2. Products

2.1. MATERIALS

2.1.1. Pipes and fittings shall be in accordance with the following unless specified otherwise by local authorities.

2.1.2. All valves on potable water systems shall be equal in performance to the models specified, shall be lead free or low lead meeting the requirements of CSA B125.3 “Plumbing fittings,” CSA B125.14 “Manually operated valves for use in plumbing systems,” NSF/ANSI 372 “Drinking Water System Components - Lead Content,” NSF/ANSI 61 “Drinking Water System Components - Health Effects,” NSF/ANSI 14 “Plastics Piping System Components and Related Materials,” and/or ANSI/AWWA C550 “Protective Interior Coatings for Valves and Hydrants” as applicable.

2.1.3. All city and domestic water, above ground, 75 mm (3 in.) and smaller, less than 1380 kPa (200 psi) working pressure:

.1 Domestic hopt and Cold Pipe: Copper Tubing, Type “L”, Hard Drawn, ASTM B88 “Standard Specification for Seamless Copper Water Tube.” Fittings: wrought copper solder joint pressure fittings, ANSI/ASME B16.22 “Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings” or cast copper alloy solder joint pressure fittings, ANSI/ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings.”

.2 Joints made with 95-5 tin antimony, 96-6 tin silver, or 96-4 tin silver solder, ASTM B32 “Standard Specification for Solder Metal.”

.3 Grooved end copper fittings designed to accept grooved end couplings of the same manufacturer. Fittings shall be wrought copper or bronze casting, conforming to ASTM B75/B75M “Standard Specification for Seamless Copper Tube.” Victaulic Copper Connection Fittings.

2.1.4. For storm and sanitary drains and vents above ground, provide cast iron or copper pipe installed as in regulations; except where copper pipe is used, make joints with 95-5 solder. ABS and asbestos cement (Transite) pipes are not acceptable.

.1 For cast iron pipe fittings on sanitary and storm, provide fittings equal to Bibby-Ste-Croix Husky SD 4000 heavy duty fittings in the following areas:

.1 All vertical to horizontal pipe connections.

.2 All joints in the Lobby and other amenity areas.

.3 Horizontal to horizontal connections within 3 m of the vertical to horizontal connection.

2.1.5. Storm and sanitary, not buried, inside the building, to CSA B1800 “Thermoplastic nonpressure piping compendium”:

.1 For Buildings that are not classified as High Buildings: PVC DWV Schedule 40 and fittings, meeting flame-spread rating not more than 25, per CAN/ULC-S102.2 “Standard Method of Testing for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies,” with pipe manufacturer’s approved solvent weld joints or pipe manufacturer’s approved mechanical joint couplings.

.2 For High Buildings and inside air plenums: PVC DWV Schedule 40 and fittings, meeting flame-spread rating not more than 25, and smoke developed classification not more than 50, both per CAN/ULC-S102.2, with pipe manufacturer’s approved solvent weld joints or pipe manufacturer’s approved mechanical joint couplings.

2.1.6. Vent stack covers:

.1 1100-0T alloy aluminum with vandal proof removable cap

.2 EPDM base seal

.3 PVC coated deck flange or bituminous deck flange as required to suit roof membrane

.4 Insulated for inverted steel roof construction with insulation on top of deck

.5 Unisulated: Thaler Metal Industries SJ-24/SJ-25

2.1.7. Buried storm and sanitary inside the building shall be SDR 28 rigid for 100 mm (4 in.) to 150 mm (6 in.), SDR 35 for 200 mm (8 in.) and larger, green PVC gasketed hub and spigot pattern sewer pipe and injection molded and fabricated gasketed fittings to meet the requirements of CSA B182.2 “PSM type polyvinylchloride (PVC) sewer pipe and fittings” assembled with PVC pipe lubricant.

2.1.8. Buried storm and sanitary, inside the building: PVC DWV Schedule 40 to CSA B1800 “Thermoplastic nonpressure piping compendium.”

2.1.9. Ball valves 50 mm (2 in.) and smaller shall be lead free, bronze body or forged brass 4137 kPa (600 psi) WOG, virgin Teflon seat, TFE stem packing and thrust washer, 1/4 turn open-closed operation with solid ball. Ball valves shall be Watts No. LFB-6000, Toyo 5044A-LF/5049A-LF, Kitz 858/859, Apollo 70LF-100/200, or NCI 600FP-T/S. Stem extensions shall be provided on all ball valves. Ball valves may be substituted for gate valves only.

2.1.10. Except where special features are required or unless otherwise approved or noted, all valves shall be of one manufacturer with the manufacturer’s name and the pressure rating clearly marked on the outside of the valve body

2.1.11. Water hammer arresters shall be stainless steel bellows type and shall bear the Plumbing and Drainage Institute seal of approval. JR Smith 5000 Series, Zurn Z1700, Mifab WHB, Watts SS Series. Piston type are not permitted.

2.1.12. Manual flow balancing valves up to 2 in. (50.8 mm): Victaulic TA Series 790 on domestic water recirculation system.

3. Execution

3.1. INSTALLATION

3.1.1. Valves shall be provided as shown and as required for the satisfactory operation and control of all equipment and shall be installed to enable each piece of equipment to be isolated.

3.1.2. Drain valves shall be installed at each low point in the piping systems and at each tank.

3.1.3. Install building premise isolation back flow prevention as required by CSA B64.

3.1.4. Buried piping shall be of a class and type and laid in a bedding as noted and/or as recommended by the manufacturer and any Authority Having Jurisdiction. Class of pipe and bedding shall take into consideration location, size of pipe, type, width and depth of trench and type of soil.

3.1.5. Connections between copper and steel pipe shall be made with brass or bronze fittings where other type of connection is not specified in regulations.

3.1.6. All piping shall run parallel with closest wall.

3.1.7. Each water hammer arrester shall be accessible for service and replacement. They shall be installed in compliance with the recommendations of the Plumbing and Drainage Institute as found in Standard PDI-WH 201 “Water Hammer Arresters.”

3.1.8. Slope all drains and vents in accordance with the Plumbing Code but not less than the minimum slopes shown on the Drawings. Slope all water lines 25 mm in 12 m (1 in. in 40 ft.) unless shown otherwise.

3.1.9. Install vent piping in accordance with requirements of the authority having jurisdiction.

3.1.10. Vent stack covers shall be properly sized for each vent penetrating the roof. Division 23 shall supply vent stack covers for installation and flashing by the Roofing Contractor.

END OF SECTION

22 13 19.13 Floor Drains

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03.00 - SHOP DRAWINGS.

2. Products

2.1. MATERIALS

2.1.1. Floor drains shall be J.R. Smith, Mifab, Watts, or Zurn.

2.2. FINISHED AREAS

2.2.1. Floor drains in finished areas shall be all coated cast iron body, flashing clamp with seepage openings and adjustable 127 mm (5") diameter nickel bronze 6.35 mm (1/4") thick strainer, secured with SS screws, 100 mm (4") throat on strainer. Drain shall be complete with trap primer connection. J.R. Smith 2005A05NB-P050, Zurn ZN-415-B5, Mifab F1100C-5-1, Watts FD-100-C-A5-1.

2.3. NON-FINISHED AREAS

2.3.1. Floor drains in non-finished areas shall be coated cast iron body, drainage flange, adjustable nominal 200 mm (8 in.) dia. heavy-duty strainer. Drain shall be complete with trap primer connection. J.R. Smith 2110, Zurn Z-536-8, Mifab F1320C-4, Watts FD320-4.

2.3.2. Electronic automatic trap seal primer system with 12 mm (1/2 in.) connection, complete with integral ball valve and CSA B64 backflow prevention to the requirements of the Authority Having Jurisdiction. Pre-pipe the unit with a copper manifold and distribution system suitable for the number of drains served. Provide electrical components with a single point power connection at 120 V. Include with unit a manual override switch and 24 hour timer with relay and adjustable delay. Factory assemble all components and install into a coated steel box with access door for surface mounted installation. Mifab MI 100-UA series; Zurn Z1020 series; Precision Plumbing Products PT Series; or Smith Fluid Controls 270/271/272 Series.

2.3.3. Where acceptable to the Authority Having Jurisdiction, provide trap seal protection device in lieu of hydronic. Trap seal protection is permitted in the following locations:

.1 Trap Guard Pro Vent System, preassembled inline floor drain trap sealer, commercial grade ABS housing and proprietary neoprene diaphragm with soft rubber sealing gasket, ASSE 1072 “Performance Requirements for Barrier Type Trap Seal Protection for Floor Drains” AF-GW rating or approved equal. Install in accordance with manufacturer’s recommendations.

.2 The use of a trap seal protection device does not negate the requirement for the installation of a trap.

3. Execution

3.1. INSTALLATION

3.1.1. Provide electronic trap seal primer assemblies for all floor drain traps. Trap primer shall be installed at the nearest cold water served fixture or faucet, except drinking fountains.

.1 Provide access to primer assembly for repair or replacement.

.2 Provide a globe valve on the water supply for regulation and shut-off.

.3 Where integral backflow prevention is not sufficient to the meet the requirements of CSA B64, provide a reduced pressure backflow prevention device on the water supply to the trap seal primer in a suitable location and discharge piped to drain.

END OF SECTION

22 33 00.00 Domestic Electric Hot Water Heaters

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03.00 - SHOP DRAWINGS.

1.2.2. Ensure Shop Drawings include unit Short Circuit Current Rating (SCCR).

2. Products

2.1. MATERIALS

2.1.1. Compact tankless electric dometic hot water heaters:

.1 Provide compact tankless heaters that are:

.1 98% efficient.

.2 Mounted under sinks or recessed inside a wall enclosure with an access door in washroom areas.

.3 CSA approved and UL listed.

.4 Complete with copper heat exchanger and copper sheathed heating elements.

.5 Manufacturered by Bosch, Bradford White, Rheem or Chronomite.

.2 Refer to drawing for Domestic Hot Water Heater Schedule for sizing.

2.1.2. System shall bear a minimum Short Circuit Current Rating (SCCR) listed by a Nationally Recognized Testing Lab, acceptable to the local Authority Having Jurisdiction, and shall be 10,000 A Lower SCCR listed units implying the use of current limiting fuses ahead of them in the field, in lieu of an actual appropriate SCCR rating, are not acceptable.

3. Execution

3.1. NOT USED

END OF SECTION

22 42 00.00 Fixtures and Trim

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03.00 – SHOP DRAWINGS.

1.3. REFERENCES

1.3.1. Comply with CSA B45 Series of standards for fixtures.

2. Products

2.1. MATERIALS

2.1.1. Plumbing fixtures shall be as indicated and specified with all required supports, accessories, drainage, vent and water connections to make the fixtures complete.

2.1.2. Fittings that supply water to a fixture shall not exceed the maximum flow rates in accordance with the following:Part 7 of the Building Code.Provide fixtures from American Standard, T&S Brass, Toto, Kohler, Franke, Zurn, Blanco, Mirolin or Novanni, equivalent to the fixtures specified. American Standard – Eljer and Placidus are not permitted. Provide white vitreous china fixtures unless indicated otherwise.

2.1.4. Provide fittings and trim from American Standard, T&S Brass, Kohler, Sloan, Chicago Faucets, Zurn, Moen, Symmons, or Delta/Cambridge except where specified otherwise. Provide polished chrome plated brass for all exposed valves, fittings, escutcheons, trim, etc., at each fixture, unless specified otherwise.

2.1.5. Provide Fixtures and Trim equal to Product Specification sheets.

2.1.6. Carriers shall be furnished for all wall hung water closets, urinals, and lavatories. Carriers shall be in conformance with Section 22 42 46.00 - FIXTURE CARRIERS.

2.2. WATER CLOSETS

2.2.1. All flush valves shall have non-syphon by-pass and factory set rate of flow.

2.2.2. Water closets shown as type “WC - Wall hung” shall be "High Efficiency", wall hung for flush valve, vitreous china, elongated syphon jet flush action bowl, 2-1/8" (54 mm) fully glazed internal trapway, 10" x 12" (254 mm x 305 mm) large water surface, 4.2 L (1.1 gal) per flush, 1-1/2" (38 mm) back spud, for use with concealed flush valve. American Standard Afwall Millenium FloWise Elongated 3351.101.020.020 HET, Zurn Z5615-BWL, Kohler Kingston High Efficiency Bowl K-84323-0.

.1 Concealed power harvesting electronic “No Touch” flush valve unit for WC unit above shall be a safe 6 V system with fixed program-automatic 8 second blocking time, field adjustable flush delay setting, volume and sensing range, and manual over ride capability. Low battery alarm, 4 x AA battery backup. The flush valve shall be high

efficiency 4.2 L (1.1 gal.) per flush, factory set flow, concealed quiet action, diaphragm flush and renewable seat with wheel handle angle pressure loss check stop. Unit to be supplied with metal recessed box and vandal resistant stainless steel face, measuring approximately 305 mm x 305 mm (12 in. x 12 in.) for both valve and sensor housing. Sloan Solis 8152-1.28 SWB, concealed Flushometer, or equal.

.2 Seats for WC unit above shall be elongated heavy-duty solid plastic open front toilet seat, less cover, with stainless steel check hinge and stainless steel posts, washers, and nuts. Bemis 1955-C, Centoco 500STSCC-001, Kohler Lustra K-4670-C, Olsonite 10CCSS, Zurn Z5955SS-EL.

2.2.3. Water closets shown as type “WC-1 - Wall hung” (Barrier Free Design) shall be "High Efficiency", wall hung for flush valve, vitreous china, elongated syphon jet flush action bowl, 2-1/8" (54 mm) fully glazed internal trapway, 10" x 12" (254 mm x 305 mm) large water surface, 4.2 L (1.1 gal) per flush, 1-1/2" (38 mm) back spud, for use with concealed flush valve. American Standard Afwall Elongated 3353.101.020.020 HET, Zurn Z5617-BWL, Kohler Kingston High Efficiency Bowl K-84323-0.

.1 Concealed power harvesting electronic “No Touch” flush valve unit for WC unit above shall be a safe 6 V system with fixed program-automatic 8 second blocking time, field adjustable flush delay setting, volume and sensing range, and manual over ride capability. Low battery alarm, 4 x AA battery backup. The flush valve shall be high efficiency 4.2 L (1.1 US gal.) per flush, factory set flow, concealed quiet action, diaphragm flush and renewable seat with wheel handle angle pressure loss check stop. Unit to be supplied with metal recessed box and vandal resistant stainless steel face, measuring approximately 305 mm x 305 mm (12 in. x 12 in.) for both valve and sensor housing. Sloan Solis 8152-1.28 SWB, concealed Flushometer, or equal.

.2 Seat for WC unit above shall be elongated heavy-duty solid plastic toilet seat, open front with cover, with stainless steel stainless steel check hinge and stainless steel posts, washers, and nuts. Bemis 1950SS, Centoco 820STS-001, Kohler Lustra K-4650-EB, Olsonite 46SS, ZURN Z5957SS-EL.

2.3. LAVATORIES

2.3.1. Lavatories shown as type “L - Counter mounted (Barrier free design & general use)” shall be 533 mm x 445 mm x 145 mm - 175 mm (21 in. x 17½ in. x 5¾ in. - 6-7/8 in.) deep, counter mounted, vitreous china, rear overflow, and self-rimming with sealant. Unit shall be provided with faucet holes to suit the faucet below. American Standard Cadet Universal Access 949x.001, Kohler Pennington K-2196, or Zurn Z5130.

.1 Hard-wired electronic “no touch” faucet for lavatory unit above shall be a 100 mm (4 in.) centreset, solid cast brass body with integral proximity sensor, with vandal-resistant 0.5 USGPM (1.9 L) flow spray outlet, control module, solenoid, strainer, circuitry, tempered water supplied by mixing valve with back checks and stops housed in 250 mm (10 in.) Sq. recessed metal box with 300 mm (12 in.) Sq. V.P. face, located in wall under basin. Flexible conduit from control module to faucet and solenoid to be provided. Each unit shall be supplied with a 120/24 VAC 50 VA Transformer (15 VA power required for each unit). Delta Commercial 591T0258TR and ELAVT0008ARI with RP32508 transformer, Kohler K-13463/K-13478-A-CP Escutcheon with K-13480-NA power supply, Sloan ETF-600-A-VPB-MIX60-A with EL-154 transformer, Zurn Z6915-XL-CWB-F-MV-SH22-ALBOX with P6000-HW6 Power converter. Lavatories shown as type “L-1 - Wall hung (Barrier free design & general use),” tight space areas shall be 533 mm x 445 mm x 133 mm - 175 mm (21 in. x 17½ in. x 5¼ in. - 6-7/8 in.) deep, wall hung, vitreous china, rear overflow, for concealed arm support. Unit shall be provided with faucet holes to suit the faucet below. American Standard Murro 095x.000, Crane Serena 129, or Zurn Z5324-PED. Provide semi pedestal American Standard Murro 0059.020, Crane Serena 132, Kohler Pinoir K-2035 to cover exposed piping.

.1 Faucet for lavatory unit above shall be 100 mm (4 in.) centreset, solid cast brass body with integral proximity sensor, with vandal-resistant 0.5 USGPM (1.9 L) flow spray outlet, control module, solenoid, strainer, circuitry, tempered water supplied by mixing valve with back checks and stops housed in 250 mm (10 in.) Sq. recessed metal box with 300 mm (12 in.) Sq. V.P. face, located in wall under basin. Flexible conduit from control module to faucet and solenoid to be provided. Each unit shall be supplied with a 120/24 VAC 50 VA Transformer (15 VA power required for each unit). Delta Commercial 591T0258TR and ELAVT0008ARI and RP32508 transformer, Kohler K-13463/K-13478-A-CP escutcheon with K-13480-NA power supply, Sloan ETF-600-A-VPB-MIX60-A with EL-154 transformer or Zurn Z-6915-XL-CWB-F-MV-SH22-ALBOX with P6000-HW6 Power converter. Lavatories shown as type “L-3 - Under counter mounted (Barrier free design & general use)” shall be 480 mm x 400 mm x 86 mm - 140 mm (19 in. x 15¾ in. x 3-3/8 in. - 5½ in.) deep, under counter mounted, vitreous china, rear overflow, with mounting kit. American Standard Ovalyn Universal Access 9482.000, Crane Tiara 1992, Eljer Baroness 051-3399, Kohler Caxton K-2211-G.

.1 Hard-wired electronic “no touch” faucet for lavatory unit above shall be 100 mm (4 in.) centreset, solid cast brass body with integral proximity sensor, with vandal-resistant 0.5 USGPM (1.9 L) flow spray outlet, control module, solenoid, strainer, circuitry, and tempered water supplied by mixing valve with back checks and stops housed in 250 mm (10 in.) Sq. recessed metal box with 300 mm (12 in.) Sq. V.P. face, located in wall under basin. Flexible conduit from control module to faucet and solenoid to be provided. Each unit shall be supplied with a 120/24 VAC 50 VA Transformer (15 VA power required for each unit). Delta Commercial 591T0258TR and ELAVT0008ARI and RP32508 transformer, Kohler K-13463/K-13478-A-CP escutcheon with K-13480-NA power supply, Sloan ETF-600-A-VPB-MIX60-A with EL-154 transformer or Zurn Z-6915-XL-CWB-F-MV-SH22-ALBOX with P6000-HW6 Power converter

2.3.4. Drain for all lavatory units with exposed under counter installation shall be 32 mm (1¼ in.) size, polished chrome plated offset open grid, and cast brass lavatory waste strainer, 17 gauge tubular offset. Safety covers are to be supplied as per local codes. Delta Commercial 33T290, Kohler K-7131-A, McGuire 155WC, Zurn Z8746-PC.

2.3.5. Drain for all lavatory units with concealed under counter installation shall be 32 mm (1¼ in.) size, polished chrome plated inline open grid and cast brass lavatory waste strainer, 17 gauge straight tubular tailpiece. Delta Commercial 33T260, Kohler K-7129-A, McGuire 155A, Zurn Z8743-PC.

2.3.6. “P” trap for all lavatory units shall be polished chrome plated cast brass, adjustable body 32 mm (1¼ in.) size with cleanout plug, 17 gauge tubular wall bend. Safety covers are to be supplied as per local codes for exposed under counter installation. Delta Commercial 33T311, McGuire 8872C, Zurn Z8700-D-PC, Kohler K-8998.

2.3.7. Supplies for all lavatory units shall be a pair of chrome plated, heavy pattern angle lavatory supplies, lockshield, screw driver slot, stuffing box cartridge, 3/8 in. IPS brass inlet supply nipple, flexible braided stainless steel risers, and stainless steel wall flange. Delta Commercial 47T2512SD, McGuire H165LKN3RB, Zurn ZH8820-LR-LK-PC-3.

2.3.8. All lavatories for health care facilities shall have concealed overflows and laminar flow outlets. Modify specified trim model numbers above as required.

2.4. UTILITY SINK UNITS

2.4.1. Janitor sinks shown as “JS-1 - Floor Mounted (Square Unit)” shall be 610 mm x 610 mm x 250 mm (24 in. x 24 in. x 10 in.) deep, floor mounted, precast terrazzo with integral drain and strainer. Stern-Williams MTB-2424, Acorn 242410.

.1 Faucets for janitor sink unit above shall be 200 mm (8 in.) centers, two handle, cast brass wall mount service sink faucet, 2.1 USGPM (7.9 L), polished chrome plated finish, ¼ turn ceramic disk cartridge, rigid pail hook spout, integral stops, color indexed 70 mm (2¾ in.) metal handles with vandal resistant screws, plain spout complete with body mounted vacuum breaker, hose threaded outlet and 1220 mm (48 in.) hose and stainless steel hanger. Chicago Faucet 305-VBRXK, Delta Commercial 28C2083 with 28T911, Kohler K-8905, Zurn Z841L1-XL-SSI-HH.

2.5. EYE WASH STATION

2.5.1. Eyewash station shown as type ‘EW-1’: Haws 7260BT-7270BT or as manufactured by Bradley. Eyewash bowl dimensions: 292 mm (11-1/2 in) diameter, green ABS. Eye-wash spray heads with two GS-Plus spray heads with fliptop dust covers and filter. Powder coated cast aluminum flag handle activation handle. 13 mm (1/2 in.) IPS chrome plated brass stay-open ball valve with teflon seal eye wash valve. 32 mm (1-1/4 in.) NPT female outlet waste connection. Unit third party certified by IAPMO to meet ANSO Z358.1 “American National Standard For Emergency Eyewash And Shower Equipment”. P-trap provided in unit, 32 mm (1-1/4 in.) waste connection to eyewash. Eyewash to be complete with a thermostatic mixing valve suitable for eyewash activation. Valve: all brass and stainless steel construction with vandal-resistant temperature adjustment.

3. Execution

3.1. INSTALLATION

3.1.1. Provide necessary plates, brackets, cleats, supports, etc., for rigidly securing fixtures in place. Accurately lay out all roughing piping, avoiding offsets.

3.1.2. Examine fixtures for defects. Remove and replace any fixture which, in the opinion of the Engineer’s Representative, is damaged. Make necessary adjustments to ensure fixtures function as per manufacturer’s operating criteria. Clean and polish all fixtures and trim upon completion.

3.1.3. Ensure wall-mounted fixtures with back water connections have an adjacent access door, unless the pipe space is sufficiently wide to allow the water connection to be made from within the pipe space. For this, pipe space shall be 600 mm (24 in.) minimum clear width.

3.1.4. Fixtures shall be installed symmetrical with wall tile pattern, unless otherwise dimensioned or shown on Architectural Drawings.

END OF SECTION

22 42 46.00 Fixture Carriers

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings and/or catalogue cuts of all items supplied in accordance with requirements of Section 20 05 03.00 - SHOP DRAWINGS.

2. Products

2.1. MATERIALS

2.1.1. Fixtures carriers shall be J.R. Smith, Zurn, or Mifab, or Watts.

2.1.2. Carriers shall be furnished for all wall hung water closets, urinals, lavatories, service sinks and drinking fountains. Carriers shall be floor mounted and supported independently of the wall. Carriers shall be suitable for each particular fixture. Carrier feet shall not project beyond finished wall.

2.1.3. All fixture carriers with integral cast iron fittings shall be certified to CSA B70 “Cast iron soil pipe, fittings, and means of joining” as required by Authority Having Jurisdiction.

2.2. WATER CLOSET CARRIERS

2.2.1. Carriers for water closets with single adjustable horizontal discharge shall be 100 mm (4”) all coated cast iron fittings, rear anchor bolt factory assembled, face plate with rear anchor support, heavy duty legs, adjustable short cast iron nipple, plated hardware, cap nuts, test plug and protection cap. J.R. Smith 0211Y-2-M51-95, Zurn Z1203-N(L/R)4-29, Mifab MC-10-3-6, Watts CA-101-(L/R)-M3-M12.

2.3. LAVATORY CARRIERS

2.3.1. Carriers for barrier free wall-hung lavatories shown as L-1 shall be all coated with rectangular steel uprights, welded block base feet support and extended concealed arms with locking device and levelling screws. J.R. Smith 700-27-M31, Zurn Z1231-79, Mifab MC-42, Watts CA-411-W.

3. Execution

3.1. INSTALLATION

3.1.1. Rigidly secure all fixture carriers to the floor using approved anchor bolts and inserts.

3.1.2. Verify the finished wall location and type of wall construction and elevation of finished floor before installation of carriers.

END OF SECTION

23 05 93.26 Testing and Balancing Air Systems

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. QUALITY ASSURANCE

1.2.1. Acceptable balancing companies are limited to the following:

.1 Design Test
.2 Pro-Air Testing Inc.
.3 VPG Associates
.4 Airwaso
.5 Leslie Danhart Inc.
.6 Air Audit
.7 Dynamic Flow Balancing Ltd.
.8 Vital Canada Group Inc.
.9 Design Test

2. Products

2.1. NOT USED

3. Execution

3.1. SYSTEM BALANCING

3.1.1. Balance the complete air system including air volumes and control settings under maximum system pressure drop conditions (filter at replacement condition). Test the entire system for noise, tightness of joints and proper functioning of the system. Make noise tests under minimum system pressure drop conditions (highest air velocities and clean filter conditions). Make necessary alterations and repeat the tests until satisfactory operation is achieved.

3.1.2. Adjust minimum outside air controller and adjust return air and exhaust air damper linkages to ensure correct air quantities.

3.1.3. Employ one of the qualified Independent Balancing Companies to balance the air systems.

3.1.4. The Independent Balancing Company measures and reports upon the air volume at each diffuser, register and grille. Report shall also show the air quantity handled by each fan, the static pressure upstream and downstream of the fan, the fan speed and the motor current. Also to be reported upon are the air flow at outdoor, return and exhaust air dampers under conditions of minimum outdoor air.

3.1.5. Provide assistance to the air balancing company and shall provide control settings, new filters, and other incidentals and equipment required for the measurements.

3.1.6. Air volumes measured by the balancing company shall be within plus or minus 5% of those shown on Drawings for diffusers, grilles and registers and within 10% for fans.

3.1.7. In all cases where measurements by the balancing company show failure to comply with the Drawings and Specifications, engage the balancing company to rebalance the system at no increase to Contract Price.

3.1.8. The balancing of the air and water systems shall be performed by the same balancing company.

3.1.9. Balancing company to review Mechanical Contractor’s proposed access door locations and sizes per Section 20 05 63.00 – ACCESS DOORS AND ACCESSIBILITY and ensure that sufficient access is available.

END OF SECTION

4. 23 09 00.04 Building Automation System (BAS)

5. General

WORK INCLUDED

provide a standalone system to control the equipment as required. System is to not be integrated into a BAS at anytime.

RELATED SECTIONS

Section 23 09 23.00 – SEQUENCE OF OPERATION FOR BAS

Section 26 05 01.00 - ELECTRICAL GENERAL REQUIREMENTS.

SYSTEM OUTLINE

Control system to consist of microprocessor based DDC controllers.

Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, passwords, engineering and programming software required for the ongoing maintenance and operation of the BMS.

FUNCTIONAL PRINCIPALS

Each controller to operate independently by performing its own specified control, alarm management, operator I/O and historical data collection receiving information from input field devices and controlling output field devices to perform the control sequences.

MECHANICAL CONTRACTOR TO CARRY THE COST OF CONTROLS CONTRACTOR.

SUBMITTALS

Product Data and Shop Drawings:

Before start of construction, submit completely engineered and coordinated shop drawing package including graphics samples

Provide drawing files through Electronic Fire Transfer.

Specifications and Instructions: Indicate: dimensions, capacities, electrical characteristics, mechanical characteristics, environmental characteristics, performance characteristics, finishes. Circle model number for Products provided or furnished. General catalogue sheets are not acceptable. Provide installation instructions.

Sequence of Operation: Provide a complete description of operation to Section 23 09 23.00 - SEQUENCE OF OPERATION FOR BAS. Provide description of operation for interlocks that directly connect to the Work. Indicate references to the system flow diagram by control device designation or point object name.

Project as-built documents:

Operation and Maintenance Manuals:

.1 Sections:

Contact Information: Provide names, addresses, 24-hour telephone numbers of service representatives and installing Subcontractors.

Operation: Provide Owner operating manuals for Operator Interfaces, Controller Resident Software, DDC Controllers, Advanced Application Controllers, Specific Application Controllers, control devices, compressed air system. For Custom Application Programs (Algorithms) Editor, provide a reference manual for the language syntax that describes each function.

Preventive Maintenance Procedures: Provide for Operator Interfaces, controllers, control devices. Provide a schedule of tasks; indicate dates for inspection, maintenance and calibration; indicate the pages in the engineering, installation and maintenance manuals that list the procedures.

Replacement Parts List: Indicate: manufacturer name, manufacturer model number, Supplier name, Supplier address, Supplier telephone number.

Certificates: Provide original issue certificates for installation, maintenance and calibration.

Provide licenses, guarantees and warranty documents for Products and systems.

As-built Product data and Shop Drawings:

Provide drawing files through Electronic File Transfer.

Points Schedule: For points schedule generated under Part 1: Submittals, Product Data and Shop Drawings, indicate operating conditions for point object data; list point objects by system designation and alphabetically by point object name.

Time-of-Day (TOD) Schedules: Indicate: objects assigned to the TOD Schedule, Occupied Mode times.

WARRANTY

Warrant the Work free from defects for a period of 12 months and in accordance with the General Conditions and as amended below.

Warranty start date will be the date the Work is accepted under Part 3: Execution, Demonstration.

Provide a single warranty start date even when the Owner has received beneficial use prior to acceptance of the Work. For Work split into multiple contracts or for a multi-phase contract, provide a separate warranty start date and period for each contract or phase.

Adjust, repair or replace defects and failures in the Work at no additional cost during the warranty period and without reduction in service to the Owner. Provide warranty service during normal business hours and within 24 hours of the Owner’s request for service.

Provide warranty service by factory trained service representatives of the Supplier.

Replace Operator Interface software, Controller Resident Software, controller firmware and database files with revisions that correct deficiencies or defects during the warranty period at no charge to the Owner. Notify the Owner of changes and schedule the installation. Update Operation and Maintenance Manuals with firmware release notes.

Warrant Products that are reconditioned under the Work to the same requirements as new Products.Products

MATERIALS

New Products: Non-beta versions currently under manufacture and have been applied in similar installations for a minimum period of one year.

Revisions: Latest available revision for Controller Resident Software and controller firmware at start of Warranty.

Replacement Parts: Readily available and not scheduled for discontinuation at time of Total Project Completion.

Expansion: Expandable through additional inputs and outputs and to card access, security, fire alarm, lighting control systems and other building systems.

STANDALONE BAS

The communication protocols utilized for peer-to-peer communications will be BACnet. Use of a proprietary communication protocol for peer-to-peer communications in any Tier is not allowed.

High speed data transfer for alarm reporting, point log reporting and uploading/downloading of programs.

Single or multiple node failure reporting.

Message and alarm buffering to prevent data loss.

Error detection, correction and re-transmission to ensure data integrity.

Synchronization of the real time clocks in the Building Controllers and Advanced Application Controllers.

Employ a device count capacity license model that supports expansion capabilities.

Shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default:

BACnet,MODBUS

POWER SUPPLIES AND LINE FILTERING

Provide a separate power supply for every Building Controller, Advanced Application Controller and Application Specific Controller for terminal units.

Power Supplies:

Power Supply Voltage: 24 V, unless indicated otherwise on Drawings. Standalone Control BAS Contractor may substitute 120 V power supply with 120 V power supply and wiring at no additional cost to Owner, including impacts to other Contractors. BAS Contractor to carry the cost of impacts to all other Contractors. BAS Contractor to coordinate with all other Contractors.

Built in over voltage and over current protection.

Able to withstand 150% current overload for at least 3 seconds without trip or failure.

Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations and controllers.

CABINETS

Type: NEMA rated and suitable for installed environment.

Door: Hinged with key-lock latch with common key for all cabinets; provide duplicate keys; for Application Specific Controllers provide screwed tight slide-off cover.

Controllers, transducers and relays mounted on backing board or DIN rails within inner section behind hinged doors.

CONTROL DEVICES

Motorized Control Dampers:

Sizing:

Dimensions: As indicated. Maximum damper section size: 1200 mm x 1500 mm (48 in. x 60 in.). For dampers larger than the section maximum, use an assembly of multiple, equally sized sections.

Two-position: Parallel blade.

Modulating: Opposed blade. Parallel blade dampers may be used for return air and bypass applications.

Frame: 125 mm x 25 mm x 3 mm (5 in. x 1 in. x 0.125 in.) 6063T5 extruded aluminum with mounting flanges on both sides.

Blades: Airfoil shape, 6063T5 extruded aluminum, maximum 150 mm (6 in.) depth.

Seals:

Blade Edge: Extruded thermoplastic rubber (TPR) suitable for -58 deg. C to 135 deg. C (-72 deg. F to 275 deg. F), mechanically locked in place and easily replaceable in the field.

Blade Jamb: Spring-loaded stainless steel.

Bearings: Molded synthetic.

Linkage: Corrosion resistant steel and concealed in the frame.

Drive Shaft: Corrosion resistant steel of square or hexagon shape.

Axle: Corrosion resistant steel.

Leakage: Maximum 40.6 L/s/sq m (8 CFM/sq ft) at 1.0 kPa (4 in. w.g.) of differential pressure across fully closed damper when tested to AMCA Standard 511.

Make and Model: Ruskin CD-50 or equivalent.

Actuators For Dampers, Electronic:

Control Signal: Compatible with BC, AAC and ASC.

Operating Time: Maximum 120 seconds throughout the full rotation or fast acting 75 seconds for critical systems with 2 position control.

Angle of Rotation: Adjustable between 0° to 90°.

Stall protection: Mechanical or electronic.

Actuators shall have electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation.

Failsafe: spring return for other applications. Spring return to normal position within 15 seconds or less than 10 seconds for critical systems with 2 position control.

Manual Override: Crank type. External gear release for fail in place actuators.

Position Indicator: Reversible for clockwise or counter-clockwise rotation; set the 0 degrees mark to the failsafe position.

Torque: To damper manufacturer’s requirements to provide complete compression of seals between frame and blades and for smooth control.

Provide 2 SPDT auxiliary switches for critical systems dampers to prove open-closed.

Electric Relays:

Type: General purpose; enclosed coil; diodes provided for inductive switched loads; override button; LED “energized” indicator; plug-in type base.

Contact rating, configuration and coil voltage suitable for application.

Regulatory: UL listed.

Damper End Switches:

Type: Lever operated activated by blade position.

Electrical Contacts: Rated for 10 A resistive, 6 FLA at 120 VAC.

Regulatory: UL listed.

Electromechanical Thermostat:

Wall Mount:

.1 Provide samples of covers to Part 1: Submittals, Samples.

.2 Low Voltage:

Type: 24 VAC, bimetal-operated, mercury-switch; adjustable or fixed anticipation heater; vented ABS plastic concealed cover.

Set Point: Range: 13 deg. C to 30 deg. C (55 deg. F to 85 deg. F); 1 deg. C (2 deg. F) maximum differential.

Space Temperature Sensors:

Stainless Steel plate sensors or white-plate sensors For installation throughout the facility where local control is not required (such as corridors or lobby) unless otherwise noted.

Covers for Wall Mount Sensors:

.3 Overrides: Exposed set point adjustment and override button.

.4 Communication Port: For communication between Portable Operator Terminals and ASC controllers.

Outside Air Temperature Sensors:

.5 Outside air temperature sensors shall be designed to withstand the environmental conditions to which they will be exposed.

.6 The sensors shall be provided with a solar shield.

.7 Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

AC Current Sensing Switches:

Type: Self-powered solid-state with split-core.

Electrical Contacts: Rated for 1 A resistive at 30 VAC/DC.

Insulation Rating: 600 VAC.

Adjustable trip point with LED status indicator.

Water Flow Meters:

Provide an Electromagnetic Flow Meter complete with integral or remote transmitter.

The transmitter shall include a backlit graphic display and keypad. Output signals shall be 4-20 mA and programmable pulse.

The flow meter shall be installed either in the supply or return pipe of the system to be measured following the manufacturer’s written instructions. The flow meter size shall be selected based on the minimum and maximum flow range for the application.

Connections to the piping shall be ANSI class 150 flanges (ANSI class 300 where required).

The flow tube shall be epoxy coated steel; the sensing electrodes shall be 316SS; the liner shall be polypropylene or ebonite for low temperature service, PFTE for hot water service (302 F maximum).

Each flow meter shall be individually wet-calibrated and accurate to within ±0.2% of reading from 3 to 33 feet per second velocity. A certificate of calibration shall be provided with each flow meter.

The flow meter shall be capable of measuring bi-directional flow.

For installations in non-metallic pipe, an internal grounding electrode shall be provided which eliminates the need for external grounding rings.

Each flow meter shall be factory programmed for its specific application, and shall be re-programmable using the integral keypad on the converter (no special interface device or computer required).

Make and Model: ONICON F-3000 Series Electromagnetic Flow Meter or equivalent.

WIRE AND CONDUIT

Conduit: Electrical metallic tubing EMT with compression type fittings in dry locations; cold rolled steel zinc coated or zinc coated rigid steel with threaded fittings in wet locations or where exposed to weather.

Wire:

Network:

.1 Per controls manufacturer recommendations

.2 Refer to Division 27

Analog Input, Output: Stranded 18 gauge copper twisted shielded.

Binary Input, Output: 18 gauge, minimum insulation rating of 600 volts.

Class 2: FT-6 without conduit in ceiling plenums; FT-4 in conduit for all other cases.

Plenum rated wiring to be used.

6. Execution

GENERAL WORKPERSONSHIP

Install all controllers, cabinets, control devices and power supplies in readily accessible locations providing adequate ambient conditions for its specified application and to the Canadian Electrical Code.

Install Products to manufacturer’s installation instructions.

Install parallel to building walls and floors unless indicated or specified or required by manufacturer’s installation instructions.

Mechanical Contractor shall install all in-line devices such as tempeOPERATOR INTERFACE

Graphics: Generate graphic representations for systems under Section 23 09 23.00 - SEQUENCE OF OPERATION FOR BAS and as follows:

Floor plans: Indicate: Equipment rooms; point object data for temperature, humidity and pressure. Directly access graphic representation for terminal systems.

Systems: Indicate: Equipment, service connections, point object data, set points, reset schedules. Highlight point objects under operator command.

Graphic representations link to and display graphic representations for associated systems.

CONTROL DEVICES

Provide or furnish control devices as indicated on the Drawings and to the requirements of this Section and to execute sequence of operation under Section 23 09 23.00 - SEQUENCE OF OPERATION FOR BAS.

Provide or furnish control devices as indicated on the Drawings and to the requirements of this Section and to execute sequence of operations.

Motor Operated Dampers (Insulated and Uninsulated):

Furnish motor operated dampers for installation under Section 23 31.13.00 - DUCTWORK AND SPECIALTIES. Provide supervision on site during installation.

Install in areas maintained above freezing.

Install insulated motor operated dampers on all systems that connect with (or transfer air to/from) the exterior ambient environment and operate intermittently (i.e. time of day schedule, temperature sensor controlled, etc.).

Actuators for Dampers, Electronic:

Mounting: Direct coupled to drive shaft or jackshaft using a V bolt design.

Samples: Provide for wall mount type to Part 1: Submittals, Samples.

Wall Mount Type:

.1 Cover Colour: White.

.2 Install to furred-in columns and permanent walls on concealed junction boxes supported by wall framing or surface mount 1.2 m (4 ft) above finished floor. Installation to mobile and temporary partitions is not acceptable.

.3 Installation to exposed architectural concrete columns and walls is not acceptable, unless otherwise indicated or specified. For installation to concrete, set conduit in place before pouring of concrete.

Single Point Type, Duct:

.4 Provide sufficient contact with process fluid to measure average conditions.

.5 Apply pipe sealing compound to plug thread.

Single Point Type, Pipe:

.6 Provide sufficient contact with process fluid to measure average conditions.

.7 Install with heat conducting fluid in wells.

Outdoor Type:

.8 Install to north side of building away from sources of heat such as lamps and exhaust vents; to greater than 1500 mm (5 ft) above horizontal surfaces.

.9 Where indicated or specified for installation in outside air intake, locate so as not to be affected by exhaust air flow or reverse flow.

.10 Provide solar shield. Install shield to open downward.

.11 Seal interior of conduit at penetration through exterior wall.

Guards for Thermostats and Temperature Sensors:

Provide for wall mount sensors and thermostats where indicated on the Drawings.

Samples: Provide to Part 1: Submittals, Samples.

DEMONSTRATION

When all tests have been completed and the documentation completed, request a meeting with the Consultant and Owner. Provide at this meeting a demonstration that all systems on the controls are operating.

INSTRUCTION AND TRAINING

Provide one day of instruction that shall cover the operation and maintenance of the control systems.

6.1.2. As part of the service, provide 24/7 contact number for service calls. Maximum response time to be 4 hours.

6.1.3. Provide a price for a one-year service agreement based on the above requirements to come in to effect upon the completion of the warranty period. Show this price as separate line item: Service Agreement.

6.1.4. Not included in the contract is the following: any customer initiated changes and additions to the system

END OF SECTION

23 09 23.00 Sequence of Operation for BAS

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS and SECTION 23 09 00.00 - BUILDING AUTOMATION SYSTEM (BAS).

1.1.2. The locations of all sensors shall be discussed with and approved by the Owner and/or Engineer's Representative, before installation. Locations shown are approximate only, and are given to assist the Contractor in pricing only, and shall not be construed as being the final approved location.

1.1.3. The control sequence descriptions are complementary. Provide detailed sequences of operation and all points required to implement the sequences.

1.1.4. All settings and set points listed in this Section shall be variable and Operator adjustable without the need to create or modify Custom Application Programs.

1.1.5. All set points and reset schedules shall be visual on the associated dynamic graphic.

1.1.6. Where the project includes an existing BAS, ensure that any upgrades to the existing BAS for this project scope does not negatively impact existing BAS infrastructure. Maintain the functionality of existing controls not revised by this scope of work.

2. Products

2.1. GENERAL APPLICATION PROGRAMS

2.1.1. Provide a specific set of programs to achieve automated, operator independent control of facility sub-systems.

2.1.2. Refer to SECTION 23 09 00.00 - BUILDING AUTOMATION SYSTEM (BAS) for software programs.

3. Execution

3.1. ERV UNIT CONSTANT VOLUME

3.1.1. Applicable Systems:

3.1.2. System Start:

.1 System start shall be initiated through time of day schedule. Upon signal to start the system, Exhaust Air Damper (EAD) opens. Open position end switch (EADES) enables exhaust fan to start when exhaust air damper is fully opened. Upon the signal to start the supply fan, Outdoor Air Damper (OAD) opens. Open position end switch (OADES) enables the supply fan to start when outdoor air damper is fully opened. ERV enthalpy wheel shall be enabled.

3.1.3. Normal Operation:

.1 The enthalpy wheel shall run continuously while ERV is running.

.2 ERV shall run for minimum 30 minutes.

.3 Enthalpy wheel standby mode: enthalpy wheel shall be rotated one and a half rotation once per day when not in use.

.4 Electric Pre-heat coil shall be enabled, and shall ensure minimum outside air temperature to the ERV is Minimum 46 deg. F.

.5 Electrical heating coil shall be enabled, and shall ensure minimum discharge air temperature from the ERV is 74 deg. F.

3.1.4. System Stop:

.1 System stop shall be initiated when the time of day. Upon signal to stop, the ERV supply and exhaust fans shall stop and enthalpy wheel shall be stopped. Exhaust Air Damper (EAD) and Outdoor Air Damper (OAD) shall close.

3.1.5. Alarms:

.1 Supply Fan Status (SFST) from current sensor.

.2 Exhaust Fan Status (EFST) from current sensor.

3.2. FORCE FLOW HEATER / RADIANT CEILING PANELS

3.2.1. Applicable Systems:

3.2.2. System Start:

.1 System shall be enabled only in winter mode.

.2 System start shall be initiated by space temperature demand. Upon signal to start the system, supply fan shall start.

.3 Normal Operation Winter Mode:

.4 Unit shall modulate to maintain Space Temperature (SPCT) at set-point.

3.2.3. System Stop:

.1 System stop is initiated when space temperature is satisfied. Upon signal to stop the system, the fan shall stop.

.2 System shall be disabled in summer mode.

3.2.4. Alarms:

.1 Supply Fan Status (SFST) from current sensor.

.2 Space Temperature (SPCT) out of range.

END OF SECTION

23 31 13.00 Ductwork and Specialties

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Shop Drawings

.1 Submit Shop Drawings of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.

.2 Submit Shop Drawings of each supporting structural assembly required in the ductwork systems, designed by an engineer licensed to practice in the Place of the Work in the appropriate discipline. Same design engineer stamps each and every Shop Drawing.

1.2.2. Samples: Submit samples as required.

1.2.3. Submit marked up prints showing detailed locations of all devices mounted in or on ductwork, dimensioning their locations.

2. Products

2.1. MATERIALS

2.1.1. Fabricate all ductwork unless specifically noted otherwise, of galvanized sheet steel with Z180 coating to A653/A653M.

2.1.2. Sealing compound: Minnesota Mining and Manufacturing or other approved manufacturer. Duct tape shall be Duro-Dyne or other approved manufacturer.

2.1.3. Flexible ducting:

.1 Flexible metal ducting shall be Flexmaster Triple-Lock Aluminum Flexible ducting T/L. ULC listing S110.

2.1.4. Flexible Connections:

.1 Ventfabrics, Duro Dyne or Dyne-Air.

.2 For fans less than 0.5 kPa (2 in. wg.) connections shall be minimum 680 gm/sq.m. (20 oz./sq.yd.) fire retardant polyvinyl-chloride polyester fabric equal to Vinyl-Flex.

2.1.5. Dampers:

.1 Construct fire dampers, smoke dampers and combination smoke and fire dampers of stainless steel where dampers are installed in aluminum or stainless steel ductwork.

.2 Fire Dampers: Underwriters' Laboratories Classified to ANSI/UL 555 Standard for Fire Dampers and CAN/ULC S112 Standard Method of Fire Test of Fire Damper Assemblies or ANSI/UL 555C Standard for Ceiling Dampers as applicable.

.1 Fire dampers shall be curtain type, rated as "Dynamic," and shall have the blades clear of the air stream. Fire dampers shall be Type B or Type C as required to suit system air velocity and pressure. Fire dampers in return and exhaust systems may be Type A with the blades in the air stream where permitted by the

Engineer's Representative. Dampers shall be multi-sectional as required to suit size and UL/ULC Listing requirements. Where the specified curtain fire dampers are limited by the UL/ULC Listing for maximum size, they shall be substituted with multi-blade type complete with power actuation and/or fusible link as required to satisfy the fire rating of the partition. Where a fire damper is required to be installed behind a wall grille, Slimline type dampers may be used to provide a flush to wall grille installation..

.3 Fabricate manual duct dampers as shown on Standard Details from galvanized steel 1.26 mm thick (0.048 in - 18 GSG gauge) or heavier. Dampers for ducts up to 300 mm (12 in.) deep shall be one blade carried on a 9 mm (3/8 in.) square steel rod mounted inside the duct. Dampers for ducts of greater depth than 300 mm (12 in.) shall be multi-blade, opposed-acting type, and shall have blades mounted in 38 mm (1-1/2 in.) steel channel frame, and interconnected for operation from one locking type hand quadrant. Dampers for right angle take-off of branch from vertical riser shall have operator extended to an accessible location. For externally insulated ducts, mount quadrant on a bracket, designed to clear the insulation. All dampers shall have indicator to show position of damper blade.

.4 Fabricate splitter dampers as shown on Standard Details from at least the same thickness of galvanized steel as the duct in which it is installed, down to a minimum of 0.95 mm thick (0.0374 in - 20 GSG gauge). Fabricate of double thickness so that the entering edge presents a round nose to the air flow, and mount securely on hinges at the air leaving edge. Length of splitter shall be at least 1-1/2 times the width of the smaller branch duct, but in no case less than 300 mm (12 in.) long. Attach splitter hinge near the air entering edge with support passing through a clamp on the side of the duct, located where it is most accessible for external adjustment and locking of the damper.

.5 Motorized dampers for Control Operation: In accordance with applicable requirements control systems (pneumatic) or central energy management systems section.

2.1.6. Interior Duct Protective Coating: Chlorinated rubber base paint or Eisenheiss Black.

2.1.7. Hardware and Accessories:

.1 Spin-in connections shall be specifically built for that purpose. Dampers shall be a minimum 1 gauge heavier than the ductwork in which it is installed and shall have a full length shaft pivoted at two diametrically opposed points. An indicator shall be attached to the shaft to indicate the damper position.

.2 Hardware for balancing or splitter dampers shall be rattle-free and leak resistant. Bearing rods shall be sized to suit the damper size. Neoprene seals shall be used to minimize leaks. Hardware shall be Dyn-Air or equal.

2.2. FABRICATIONFabricate ductwork in accordance with applicable duct construction requirements of SMACNA.

3. Execution

3.1. INSTALLATION

3.1.1. Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.

3.1.2. Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.

3.1.3. Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.

3.1.4. Hang all ductwork securely and in a rigid manner. Provide hangers in accordance with SMACNA Standard "HVAC Duct Construction Standards Metal and Flexible."

3.1.5. Where pre-engineered support systems are provided, provide systems that have been evaluated and certified by SMACNA as well as a 3rd party evaluation service. Ensure application of pre-engineered support systems comply with the limitations noted in the SMACNA and 3rd party certification documents for the specific product in question (e.g. maximum duct width, single tier trapeze only, etc.). Install pre-engineered support systems in strict conformance to the manufacturer's written installation instructions and the conditions of the SMACNA and 3rd party evaluation documents.

3.1.6. The following low pressure, medium pressure and high pressure duct construction is based on an ASHRAE method of construction, and gives a minimum standard of construction. Alternative ASHRAE or SMACNA duct construction is acceptable, provided it meets the minimum standards as outlined by these Specifications. Submit proposed alternatives for review prior to fabrication.

3.1.7. Low pressure ductwork 0.5 kPa (2 in. wg) static pressure and less as follows:

.1 Rectangular/round duct location:

.1 Ductwork serving fans with an external static pressure of 0.5 kPa (2 in. wg) or less.

.2 Downstream of terminal heating and cooling devices.

.2 Seal ducts to Seal Class C in accordance with SMACNA "HVAC Duct Construction Standards Metal and Flexible" and "HVAC Air Duct Leakage Test Manual."

.3 SMACNA leakage class:

.1 Rectangular ductwork: 16

.2 Round ductwork: 8

.4 Refer to tables for low pressure rectangular duct construction and round duct construction below for further duct construction requirements.

3.1.8. Comply with the tables below in conjunction with the clauses above.

TABLE 1: LOW PRESSURE RECTANGULAR DUCT CONSTRUCTION

MAX. DUCT DIMENSION	SHEET METAL US GAUGE	TRANSVERSE JOINT CONNECTION AND BRACING
Up to 300 mm (12 in.)	26	Flat drive or flat 'S' no bracing
325 mm to 425 mm (13 in. to 18 in.)	24	Flat drive or flat 'S' no bracing
.1 Bracing spacing shown is maximum spacing between two bracings or between bracing and joint. .2 Locate bracings mid-way between joints. .3 Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.		

TABLE 4: ROUND DUCT CONSTRUCTION

1. Round ducts up to 750 mm (30 in.) diameter factory fabricated, helically wound galvanized iron strips with spiral lock seam.			
DIAMETER	STRIP METAL US GAUGE	STRIP JOINT	GIRTH JOINT
Up to 200 mm (8 in.)	26	100 mm (4 in.)	50 mm (2 in.) long slip
225 mm to 550 mm (9 in. to 22 in.)	24	100 mm (4 in.)	50 mm (2 in.) long slip

3.1.9. Seal all joints of all ducts. Brush joints with the compound before and again after assembly. Seal any leaks causing noise.

3.1.10. Seal the bottom and side joints of outside air ducts or plenums water-tight.

3.1.11. Flexible duct shall be connected to sheet metal duct and diffusers using duct sealer, minimum of two screws separated by 180 degrees and metal draw bands. Duct tape is not acceptable.

3.1.12. Flexible ductwork may be used under the following conditions:

.1 Where shown on Drawings to allow easy location of diffusers.

.2 Except where indicated otherwise in clauses below, minimum length of flexible duct used to connect diffusers and interior troffers: 2,400 mm (84 in.).

.3 Except where indicated otherwise in clauses below, maximum length of flexible duct: 3,000 mm (120 in.).

.4 Do not pass flexible ductwork through floors or fire walls.

.5 Install flexible ductwork as a single section of duct (no joints). In the event that building construction requires connection between lengths of flexible duct, use a rigid section of duct as the joint. Secure flexible duct to the rigid section using ties and sealant.

.6 Support flexible duct lengths greater than 2,400 mm (84 in.) at the midpoint with strap hangers.

3.1.13. Where ductwork passes through a wall or floor, other than when a fire damper is required, pack around the duct using a fire resistant material to ensure a sound and airtight joint.

3.1.14. If changes of size of ducts are necessary because of building construction, maintain the same circular equivalent for the new size. Ratio of the longest side of the duct to the least shall not exceed 4 to 1 unless specifically authorized by the Engineer’s Representative.

3.1.15. Select the gauge of metal and method of construction for the new size. Notify the Engineer’s Representative of any change before such changes are incorporated into the Work.

3.1.16. If changes of location of duct are required because of building construction, review with the Engineer’s Representative before the locations indicated are changed in any way.

3.1.17. Make changes of direction of horizontal ducts with elbows having an inside radius not less than 3/4 the width of the duct. Make change of direction from horizontal to vertical duct with elbows having an inside radius equal to the depth of the duct. Where this is not possible due to the building construction, use turning vanes.

3.1.18. Provide flexible connections at each air handling unit (where not provided internally) and fan duct connections before and after any required transitions on the fan inlet and outlet respectively (i.e. on the largest duct perimeter and not directly installed on the fan inlet and outlet to reduce noise and air turbulance).

3.1.19. Install manual duct dampers as shown on Standard Details. Ensure dampers for right angle take-off of branch from vertical riser have operator extended to an accessible location. Adjust quadrants to clear duct insulation.

3.1.20. Provide splitter dampers as shown on Standard Details.

3.1.21. Incorporate counterbalanced backdraft dampers where shown. Adjust counterweights to the minimum pressure required to relieve the system pressure. Incorporate gravity backdraft dampers where shown.

3.1.22. Install fire dampers where shown and at all penetrations through all fire rated assemblies. Provide firestop flap type fire dampers where fire dampers are shown in grilles or diffusers at ceiling level. Provide the appropriate fire damper model to suit the installation condition and provide all necessary flanges, frames, fittings, and accessories to ensure a flush installation. Obtain local authorities' approvals for all damper locations and keep one set of marked-up prints on site. Approvals shall be obtained before installation of fire dampers.

3.1.23. Where a fire damper is required to be installed behind a wall mounted grille, provide damper, angles, and retaining devices as required to provide a smooth, flat to wall installation.

3.1.24. Where fire dampers for ducts shown on Drawings require a change of type and/or powered actuation due to dimension limitations to satisfy the cUL Classification requirements, provide transitions as required to adjust duct dimensions while maintaining the equivalent circular duct diameter to avoid exceeding any specific listed maximum dimension. Where transitions are not possible or dimensions cannot be adjusted to avoid powered actuation, provide power from the closest available emergency power source as required. Review all conditions with the Engineer's Representative in advance of fabrication.

3.1.25. Receive automatic dampers from separate Section on site, and set in place under the supervision of the control manufacturer.

3.1.26. Provide access panels at all fire dampers, gravity dampers, motorized dampers, coils, heaters, humidifiers, fan bearings or similar equipment requiring occasional maintenance or inspection. Panels shall be 600 mm x 450 mm (24 in. x 18 in.) or full width of duct if less than 450 mm (18 in.) wide. Panels shall be of double wall construction and shall be internally insulated on insulated ducts. Frame shall be of structural angle with welded corners, gasketed to receive the panel. Panel shall be held in place with 4 window sash locks.

3.1.27. Paint visible internal surface behind each grille or register flat black.

3.1.28. Where duct is acoustically lined, duct dimensions shown are net, inside of lining, free area dimensions.

3.1.29. Provide internal acoustic duct lining in accordance with Section 20 05 48.00 – VIBRATION AND NOISE CONTROL.

3.1.30. Spin-in connections shall only be used downstream of variable volume boxes.

3.1.31. Ductwork shall be run parallel to the closest wall. Coordinate with piping and structural elements.

3.1.32. All exposed open ends of ductwork located less than 2000 mm (79 in) above the finished floor that do not have a diffuser, grille or register shall have a protective screen mounted in a suitable frame to connect the screen securely to the duct, wall and floor as applicable. The screen shall be installed and painted matte black and shall not be capable of passage of anything larger than a 15 mm (1/2 in.) sphere through the openings.

3.1.33. Where acceptable to Engineer's Representative, and where fans shut down upon detection of fire, static fire dampers may be used in lieu of dynamic fire dampers.

END OF SECTION

23 37 13.00 Diffusers, Grilles and Registers

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.3. SUBMITTALS

1.3.1. Shop Drawings: Submit detailed Shop Drawings of all components furnished under this Section. Manufacturer to indicate ceiling installation type for each type of diffuser specified.

2. Products

2.1. MATERIALS

2.1.1. Diffusers, registers and grilles shall be Price, Nailor, Krueger, Titus or Carnes equal to the units specified.

2.1.2. Select all diffusers to provide uniform air coverage without overlap. Air velocity up to a height of 1800 mm (6 ft.) above the floor shall be 0.127 to 0.254 m/s (25 to 50 fpm).

2.1.3. Noise generated by diffusers shall be such that room sound pressure level does not exceed noise criteria 32 with an 8 db room attenuation, the sound power level reference to 10 to -12 power watts.

2.1.4. All volume and air pattern devices shall be fully adjustable from the face of the diffuser, register or grille.

2.1.5. In gypsum board or plaster ceiling applications, provide matching mounting frame. Finish shall be prime painted, off-white in plaster and gypsum board ceilings.

2.1.6. Diffusers shall meet test requirements of ASHRAE Standard 36B-63, including air pattern and noise levels for air quantities from 10 % to 110 % of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63 and NC ratings shall be determined using an 8 db room attenuation factor.

2.2. WALL AND DUCT GRILLES

2.2.1. All supply registers shown as type “B” shall be standard double deflection type with adjustable horizontal face bars and vertical rear bars. Frame shall be gasketted. Construction shall be aluminum with prime coat. Registers larger than listed sizes shall be shop fabricated in Sections such that the Sections will appear as one integral register when installed. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The damper shall be coated or galvanized steel. E.H. Price 620D, Nailor 5100 Series, Krueger 5880 Series, Carnes RNGM.

2.3. RETURN, EXHAUST AND TRANSFER GRILLES

2.3.1. Return registers shown as type “K” shall be standard return grilles with horizontal fixed bars set at approximately 45 deg. for wall returns and set straight for ceiling return. Key operated damper shall be mounted behind. General appearance, type of material and finish shall match the type “…” supply register. E.H. Price 530, Nailor 6100 Series, Krueger S80, Carnes model RSBAH.

3. Execution

3.1. INSTALLATION

3.1.1. Refer to the Architectural Drawings for actual locations of diffusers, grilles and registers and install to suit these Drawings. The Mechanical Drawings show intent and number of diffusers, grilles and registers required.

3.1.2. .

3.1.3. For special mounting of diffusers, grilles and registers refer to Architectural Drawings.

3.1.4. Where rigid duct is connected to the diffuser, grille or register all devices used for flow pattern adjustment, flow balancing and flow equalizing shall be accessible from the face of the diffuser.

3.1.5. Install mounting frame tied into plaster and gypsum board ceilings to allow lay in type diffusers to rest on the frame.

3.1.6. Contractor shall be responsible for mounting concealed flange linear diffusers in heated environment and following manufacturers’ instructions.

3.1.7. Contractor shall caulk around edges of linear diffusers in installations with imperfect walls.

END OF SECTION

23 37 13.01 Louvers

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit detailed louver Shop Drawings in accordance with Section 20 05 03.00 – SHOP DRAWINGS.

2. Products

2.1.1. Provide 103 mm (4 in.) deep, 39 degree stationary blade, drainable, louvers of sizes shown on the Drawings.

2.1.2. Provide extruded aluminum louvers with minimum 2 mm (0.081 in.) wall thickness, with cured fluoropolymer based resin coating meeting salt spray and hardness specifications of American Architectural Manufacturers Association (AAMA) 2605 “Voluntary Specification, Performance Requirements and Test Procedures For Superior Performing Pigmented Organic Coatings on Aluminum Extrusions and Panels.”

2.1.3. Provide louvers of welded construction.

2.1.4. Components: design and size to withstand dead and live loads caused by positive and negative wind pressure acting normal to the plane of louver as calculated in accordance with applicable codes and measured in accordance with ASTM E330 “Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.”

2.1.5. Wind loads: to withstand positive and negative wind pressure when subjected to positive and negative wind loads based on Building Code 50 year probability.

2.1.6. Maximum deflection: L/175 or 19 mm, whichever is the lesser, and non-accumulative.

2.1.7. Provide louvers fitted with 13 mm (1/2 in) aluminum bird screen mounted on interior louver face.

2.1.8. Provide louvers with performance based on AMCA Publication 500-L “Laboratory Methods for Testing Louvers for Rating.”

2.1.9. Provide louvers of E.H. Price, Nailor, or Ruskin.

3. Execution

3.1. INSTALLATION

3.1.1. Install louvers in accordance with manufacturer’s written instructions.

END OF SECTION

23 72 19.00 Energy Recovery Ventilators

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Shop Drawings:

.1 Submit Shop Drawings of all energy recovery ventilators with catalogued components to be supplied. Include manufacturer's data sheets for: performance criteria, ratings, and physical dimensions and finishes.

2. Products

2.1. MATERIALS

2.1.1. Commercial Energy Recovery Ventilators (ERV):

.1 Provide belt driven, indoor type, horizontal and/or bottom return/discharge ERV as shown.

.2 Manufacturer: Mitsubishi Lossnay, Loren Cook, Carnes, Engineered Air, Venmar, Aldes, or Greenheck.

.3 Unit:

.1 Of bolted construction utilizing corrosion resistant fasteners.

.2 Walls and roof: bolted to a 16 ga. galvanized steel base with lifting lugs.

.3 Provided with all internal surfaces covered with 25 mm (1 in.) thick, 3 lb. density foil faced insulation. Fasten insulation with adhesive and weld pins.

.4 Energy recovery wheel mounted in a slide track for easy inspection and cleaning. Provide separate blower and motor for supply and exhaust airstream for independent system balancing.

.5 Blower and motor assemblies mounted on rubber vibration isolators.

.6 Provide 50 mm (2 in.) thick, 30 % efficient pleated filters for supply and exhaust airstreams.

.7 Provide removable side panels for easy access to motors, blowers, filters and energy recovery wheel.

.8 Provide unit with an engraved aluminum nameplate and ship unit in International Safe Transit Association (ISTA) certified transit tested packaging.

.4 Provide units with:

.1 Energy Wheel: A total energy recovery wheel constructed of fluted synthetic fiber-based media impregnated with a non-migrating water selective 4 angstrom molecular sieve desiccant. Wheels with the desiccant applied in a secondary operation will not be accepted. Energy transfer ratings AHRI certified in accordance AHRI Standard 1060 "Performance Ratings of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment."

.2 Electric Re-Heat Coil: Provide coils of the capacity shown on the Drawings. Provide all controls integral to the unit.

.3 Filters: Standard size 50 mm (2 in.) thick, 30 % efficient pleated filters in both supply and exhaust air streams.

.4 Fan Wheel: DWDI centrifugal forward curved type, constructed of painted steel. Wheel balanced in accordance with AMCA Standard 204 “Balance Quality and Vibration Levels for Fans.”

.5 Motor: High efficiency heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure suitable for variable frequency drives where indicated.

.6 Controls and Electrical: All internal electrical components pre-wired for single point power connection. Internal control panel cUL listed with hinged access door and interlocking CSA Type 3R fused disconnect switch. Provide each motor complete with variable frequency drive. Provide a 24 V circuit to allow remote on/off control of ERV by Building Automation System and control each variable frequency drive via a 0-20 mA connection by the BAS. Provide short circuit protection on primary and secondary of control power transformer.

.7 Bearings: Permanently lubricated, sealed ball type selected for a minimum L50 life in excess of 200,000 hours at maximum catalogued operating speed.

.8 Belts and Drives: Provide oil and heat resistant, non-static type belts. Provide precision machined cast iron type drives, keyed and securely attached to the wheel and motor shafts. Size drives for 150% of the installed motor horsepower. Set the variable pitch motor drive to the specified fan RPM at the factory.

.5 Provide unit complete with the following control options:

.1 Filter Sensor – Monitors fan compartment pressure change, which actuates a filter sensor warning light on the unit controller.

.2 Rotation Sensor – Monitors wheel rotation. When wheel stops, sends a 24 V signal to the BAS.

.3 Economizer Mode – Stops wheel during periods when outdoor air conditions are close to indoor air conditions such that sensible and latent heat transfer no longer occurs.

.4 Remote enthalpy sensor.

.5 Preheat Frost Control – Provide outside air temperature sensor. When outside air is below a preset air temperature, energize a two stage electric coil to preheat intake air. Refer to schedule for electric heater kW rating.

.6 Motorized dampers for unit isolation on the outside air and return air.

.7 Backdraft damper on exhaust air discharge.

3. Execution

3.1. INSTALLATION

3.1.1. General:

.1 Install all ventilators with vibration isolation hangers with flexible connections on both inlet and outlet.

.2 Provide full size access panels.

3.1.2. Commercial Energy Recovery Ventilators (ERV):

.1 Install as per manufacturer's written recommendations.

.2 Co-ordinate controls with Section 23 09 00.00 – BUILDING AUTOMATION SYSTEM (BAS).

END OF SECTION

23 82 39.14 Electric Cabinet Heaters

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Submit Shop Drawings of all items supplied in accordance with requirements of Section 20 05 03.00 - SHOP DRAWINGS.

2. Products

2.1. MATERIALS

2.1.1. Provide Electric Cabinet Heaters:

.1 Steel, prime coated casing with minimum thickness of 1.27 mm (0.05 in. – 18 GA).

.2 Tubular finned heating element.

.3 Provide access to the control specified below with an access panel beside discharge grille.

.4 Internal vibration isolation and construction quality to prevent vibration or rattling at any speed

.5 High-limit temperature control with automatic reset.

.6 Fan delay to purge residual heat.

.7 Acceptable manufacturers are Ouellet, Reznor, or Indeeco.

2.1.2. For floor and wall mounted units, provide temperature controllers with bulb firmly clamped in bulb holder in return air stream. For ceiling mounted units, provide a wall thermostat with range, 5 to 25 deg. C. (41 to 77 deg. F.). Program temperature controller to cycle fan and heating element. Acceptable manufacturers are Honeywell, Powers, Johnson, Penn or White Rodgers.

2.1.3. Provide Electric Cabinet heaters with sizes, capacities and other design parameters shown on Drawings or in schedules. Provide model suitable for installation type (exposed) noted.

2.1.4. Provide Electric Cabinet heaters with a single point 120/1/60 electrical connection that powers all components including but not limited to

.1 Fan motor

.2 Control panel

.3 Safeties

2.1.5. Provide permanent split capacitor type motors.

3. Execution

3.1. INSTALLATION

3.1.1. Install in accordance with manufacturer’s current installation guidelines.

3.1.2. Install remote bulb temperature controller inside of wall and floor units. For ceiling mounted units install temperature controller on wall adjacent to unit. Provide all interconnecting wiring.

END OF SECTION

23 83 00.14 Electric Radiation Heaters

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 20 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. Provide Electric Ceiling Radiant panels:

.1 0.9525 mm thick (0.0375 in. – 20 MSG) steel, prime coated, complete with end caps.

.2 Built-in thermostat and controls, unless otherwise indicated on Drawings.

.3 Acceptable manufacturers are Ouellet, Reznor, Dimplex, Stelpro, Chromalox or Indeeco.

2.1.2. Provide Electric Radiant Panels Heaters with capacities as shown on Drawings.

2.1.3. Provide Electric Heaters with a single 120/1/60 electrical connection that powers all components including but not limited to:

.1 Control panel

.2 Safeties

3. Execution

3.1. INSTALLATION

3.1.1. Install in accordance with manufacturer’s current installation guidelines.

END OF SECTION

26 01 00.00 Operating and Maintenance Instructions

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 03.00 – AS-BUILT DRAWINGS.

1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.4. Section 26 08 00.00 – COMMISSIONING.

1.1.5. Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

2. Products

2.1. NOT USED

3. Execution

3.1. REQUIREMENTS FOR MANUALS

3.1.1. A minimum of three copies of complete and approved operating and maintenance instructions for all electrical equipment and systems shall be supplied before substantial completion. Provide additional copies if required under the General Requirements. In addition to the three copies of manuals, the contractor to provide a manual in a searchable PDF format on USB stick or sent via electronic transfer. As-Built Drawings to be included on the USB stick or sent via electronic transfer.

3.1.2. The contractor to identify the cost of AS-BUILT DRAWINGS and the Operation and Maintenance Manuals as a separate line item on their progress draw. The values to be broken out can be found in Section 26 05 03.00 – AS-BUILT DRAWINGS. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received and reviewed without comments.

3.1.3. Binders shall be three-ring, hard-cover, loose-leaf type and identified on the binding edges as “Maintenance Instructions and Data Book”, for “LOWER HILLSIDE WASHROOM BUILDING IMPROVEMENTS.”

3.1.4. Terminology used in all the sections shall be consistent.

3.1.5. Volume One shall contain the master index of all systems, the name of the Contractor, Electrical Subcontractors and the date of substantial performance for the Contract.

3.1.6. Volume One shall contain a section with all necessary warranty information.

3.1.7. Each binder shall have a complete index for all volumes.

3.1.8. Each binder shall be no more than half filled.

3.1.9. There shall be a separate section for all materials used on the project which fall under the WHMIS legislation. There shall be Material Safety Data Sheet (MSDS), hazard data sheet, for each of the materials.

3.1.10. There shall be a separate section for all Insurance Certificates, Test Certificates, Verification Forms and Test Forms.

3.1.11. All relevant information relating to a system or product shall be contained within one binder.

3.1.12. The manual sections shall follow the specification sections.

3.1.13. Any diagrams, installation drawings, single line diagrams charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved they shall be carefully folded and contained within a clear plastic wallet within the manual.

3.2. DATA FOR MANUALS

3.2.1. Equipment data shall contain:

.1 Operating instructions.

.2 Operating conditions such as temperature and pressure.

.3 Location of equipment.

.4 Maintenance instructions and schedules for one-year routine.

.5 Recommended list of spare parts.

.6 Maintenance schedule.

.7 A trouble shooting table showing where to look for problems under various conditions of malfunction.

.8 All wiring diagrams.

.9 Equipment operating curves.

.10 Equipment nameplate data and serial numbers.

3.2.2. System data shall contain:

.1 A listing of all systems.

.2 All panel, mcc and fire alarm schedules and locations.

.3 Equipment name tags.

.4 Cleaning, maintaining and preserving instructions for all material, products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.

3.2.3. Sub-Contractor manuals are required for:

.1 Switchboards and power distribution systems.

.2 Lighting systems.

.3 Emergency power systems.

.4 Fire alarm systems.

3.2.4. As-Built documentation shall contain:

.1 Reviewed As-Built Shop Drawings.

.2 As-Built Construction Drawings.

.3 Originals of test forms.

.4 Originals of test certificates.

.5 Cyber Security Report Letter and backup schedule as required by Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.3. OPERATING INSTRUCTIONS

3.3.1. Instruct the Owner's representative in all aspects of the operation and maintenance of systems and equipment.

3.3.2. Where commissioning is a requirement of the project, the Contractor shall comply with all requirements of Section 26 08 00.00 – COMMISSIONING, for duration of tests.

3.3.3. Instruct the Owner for a minimum of five (5) working days.

3.3.4. All instruction sessions to be video-taped and copy must be provided to the Engineer's Representative/owner.

3.3.5. Arrange for and pay for the services of engineers and other manufacturers' representatives required for instruction on the systems and the equipment as requested by the Engineer's Representative and/or the Owner.

3.3.6. At the time of final review, provide a sheet for each system and piece of equipment showing the date instructions were given. Each sheet shall show the duration of instruction, name of persons receiving instruction, other persons present (manufacturer's representative, Engineer's Representative, etc.), system or equipment involved and signature of the Owner's staff stating that they understood the system installation, operating and maintenance requirements. This information shall be inserted in the manuals after all instructions have been completed.

3.3.7. Review information with the Owner's representative to ensure that all information required has been provided.

3.3.8. Electrical equipment and systems included in the instruction requirements, include but not limited to the following:

.1 Switchboards and related power distribution equipment.

.2 Emergency generator.

.3 Automatic transfer switches.

.4 Fire alarm systems.

3.4. TRIAL USAGE

3.4.1. The Owner shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties nor be construed as acceptance, and no claim for damage shall be made against the Owner for any damage or breakage to any part or parts due to the tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or workpersonship of any kind.

END OF SECTION

26 05 01.00 General Instructions for Electrical Sections

1. General

1.1. WORK INCLUDED

1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.

1.2. DESCRIPTION OF SECTION

1.2.1. The specification is divided into sections of work and a section may consist of the work of more than one subcontractor. The responsibility as to which electrical subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Electrical Contractor.

1.3. SECTIONS AFFECTED

1.3.1. These instructions apply to and form a part of all electrical sections.

1.4. DEFINITIONS

1.4.1. Where used on the Drawings or in the Specifications, the following words are given the meanings below.

.1 Provide: means supply, install, connect, and test.

.2 Demolish: detach existing items and legally dispose of them off site.

.3 Remove and Reinstall: Detach existing items, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: existing items that are not removed and that are not otherwise indicated as being removed, removed and salvaged (turned over to Owner), or removed and reinstalled.

.5 Remove and Salvage: detach existing items and turn over to Owner.

1.5. SCOPE

1.5.1. Provide all labour, materials, equipment and services to complete the work of the electrical division as further specified and as shown on the drawings.

1.5.2. Should any discrepancy appear between any parts of the specifications and/or the drawings to cause doubt as to the true meaning and intent of the drawings and specifications, a ruling shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the following will be assumed:

.1 Where a discrepancy occurs between the specification and the drawings, the more expensive/onerous alternative will be deemed as included in the contract.

.2 Where a discrepancy occurs in the drawings the more expensive/onerous alternative will be deemed as included in the contract.

.3 Where a discrepancy occurs in the specifications the more expensive/onerous alternative will be deemed as included in the contract.

1.5.3. For any equipment/device where circuit numbers and/or panel designation labels are missing and not indicated on the drawings or specifications, a clarification shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the Contractor shall power the equipment/device from the respective 120 V/208 V or 600 V electrical panel serving the equipment in that area at no additional cost to the Owner.

1.6. REGULATIONS

1.6.1. All work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of all authorities having jurisdiction except where the requirements of the drawings and specifications exceed the codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.

1.6.2. These specifications are supplementary to the requirements above.

1.6.3. Comply with all guidelines and standards issued by the authorities having jurisdiction.

1.6.4. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the contractor shall notify the Engineer's Representative.

1.7. PERMITS, FEES, AND REVIEWS

1.7.1. Make submissions to obtain all permits. Include for and pay for all fees and arrange for all reviews required for the work of this division.

1.7.2. If required by code, plans and specifications have been previously submitted to the Authority Having Jurisdiction.

1.7.3. Furnish certificates of Acceptance from the Authority Having Jurisdiction and include them in the Operation and Maintenance manual.

1.8. VOLTAGE RATINGS

1.8.1. Operating voltages are as specified in CAN3-C235 (latest edition).

1.8.2. Motors, electric heating, control and distribution devices and equipment are to operate satisfactorily at 60 Hz within operating limits established by the above standard.

1.9. COORDINATION WITH MECHANICAL DIVISIONS.

1.9.1. Unless indicated otherwise on the Electrical Drawings, Electrical Contractor will be responsible for the supply and installation of the following:

.1 Starters.

.2 Line and load side wiring for starters.

.3 Reduced voltage starters including "Soft Start" starters.

.4 Line and load side wiring to variable speed drives, including but not limited to wiring of associated harmonic filters, AC line input reactors, dV/dT filters, and output filters.

.1 Where harmonic filter is complete with a capacitor switching system, route a harmonic filter output conductor through the current transformer window within the harmonic filter. Coordinate with Mechanical Contractor and follow harmonic filter manufacturer's written instructions.

.5 Disconnect switches for all mechanical equipment.

.6 All power wiring (120 V & above) to all mechanical equipment.

.7 Electrical ramp heating cables and controls.

.8 All motorized damper power connections (120 V & above).

.9 Fire alarm devices.

.10 Wiring to electric space heaters.

1.9.2. Mechanical Divisions will be responsible for the supply and installation of the following:

.1 All variable speed drives and control wiring to starters.

.2 Pipe tracing and related controls.

.3 Electric hot water heaters.

.4 All electrical heaters including baseboard heaters, cabinet heaters, force flow heaters and radiant heaters.

.5 All interposing relays, relays, contactors and 120 V control devices.

.6 All 120 V and low voltage control wiring and conduits.

1.9.3. Determine exact location of starters, motors and line voltage controls based on the Mechanical Drawings to coordinate with the locations of all equipment to ensure the required clearances are maintained. If no wall location is suitable for the motor starters, then mount the starters on a plywood backboard on Unistrut supports near the respective equipment to meet the applicable code requirements for motor isolation switches. If a motor or piece of equipment is listed on one of the starter schedules but is not shown on the floor plans, the contractor is to reference the Mechanical Drawings for the location of the respective piece of equipment. No additional costs will be entertained.

1.9.4. Should the Mechanical Contractor change any of the motor or equipment sizes from those identified on the Mechanical Schedules and Drawings at any stage of the project to aide their installation, the Mechanical Contractor will incur all extra electrical costs to revise the electrical feeders/wiring, breakers, fuses, starters and equipment to supply power to the revised piece of equipment.

1.9.5. Should the Mechanical Contractor provide alternates to any mechanical equipment selection by deviating from the make and model identified on the Mechanical Schedules and Drawings, the Mechanical Contractor will incur all extra costs to revise the electrical provisions including but not limited to feeders/wiring, breakers, fuses, starters and equipment to supply power to the alternate piece of equipment.

1.9.6. Where power for any flush valves, hands-free faucets, or other powered plumbing fixtures are shown on the Drawings, provide either a hard wired direct connection or a duplex receptacle, as required for the valve/faucet/fixture in question, based on coordination with the Mechanical Contractor.

1.9.7. Where large smoke dampers or large combination smoke and fire dampers, with multiple actuators per damper, are supplied by the Mechanical Contractor, extend the power connections and fire alarm monitoring and control connections shown on the Drawings to each and every actuator.

1.10. PLYWOOD BACKBOARDS, EQUIPMENT MOUNTING, & HOUSEKEEPING PADS

1.10.1. Provide fire rated plywood backboards as shown on the Drawings and mount where all communication equipment is to be wall mounted. Plywood is to be 21 mm, urea-formaldehyde (UF) free and shall be either, Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or CSA Z809 - (latest edition) certified. Plywood to be either fire rated with the appropriate label displayed once installed or coated with fire retardant paint. Do not paint over plywood fire rating certification stamp. All Certification not to be painted.

1.10.2. For clause above, submit documentation as a shop drawing for review by the LEED Representative prior to ordering.

1.10.3. Surface mounted electrical equipment boxes are to be installed on galvanized Unistrut stand-offs. Electrical equipment boxes shall include, but not be limited to electrical panels, low voltage lighting control, fire alarm, security, communication, electrical sub-metering, etc. Panels are to be grouped on common base wherever practical.

1.10.4. Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment.

1.10.5. Provide pre-cast steel re-enforced concrete pads under all outdoor ground mounted electrical equipment, unless a different support structure is detailed on the Drawings.

1.10.6. Additionally, provide steel re-enforced concrete housekeeping pads where shown on the Drawings.

1.10.7. Provide all housekeeping pads with a minimum height of 100 mm above finished floor and do not extend beyond 50 mm beyond the electrical equipment unless shown otherwise on the Drawings. Ensure concrete pads fully cured for 28 days before installing equipment.

1.11. FINISHES

1.11.1. Metal enclosure surfaces are to be finished by the application of rust resistant primer on both the inside and outside, with at least two coats of enamel.

1.11.2. Clean and touch up all surfaces of equipment scratched or marred during shipment or installation. Match the original paint.

1.11.3. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.11.4. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.

1.12. SAFETY

1.12.1. Protect exposed live equipment during construction for personnel safety.

1.12.2. Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

1.12.3. Arrange for the installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.

1.13. FIRE STOPS

1.13.1. Provide fire stops in accordance with front end, and Division 1 documents and as described herein. Contractor to coordinate fire stops with General Contractor.

1.13.2. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.

1.13.3. Fire stops and smoke seal systems: in accordance with CAN/ULC-S115 (latest edition).

.1 Asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 (latest edition) and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating for service penetrations: to suit the latest edition of the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

.3 Fire stop system rating for sealing junction of rated walls to rated floors and ceilings: to suit the National Building Code of Canada with local amendments or the

Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

1.13.4. Service penetration assemblies: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.

1.13.5. Service penetration fire stop components: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

1.13.6. Fire resistance rating of installed fire stop assembly not less than the fire resistance rating of surrounding floor and wall assembly, and in accordance with the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

1.13.7. Fire stops 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.

1.13.8. Fire stops and smoke seal all electrical penetrations through rated assemblies as per ULC Standards.

1.13.9. Where sound and vibration control is required, use an elastomeric seal; do not use a cementitious or rigid seal at such locations.

1.13.10. Primers: to manufacturer's recommendation for specific material, substrate, and end use.

1.13.11. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

1.13.12. 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.

1.13.13. Sealants for vertical joints: non-sagging.

1.13.14. Colour: if range available to Engineer’s Representative's choice of standard colours, generally to match background colour where visible in finished spaces.

1.13.15. Through non-fire or non-smoke separations or where waterproof membrane is field applied, where pipes are insulated, sleeves shall be sized to accommodate the insulation and vapour barrier.

1.13.16. Where-holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.

1.13.17. Submit a complete fire stop system shop drawing package, identifying the products that may be used on the project. Prior to submitting data, review with Authority having Jurisdiction to confirm acceptability of proposed materials and assemblies.

1.13.18. Installation

.1 Install fire stops and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal-holes or voids made by through penetrations, poke through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

1.14. ACOUSTIC TREATMENT

1.14.1. Electrical Contractor will be responsible for coordinating the electrical installation with the recommendations of the acoustic consultant and their report where one has been included in the contract documents.

1.14.2. Refer to the recommendations of the acoustic report where provided, and provide and install acoustic treatments as necessary. This may include separation of receptacles in stud bays, sealing of junction boxes, application of sound insulating materials etc. Coordinate the installation of these materials with the General Contractor and Drywall/Partition Subtrade.

1.14.3. Do not install back to back receptacles/back boxes within the same stud bay wherever possible. Where it is not possible to stagger receptacles, provide acoustic seal around receptacle/back box to provide acoustic isolation/separation of spaces.

1.15. HOISTING

1.15.1. Electrical Contractor will be responsible for the hoisting of all the equipment in the contract. Contractor to coordinate with General Contractor for use of the general hoisting facilities. If hoist facilities are inadequate, then subcontractors must provide their own. Subcontractors must inform general contractors in writing of requirements before tender closing date. Any hoisting required in addition to that provided by the General, will be included in the bid price.

1.15.2. Electrical Contractor to include for the qualified millwrights to move and place all equipment over 1000 lbs. Contractor to provide proof of millwright certification.

1.16. CLEANING AND WASTE REMOVAL

1.16.1. Clean all electrical equipment that has been exposed to construction dust and dirt.

1.16.2. Contractor to clean all electrical equipment, inside and out, prior to turn over to Owner. Equipment is subject to review by Engineer’s Representative and/or Owner.

1.16.3. Contractor is responsible to remove their own waste from the site. All re-usable materials shall be recycled.

1.17. SPRINKLERS

1.17.1. All electrical equipment shall be suitable for installation in a sprinklered environment and enclosures are to be CSA Type 1 with drip hood, sprinkler proof enclosure unless otherwise noted.

1.18. TEMPORARY LIGHT AND POWER

1.18.1. Temporary light and power for construction shall be provided, metered, and maintained by the electrical trade, as directed by the General Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their work.

1.18.2. All temporary light to be fluorescent or LED. Provide adequate lighting to meet all health and safety standards.

1.19. EXAMINATION AND PROTECTION OF SITE

1.19.1. Before submitting Bid, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.

1.19.2. Contractor to document any existing conditions on site and submit a pre-condition survey including pictures. Contractor will be responsible to return the site back to its original form, which includes but is not limited to ground repair including grading and new sod and repair of damaged walls, doors and/or floors.

1.19.3. Contractor is to protect trees and plants on site and on adjacent properties. Plants to be protect with burlap. Trees and roots within construction area to be protected by the erection of temporary 2 m high plywood hoarding at the drip line of the tree. Contractor to avoid unnecessary traffic, dumping and storage of materials at or near trees or plants.

1.19.4. When requested by the Owner and/or Engineer's Representative, the Contractor is to provide digital pictures of the site, including but not limited to progress of work and installed equipment, via e-mail to the Owner and/or Engineer's Representative.

1.20. DRAWINGS AND INSTALLATION

1.20.1. The drawings are intended to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.

1.20.2. The location, arrangement and connection of equipment and materials shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Owner.

1.20.3. Certain details indicated on the drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the drawings.

1.20.4. The actual location of switches, outlets and luminaires, etc. shall be reviewed by the Engineer's Representative before installation.

1.20.5. The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.

1.20.6. Changes and modifications necessary to ensure co-ordination and avoid interference and conflicts with other trades or to accommodate existing conditions, shall be made at no extra cost to the Owner.

1.20.7. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.

1.20.8. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

1.20.9. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Engineer's Representative before proceeding with the work.

1.20.10. Contractor is to review Architect's specifications, drawings and details to confirm locations of devices and equipment.

1.20.11. This Contractor is responsible to mark-out his work, fully coordinated with all other trades, in sufficient time for review by Architectural Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by Architectural Consultant. Do not proceed with any work until the Architectural Consultant has reviewed the layout drawings.

1.20.12. The Contractor will reimburse the Engineer's Representative for their time spent on answering any written questions or requests for information where the answer is clearly identified on the drawings or in the specifications.

1.21. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

1.21.1. The Contractor is to complete installation, interference and setting drawings, dimensioned and to scale for all systems. They shall be made available for review by the Engineer's Representative, if requested. The drawings are required to make clear the work intended or to show its relation to adjacent work or to the work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, drawings of the area involved shall be prepared by this division.

1.21.2. Slab layout drawings are to be submitted for review by the Structural Engineer's Representative. These slab layout drawings are to be included in the as-built drawings. Refer to Section 26 05 03.00 – AS-BUILT DRAWINGS.

1.21.3. Interference drawings are required for shafts, ceiling spaces, basement areas, typical floors and wherever there is possible conflict in the positioning of electrical equipment, piping, ductwork sub-trades or architectural features.

1.21.4. This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for conduit, bus ducts and equipment for review by the Structural Engineer and Architect. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.

1.22. SUPPLEMENTARY BID FORM AND SUBMISSIONS OF BID

1.22.1. Submit with tender, if included in the documents, a complete Electrical Supplementary Bid Form. Tenders not completed in full may, at the discretion of the Owner be rejected.

1.22.2. Several alternative, separate and itemized prices may have been requested. These shall be completed on the Electrical Supplementary Bid Form. Refer to the specific sections of the specifications and to the drawings for details.

1.23. Approved Manufacturers

1.23.1. Where only one name appears in the specification, the bid shall include for the specified equipment.

1.23.2. Where two or more names are shown in the specifications as alternates or equal to, this division can select which manufacturer is to be carried.

1.23.3. The Contractor is to list substitute equipment as a price deduction to the Bid Price on the Electrical Supplementary Bid Form. Space has been provided to show manufacturers not specifically mentioned. Acceptance of substitute equipment shall be at the discretion of the Owner and/or Engineer's Representative. Any substitutes not listed on the Electrical Supplementary Bid Form will not be entertained.

.1 The proposed substitution shall show product name and complete description and also what difference, if any, will be made in the amount of the Bid Price for each substitution, should it be accepted.

.2 Materials and products specified by the name of the manufacturer, the brand or trade name, or catalogue reference, shall be the basis of the Bid Price.

.3 Any alternate and/or substitute equipment listed shall be equal in performance and quality to that specified. If space, power, structural or any other requirements are different from the equipment specified, the cost of any changes shall be included for in the price shown on the Electrical Supplementary Bid Form.

.4 The Owner reserves the right to accept or reject any substitution without question.

.5 The "Base and Alternate Equipment" is for North American manufactured products. Where a listed manufacturer can offer either North American or non-North American source for the equipment, the country of origin shall be shown under "Substitute Equipment" and the cost savings shown under "Deduct from Tender Price".

1.24. PRODUCTS AND MATERIALS

1.24.1. Make and quality of materials used in the construction of this project shall be subject to the approval of the Engineer’s Representative.

1.24.2. All equipment and material are to be CSA certified or approved by an accredited organization. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authorities.

1.24.3. Factory assemble control panels and component assemblies.

1.24.4. Materials and equipment supplied by this division shall be new and free from defects and shall be equivalent in physical characteristics and performance to that specified by the manufacturer's name and catalogue reference.

1.24.5. Where a certain manufacturer's equipment has been specified by name or model number, the contractor shall be responsible for ensuring that the performance and quality meets the specified equipment and that the same access or maintenance space is available for an alternative manufacturer's equipment that is used and that interfacing connections with other trades can be made at no extra cost.

1.24.6. Within 30days of the award of contract, the Contractor is to submit a complete list of the manufacturers for all equipment being supplied on the project.

1.24.7. Availability

.1 In submitting Bid, Contractor warrants that all materials are available in suitable time to meet Contract dates.

.2 Subject to sentence .3 below, where the Contractor advises that the Contractor cannot supply materials in suitable time to meet Contract dates, and should it subsequently appear that Work may be delayed for such reason, the Engineer’s Representative reserves the right to substitute more readily available products of similar character, even if more costly to the Contractor, at no increase in Contract Price.

.3 Where the Contractor can show that the Contractor promptly ordered the originally specified materials the Owner will pay the differential in cost between the originally specified material and the substitute material without any mark-ups applicable by the Contractor, subcontractors, sub-subcontractors or suppliers. For greater certainty, the Contractor’s failure to submit shop drawings or other submittals or seek direction in those instances where the Contract Documents so require in sufficient time to permit ordering materials is not cause for the Owner to pay the cost differential in sentence .2 above.

1.25. CO-OPERATION WITH CONSULTANTS

1.25.1. To assist in the successful execution of the project, the Contractor shall receive a job report that summarizes the expectations of the Consultant and the Contractor. This document covers topics such as progress billings breakdowns, shop drawing requirements, change order pricing breakdowns, the commissioning process, installation drawings, the specifications, as-built drawings and O+M manuals, along with a number of other items. This job report is intended to reiterate and elaborate on key items of the Contract Documents and is not intended to impose new requirements.

1.25.2. At the appropriate time during construction the Contractor shall submit the applicable documentation listed in the “Mechanical/Electrical Unfinished Building Occupancy Checklist”. The list shall be issued by the Consultant during the course of the project; however, a sample checklist can be provided at any time upon request. The checklist shall be completed by the Contractor when the information required for occupancy is submitted. The Consultant shall review the information and checklist and shall identify when the information is complete. The Consultant’s general review letter (required for building occupancy) shall only be issued when all the information requested in the checklist is submitted by the Contractor and deemed to be complete by the Consultant.

1.25.3. For electrical systems occupancy, provide a PDF copy of the following documents to the Engineer's office for review:

.1 Electrical inspection authority inspection certificate/report with no deficiencies.

.2 Fire alarm verification report with no deficiencies.

.3 CAN/ULC-S561 “Standard for Installation and Services for Fire Signal Receiving Centres and Systems” certificate.

.4 Maglock test and verification report with no deficiencies.

.5 CAN/ULC-S1001 “Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems” reports for electrical systems with no deficiencies.

.6 Letter confirming that all emergency lighting and exit signs are installed and illuminated.

.7 Letter confirming that all unit equipment for emergency lighting (batteries, heads, exit signs) are installed and powered and have been tested to demonstrate that they last for the run time indicated in the Specifications or on the Drawings.

.8 Emergency generator testing and commissioning reports with no deficiencies.

.9 Emergency generator TSSA inspection report with no deficiencies.

.10 Fire pump testing and commissioning reports with no deficiencies.

.11 Emergency power (inverter) testing report with no deficiencies.

.12 Seismic Engineer’s letter for seismic restraint system (if applicable).

.13 Letter confirming that all openings in walls and floors for electrical services have been fire stopped.

.14 Cyber Security Report Letter and backup schedule as required by Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

.15 Lighting control commissioning documentation.

.16 Hood fire suppression certificate of acceptance by third party testing agency or signed and sealed letter of assurance from hood fire suppression engineer.

.17 Letter confirming that all breaker trip unit/protective relays settings have been set in accordance with the power system study.

.18 Additional items as indicated by the Engineer’s Representative.

.19 Additional items as indicated on the Occupancy of Unfinished Buildings Checklist issued by Engineer’s Representative.

1.26. CO-OPERATION WITH OTHER DIVISIONS

1.26.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.

1.26.2. Electrical conduits shall not touch or be supported on pipe or duct walls.

1.26.3. Each section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other sections or divisions. Where the space allocated to another section or division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various sections and divisions. Relocation of materials and work involved shall be paid for by the section responsible for the encroachment at no extra cost to the Owner.

1.26.4. The supply of all items is to have built-in to the delivery schedule, ample time for rapid progress of work. Proceed with work determined by the construction schedule.

1.26.5. The Electrical Contractor shall coordinate the exact breaker/fuse sizes with all mechanical equipment shop drawings prior to rough-in and ordering of the electrical distribution equipment. Size of breakers/fuses shown on drawings are based on generic equipment manufacturers and sizes may change depending on successful equipment manufacturer. No additional costs shall be allowed for non-coordinated mechanical shop drawing reviews by the Electrical Contractor.

1.27. TEMPORARY USE OF EQUIPMENT

1.27.1. Where the electrical systems are operated during construction, the Electrical Contractor shall maintain the system and equipment in proper operating condition.

1.27.2. Before any area of the building is turned over to the Owner for acceptance and for beginning of the guarantee/warranty period, the systems and equipment shall be returned to the initial new condition.

1.27.3. Permanent electrical equipment is only to be used upon permission of Owner and Engineer's Representative and is only to be used on a limited basis. All equipment must be cleaned prior to turnover.

1.28. TESTING

1.28.1. General

.1 Refer to the testing requirements outlined in each individual specification section and provide all required staffing, materials, tools and expertise to perform the required testing. Where specification Section 26 08 01.00 - TECHNICAL SERVICES DIVISION STARTUP SERVICE has been included, ensure all testing is performed accordingly by the Technical Services Division Startup Service trade.

.2 This specification is intended to capture the requirements for factory testing, factory witness testing, site startups, site testing and training of electrical equipment. This specification represents a minimum requirement and does not absolve the equipment manufacturers from performing any tests required by the standards referenced in the individual specification sections.

.3 The testing process for the Electrical Systems shall include:

.1 Verification that the installation meets the requirements of the contract documents.

.2 Verification that the system's performance meets the design intent.

.3 Building operator training.

.4 As-Built documentation, operating and maintenance manuals, and systems operating manuals.

.4 The Contractor, Engineer's Representative, Technical Services Division Startup Service (where called for in the Specification) and Commissioning Agent (where identified as part of the project) shall provide the services to complete the process. See further explanation below defining the areas of responsibility.

.5 Provide labour, equipment and material to conduct the testing process as outlined in this Section.

1.28.2. Factory testing

.1 All equipment is to have factory testing performed by the equipment manufacturer. These tests are to include the manufacturers standard factory testing, and any required testing to conform to the standards, and any additional testing referenced in the individual specification sections.

.2 The manufacturer is to perform the required testing and submit test reports recording the results of all tests to the Electrical Contractor for review and if found acceptable submit to Engineer's Representative for Shop Drawing review and the final copy included in the O&M Manuals. Test reports are to be submitted and reviewed by the Electrical Contractor and Engineer's Representative prior to shipment to site.

.3 Any deficiencies noted in the factory testing are to be corrected prior to shipment of electrical equipment unless otherwise agreed to by the Electrical Contractor.

1.28.3. Factory Witness Testing

.1 For all factory witness testing, the manufacturer is to act as the test leader and is responsible for all required organization, coordination, performance of testing and documentation of test results. The manufacturer is to ensure the tests being performed are in alignment with the requirements of the Specification in advance of the testing and provide hard copies of the latest Shop Drawings and test scripts for each attendee of the witness test. Any deviations to the tests being requested in the Specifications and Drawings must be communicated to the Electrical Contractor and Engineer's Representative in advance and must be accompanied with a rationale and/or an alternate test method that demonstrates that the intent of the specified test would be met.

.2 Each factory witness test is to include at a minimum:

.1 Introductions.

.2 A walkthrough of the latest Shop Drawing and review of latest Shop Drawing commentary with discussion on any remaining open items.

.3 A walkthrough of the test script.

.4 A walkthrough of the Design Specifications and Drawings noting/reiterating any required deviations from the design documents in terms of testing requirements.

.5 Performance of tests

.6 At the conclusion of all factory witness tests, the manufacturer is to produce signed factory test results recording all noted results and documenting any remaining deficiencies. Report to include record of the testing instruments used along with calibration dates (where required) and serial numbers.

.3 Factory witness testing shall be attended by the persons as listed below, attendance at the witness testing is at the discretion of each representative and is to be confirmed by all parties prior to witness testing.

.1 One (1) Electrical Contractor Representative

.2 One (1) Engineer Representative

.3 One (1) Commissioning Agent Representative

.4 One (1) Technical Services Division Startup Service Representative

.4 Manufacturers to include for the complete cost of the attendees listed above to attend the factory witness testing for the equipment. Cost to include but not limited to all travel,

food and lodging costs. Manufacturer to note, attendees may be coming from different locations within Canada.

.5 Manufacturer to provide factory witness test scripts to the Contractor as a formal Shop Drawing in advance of the factory witness test for review by the Contractor, Engineer and Commissioning Agent through the formal Shop Drawing review process. Factory witness test shall not be scheduled without a reviewed test script.

.6 Manufacturer to notify the attendees minimum two (2) weeks prior to the date the tests are to be performed. Where travel out of province is required, provide minimum four (4) weeks notice.

.7 Manufacturer to perform their own internal quality assurance and control check prior to any factory witness test such that the manufacturer is prepared to perform the complete demonstration of the equipment.

.8 Any deficiencies noted in the factory testing is to be corrected prior to shipment of the electrical equipment.

1.28.4. Site Startup

.1 Manufacturer to include for the costs of technician(s) to perform initial system startup on site as required by the Specifications and Electrical Contractor. Extent of technician(s) involvement to be coordinated with the needs of the Specifications and the Electrical Contractor.

1.28.5. Site tests

.1 Manufacturer to include for the costs of technician(s) to perform site tests as required by the Specifications and Electrical Contractor. Refer to tests identified in the individual Specification sections and include all personnel and equipment to perform testing.

1.28.6. Materials

.1 The Contractor and Manufacturer shall provide all instrumentation and equipment necessary to conduct the tests as specified in the specifications. The Contractor shall ensure the instrumentation to be used are properly and adequately calibrated and if required by the Engineer's Representative or Commissioning Agent to provide the dates the instrumentation was last calibrated.

1.29. TRAINING

1.29.1. The Manufacturer is to include for qualified technician(s) with project specific knowledge to perform in depth training for facility management team members.

1.29.2. Training may include up to ten (10) attendees and may be video recorded by others.

1.29.3. Training program to include:

.1 One site 'in class' introduction session covering the basics of system operation.

.1 Manufacturer to submit a course outline before training commences.

.2 Manufacturer to provide course training documentation (if required) for attendees.

.2 On site 'hands on' session covering the specific equipment design and operation details, including:

.1 All operating procedures including automatic and manual intervention procedures.

.2 All regular maintenance procedures.

.3 Troubleshooting procedures.

.4 Spare parts required.

1.29.4. Timing of training to be coordinated with Electrical Contractor and Owner/Facility Management staff and is to be provided in advance of systems supporting critical loads to allow for full ability to operate the systems. The Electrical Contractor/Manufacturer to notify the Owner/Facility Management team a minimum two (2) weeks prior to the date of training.

1.30. LIFE SAFETY INTEGRATION TESTING

1.30.1. Provide testing of the integration of all life safety and fire protection systems.

1.30.2. The Integrated Testing Coordinator (ITC) will complete an Integration Testing Plan (ITP). Carry out the testing as described by the ITC in the ITP, and in accordance with CAN/ULC-S1001 as it relates to any electrical systems.

1.30.3. The ITC and development of the ITP are not the responsibility of this Contractor.

1.30.4. The testing of the integrated systems shall include, but not be limited to the following systems and all associated components:

.1 Fire Alarm System
.2 Fire Signal Receiving Centre
.3 Mass Notification
.4 Elevators
.5 Emergency Generators and/or Inverters
.6 Audio/Visual Systems
.7 Lighting Control Systems
.8 Notification Systems (Public Address)
.9 Sprinkler Systems
.10 Standpipe Systems
.11 Fire Pumps
.12 Water Supplies
.13 Water Supply Control Valves
.14 Heat Tracing for Life Safety Systems
.15 Fixed Fire Suppression Systems
.16 Cooking Equipment Fire Suppression Systems
.17 Automatic Door Operators for Stair Relief
.18 Hold-Open Devices
.19 Electromagnetic Locks
.20 Smoke Control Systems and Associated Dampers
.21 Venting to Aid Firefighting
.22 Smoke Alarms
.23 Hazardous Protection Monitoring
.24 Gas / CO Detection Systems
.25 Prevention of Smoke Recirculation (AHUs)

1.30.5. Coordinate with all other trades to carry out the appropriate testing.

1.30.6. Be responsible for carrying out and coordinating the testing work associated with the ITP. All work shall be coordinated with the ITC and shall include but not be limited to:

.1 Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.

.2 Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.

.3 Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001 “Integrated Systems Testing of Fire Protection and Life Safety Systems.”

.4 Provide fire alarm verification report along with all other documentation requested by the ITC as it relates to the electrical systems in conformance with CAN/ULC-S1001 “Integrated Systems Testing of Fire Protection and Life Safety Systems.”

1.31. STATEMENT OF PRICES

1.31.1. To form a basis for progress payments the successful bidder shall submit a sample progress draw for the various portions of the work. The format of the sample progress draw shall be as shown in the example progress draw below. The sample progress draw shall include a breakdown which illustrates all categories shown on the example progress draw which are relevant to the project. The categories shall be broken down to clearly illustrate the value of the material being supplied as the first subcategory and the value of the labour being supplied as the second subcategory, as shown on the example progress draw. The electrical Engineer’s Representative reserves the right to request that additional categories be added to the progress draw if the Engineer’s Representative feels that doing so will aid in assessing the contractor’s progress on site, thereby expediting contractor payment. Progress draws not including the categories shown on the example progress draw where relevant to the project and / or not providing separate labour value and separate material value subcategories will be rejected.

1.31.2. The total price of all portions of the work shall equal the total price of the work covered under the electrical division. Cost for as-built drawings and manuals to be carried as a separate line item.

1.31.3. Contractor to list and track all fixed per unit cost luminaires as part of Light Fixtures - Materials on the progress draw.

1.31.4. Contractor to list and track each of the approved changes on separate lines on the progress draw.

1.31.5. Costs of temporary facilities and utilities shall be amortized over the duration of the Work. Claims for ‘mobilization’, ‘bidding costs’, or similar lump sums at or before start of work are not acceptable.

EXAMPLE PROGRESS DRAW

Electrical Contractor Name
Billing Application Electrical Division
Project Name

Application Number – xx **Date – xxxx to xxxx**

Description	Contract Value	%	Billed To Date	%	Prev. Billed	%	This Billing	Balance to Complete
Permits / Mobilization	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Demolition & Removals	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Duct Banks – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Duct Banks – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx

Feeder Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Feeder Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Feeder Wire – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Feeder Wire – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Ltg. Branch Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Ltg. Branch Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Lighting Branch Wire – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Power & Lighting Branch Wire – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Cable – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Cable – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Conduit – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Conduit – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Cable – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Comms / Security / AV Cable – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Distribution Equipment – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Distribution Equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Generator / Inverter – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Generator / Inverter – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Light Fixtures – Material†	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Light Fixtures – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Lighting Controls – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Lighting Controls – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Equipment – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Fire Alarm Equipment – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Wiring Devices – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Wiring Devices – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Hand Dryers – Material	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Hand Dryers – Labour	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Commissioning / Training	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Demobilization / Clean-up	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Manuals / As-Built Drawings	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Subtotal	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Additions to Contract								
CO # / PC # / CCN #	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx

Cash Allowance #	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
Subtotal	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xxx	xx,xxx.xx	xx,xxx.xx
Total Contract	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx	xxx,xxx.xx	xxx,xxx.xx
Less Holdback			xxx,xxx.xx		xxx,xxx.xx		xxx,xxx.xx	
Total			xxx,xxx.xx		xxx,xxx.xx		xxx,xxx.xx	

† Inclusive of fixed per unit cost luminaires. Refer to luminaire schedule and/or electrical supplementary bid form for luminaire fixed unit costs.

1.32. METRIC CONVERSIONS

1.32.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, conduit and site services in both new and existing installations.

1.33. INTERRUPTION OF SERVICES

1.33.1. Any interruption of the electrical services to any part of the building shall come at a time agreeable to the Engineer's Representative. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.

1.33.2. Testing and operation of major equipment shall be approved by the Engineer's Representative to avoid excessive electrical utility charges. Such testing to be generally carried out after normal working hours or on weekends.

1.33.3. All such overtime work shall be carried out without additional cost to the Owners.

1.33.4. Modifications to existing electrical equipment, which will require shutdown, must be coordinated with the Owner and will only be permitted on weekdays from 10:00 pm to 6:00 am and on weekends from Friday at 7:00 pm to Sunday 6:00 pm. Exact weekends to be co-ordinated with the Owner. Consecutive weekends of shutdowns will not be allowed. Contractor to pay for all utility costs associated with shutdowns. Any work not associated with live equipment can be done during normal working hours. Work considered disruptive to the normal operation of the building will be done after normal business hours. Exact times to be co-ordinated with Owner.

1.33.5. Contractor to provide a minimum of 5 days written notice of a requirement for a shutdown. Contractor to include for separate meetings with the Owner and Engineer's Representative to discuss the shutdown in detail and to coordinate all the work being performed.

1.33.6. The Contractor is responsible for co-ordination and isolating of all existing services at all voltage levels required for the disconnections and connections to existing buildings. This includes shutting down and isolating existing low and medium voltage services. The owner will not perform any isolations for the contractor but will be present during the work. The contractor is to use qualified personnel for these shutdowns ensuring compliance with all applicable safety requirements.

1.33.7. The Contractor is responsible for any damages caused to existing systems when making connections.

1.33.8. The Contractor is to keep shutdowns of existing buildings to a minimum by scheduling the work and providing the required number of personnel to keep the shutdown to a minimum. This Contractor is to include for as many multiple teams of electricians as is feasible to keep the shutdown work to a minimum.

1.34. PRE-PURCHASED EQUIPMENT

1.34.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-purchased equipment and its associated equipment as if it had been purchased by the Contractor, with the single exception of payment.

1.34.2. The Electrical Trade shall provide a warranty for all pre-purchased equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-purchased equipment at no cost to the Owner during the warranty period.

1.34.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.

1.34.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-purchased equipment into a working system whether or not shown on the Drawings or specified herein.

1.34.5. The following list of equipment is pre-purchased:

.1

1.35. PRE-TENDERED EQUIPMENT

1.35.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-tendered equipment and its associated equipment as if it had been purchased by the Contractor, including payment.

1.35.2. The Electrical Trade shall provide a warranty for all pre-tendered equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-tendered equipment at no cost to the Owner during the warranty period.

1.35.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.

1.35.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-tendered equipment into a working system whether or not shown on the Drawings or specified herein.

1.35.5. The following list of equipment is pre-tendered: Insert the list of Owner Pre-tendered equipment or delete this if none are being included in the project

.1

1.36. VALUATION OF CHANGES

1.36.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:

.1 Estimate and acceptance in a lump sum, unless the Engineer’s Representative otherwise determines that the method shall be unit prices set out in the Contract.

1.36.2. Contractor shall provide the Engineer’s Representative with a detailed cost analysis of the contemplated change indicating:

.1 Quantity of each material.

.2 Unit cost of each material.

.3 Time involved.

.4 Sub-trade quotations including a complete analysis of costs.

.5 Mark-ups, if applicable.

.6 Value of GST or HST, as applicable.

.7 Proposed change in Contract Time.

1.36.3. The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.

1.36.4. The following shall not be included in the cost of the work but are covered by the hourly labour rate:

.1 The Contractor's payroll, administrative, head office and site office expenses, including stationary, postage and other office supplies.

.2 The costs of the Contractor's Project Manager, clerical and administrative personnel, and executive personnel.

.3 Use of temporary offices, sheds, small/hand tools, storage, and site office consumables, etc., including but not limited to the cost of telephone, light, power, water and heat used therein.

.4 Transportation and overnight room expenses for out of town labour, if local labour is unavailable.

.5 Insurance premiums, all government payroll burdens, variable labour factors and union or association funds.

.6 Licenses and permits, except when these are special for a particular item of work.

.7 Printing charges for Proposed Changes, Change Orders and Drawings for Contractor's and Subcontractors' use in the work. Engineer's Representative will provide a PDF electronic copy of change notice documentation.

.8 The cost of preparing As-Built, layout and working drawings and shop drawings. This includes any and all AutoCAD/BIM costs related to interference drawings or other associated drawings that may be required as part of the changes.

.9 The cost of clean-up and disposal of waste material.

.10 Parking, travel, coffee break/rest periods, warranties, safety training, WHMIS and health and safety committee, and non-productive time.

.11 Rentals, additional bonding, project financing.

1.36.5. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-2020 GC 6.2.

1.36.6. The Contractor shall inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.

1.36.7. Special equipment rental rates will be charged at cost. The Contractor shall provide an official quotation of the equipment rental with the Proposed Change quotation as backup, otherwise special equipment rentals will not be accepted by the Owner/Consultant.

1.36.8. The maximum percentage fee for mark-ups shall be as stated in the Division 0/1 specifications or the Contract Supplementary Conditions.

1.36.9. All changes, change notices, revisions to contract, Supplemental Instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.

1.36.10. The material costs used shall be a discount to nationally available pricing guides (i.e. Trade Service, Allpricer, etc.) to reflect a value with a fair and reasonable markup to the actual cost of the materials purchased from distributors. The Owner and/or Engineer's Representative reserve the right to negotiate material pricing to a value that is fair and reasonable to the Owner.

1.36.11. Labour Rate

.1 During the duration of the electrical contract, extra work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour units column 1(one). No additional factors will be accepted.

.2 The hourly labour rate for all changes will be based on a Journeyman Electrician rate as listed on the Bid Form and/or Electrical Supplementary Bid Form. The Owner and/or Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be inclusive of overhead, markup and profit. The labour rate will be inclusive of all labour burden charges as stated in this 'Valuation of Changes' section above.

.3 The following labour burdens are not part of the hourly labour cost, but are covered under the NECA labour unit rates: safety measures and regulations; drawing and specification study; layout, measuring and marking the installation location; material unloading, jobsite storage and delivery to the installation area; inspection, uncrating and shipping support removal; tool acquisition and return to storage; clean-up of excess material; and testing circuits for continuity.

.4 At the request of the Owner or the Engineer's Representative, the Contractor is to submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.

1.36.12. When pricing additional work for Proposed Changes, the Electrical Contractor shall only price new materials that are required for the Proposed Change. Where existing materials and/or infrastructure (i.e. homerun conduits back to electrical panels) can be re-used for the Proposed Change, the Electrical Contractor shall utilize these items in the valuation of the Change at no extra cost.

1.36.13. Where a Proposed Change includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.

1.36.14. When pricing Proposed Changes containing both additions and credits, and where no work and/or materials have been installed on site, the Electrical Contractor shall only price the net new materials and net new labour that are required for the Proposed Change. Per unit labour and material costs shall be equal for credits and additions.

PROPOSED CHANGE ORDER

Company Name:
Address:
City, Prov.:
Postal Code:

Telephone:
Fax:
E-Mail address:

Client Address:

CCN #
Date:
Project Name:
Project Number:
Page Number:
Change Order #:

Work Description

We reserve the right to correct this quote for errors and omissions.
This quote covers direct costs only.
This price is good for acceptance within 30 days from the date of receipt.

Itemized Breakdown

Description	Qty	Net Price U	Total Mat($)	Labor U	Total Hours
¾’ EMT		xxx.xx C		5.00 C	
¾’ EMT STL SS CONN		xx.xx C		10.00C	
¾’ EMT STL SS CPLG		xx.xx C		5.00 C	
¾’ EMT STRAO 1-H		xx.xx C		4.00 C	
#10 x 1” SELF TAPPING SCREW		x.xx C		5.50 C	
TOTALS					

Description

Material

General Materials		
Permitted Mark-up	(@ xx.xx %)	
Material Total		

Labour

Journeyman	(xx Hrs. @ $xx.00)	
Foreman @ 10%	(xx Hrs. @ $xx.00)	
Labour Total		

Material and Labour Total

Final Amount

1.37. DEMOLITION

1.37.1. The demolition drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services follow the service through to ensure other areas of the building are not affected.

1.37.2. Whenever existing services or equipment are to be removed, all electrical connections for such services shall be removed and securely terminated in an approved manner. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this division.

1.37.3. Whenever it becomes necessary to relocate any electrical services equipment to make possible installation of the work under this contract, such relocation shall be done by this division without additional cost to the Owner.

1.37.4. Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate the demolition.

1.37.5. If applicable, review the mechanical, architectural, and other related discipline drawings, and include for removing and making safe all power connections to demolished equipment and devices, back to the source panel, except where indicated otherwise on the drawings.

1.37.6. Ensure that all electrical, life safety services, and services for existing equipment, in areas outside the areas of this work, that are required to remain in service, shall do so.

1.37.7. Relocate any electrical feeders or equipment that are required to remain in service, that are secured to existing walls, floors or ceilings to be demolished or that are buried and required to be excavated for new work.

1.37.8. Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.

1.37.9. Disconnect and remove existing light fixtures, devices, outlets, CCTV, security devices, etc. which are not to be reused. Such items shall be packaged and turned over to the Owner at a place designated by the Owner. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an approved manner.

1.37.10. Ensure that all existing equipment which is to be reused and/or relocated is thoroughly reviewed and refurbished to ensure correct operation when put back into service and to meet the requirements of the local authorities having jurisdiction. All existing electrical equipment which is no longer required shall be removed and disposed of off-site.

1.37.11. Carry out the work with a minimum of noise, dust and disturbance.

1.37.12. Provide tools and clean up equipment. Obtain the Owner's permission for the use of electrical, plumbing or drainage outlets.

1.37.13. Where a device is shown to be relocated on the drawings, contractor to remove and re-install device and back box and re-feed the device with new conduit and wire from the nearest existing accessible junction box.

1.37.14. Electrical Contractor is responsible for the patching and re-painting the entire wall where a device and/or box has been added, removed or relocated.

1.38. CYBER SECURITY

1.38.1. Coordinate with Owner’s Information Technology representatives, obtain a copy of Owner’s cyber security policy and provide all applicable cyber security configurations.

1.38.2. Definitions

.1 Cyber Assets: Systems (including hardware, software, and data) and communication networks (including hardware, software, and data).

.2 Critical Cyber Assets: Cyber assets that perform critical system functions. The loss or compromise of these cyber assets would adversely affect the operational reliability of the system.

.3 Cyber Attack: The use of electronic means to interrupt, manipulate, destroy, or gain unauthorized access to a computer system, network, or device.

.4 Cybercrime: Any crime where cyber – the internet and information technologies, such as software, firmware, computers, tablets, personal digital assistants or mobile devices – has a substantial role in the commission of a criminal offence.

.5 Cyber Hygiene: Practices and steps that users of computers and other devices take to maintain system health and improve online security. These practices are often part of a routine to ensure the safety of identity and other details that could be stolen or corrupted.

.6 Cyber Incident: Any unauthorized attempt, whether successful or not, to gain access to, modify, destroy, delete, or render unavailable any computer network or system resource.

.7 Cyber Security: Technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access.

.8 Cyber Threat or Cyber Security Threat: Malicious act that seeks to damage data, steal data, or disrupt digital life in general. Cyber threats include computer viruses, data breaches, Denial of Service (DDoS / DoS) attacks and other attack vectors.

.9 Cyber Threat Actors: Broad term for any states, groups, or individuals who, with malicious intent, aim to take advantage of vulnerabilities, low cyber Security awareness, and technological developments to gain unauthorized access to information systems in order to access or otherwise affect victims' data, devices, systems and networks.

.10 IP Multicast: Technique for one-to-many and many-to-many real-time communication over an IP Infrastructure network.

.11 Endpoint: Remote computing device that communicates back and forth with a network to which it is connected. Such as a server, desktop, or laptop.

.12 Network Certificates: Also known as a Digital Certificates, which are an electronic "password" that allows a person or organization to exchange data securely over the internet using the public key infrastructure (PKI). Digital Certificates are also known as a public key certificate or identity certificate. There are 3 Main types of certificates:

.1 Secure Socket Layer Certificate (SSL) Digi-SSL

.2 Software Signing (Code Signing Certificate) Digi-Code

.3 Client Certificate (Digital ID) Digi-ID

.13 Social Engineering: Exploitation methods that target human vulnerabilities, such as carelessness and trust.

.14 Technical Vulnerabilities: Weaknesses or flaws in the design, implementation, operation, or management of an information technology system, device, or service.

1.38.3. Cyber Security Measures

.1 Implement at minimum the following multi-layered Cyber Security measures to limit and / or reduce the Owner's potential risk from a cyber threat event; such as a Cyber Security data breach or Cyber Security attack.

.2 Password Management

.1 Employ password management best practices such as:

.1 Do not use default passwords.

.2 Use strong and unique passwords for all applications. Use a minimum of 8 characters where there is no password policy inherent in the software; use a mixture of uppercase and lowercase letters, numbers, and include at least one special character (! @ # ?]).

.3 Reset passwords at regular intervals.

.4 Configure two-factor authentication for all accounts where possible in the system software.

.5 Do not use System Admin logins for simple tasks; create separate User accounts with rights levels appropriate for the job function. Create and define user accounts as appropriate such as Role based, Individual logins or assigned roles.

.6 Use different passwords for every account.

.7 Enforce secure password policies within the business environment.

.8 Have interface lock after a predefined # of failed login attempts for a pre determined time interval.

.3 Port and Interface Management

.1 Employ Port Management techniques such as:

.1 Restrict access on network switch ports to assigned devices addresses.

.2 Lock down all open, unused and unsecure ports on the networking devices such as switches, routers, and firewalls.

.3 Shut off all unused communication services and hardware interfaces.

.4 Advise Owner on use of 3rd party port security monitoring.

.4 Physical and Virtual Networks

.1 Provide a dedicated VLAN for network connected systems where a dedicated LAN has not been provided.

.5 Encryption

.1 Use minimum TLS 1.2 for all network attached equipment and use TLS 1.3 where available.

.6 Network Certificates

.1 Ensure Network Certificates are up to date and not expired for all equipment and systems.

.7 Firmware & Software Update Management

.1 Use the latest stable Firmware / Software version on all devices / equipment as well as implement a Firmware / Software Update management process and procedure.

.8 Manufacturer’s System Hardening Guides

.1 Provide the Manufacturer’s System hardening guides for the equipment being installed and implement as many recommendations / features as possible.

.9 External Memory

.1 Restrict the use of external memory. Restrict or eliminate the use of devices such as external USB Thumb drives unless expressly allowed by the Owner’s Information Technology representatives.

.10 Log Off

.1 Enable auto-log off timer for all software, websites and logins. Set auto-log off timer on local Workstation(s) being used to access the equipment with a reasonable timer in the case that an employee leaves the workstation unattended.

.11 Anti-Virus Software

.1 Enable and configure anti-virus software on PC endpoints in accordance with the Owner's Information Technology requirements, unless it is to be installed and configured by the Owner.

.12 Filtering Techniques

.1 Apply filtering techniques including the types listed below where possible:

.1 Web Filtering: A Web filter adds another layer to anti-phishing defences by blocking the web based component of phishing and malware attacks.

.2 Multicast Message Filtering: Filters the packets sent to multicast groups users are not subscribed to.

.3 Content Filtering: Is the use of a program to screen and / or exclude access to web pages or email deemed objectionable. A content filter will then block access to this content.

.13 Back up Regularly

1. Provide backup schedule in the closeout submittals and configure system for automatic backups wherever possible.
2. Identify files that require manual backup and the backup procedure. This helps to protect against many types of data loss, especially if a Cyber Threat Actor gains access.

1.38.4. IT Devices and Systems

.1 Apply the Cyber security measures listed in the clauses above in part or in full, as possible, to a wide range of Information Technology (IT) Devices including:

.1 Firewalls

.2 Routers

.3 Network switches (Core and Edge Devices)

.4 Servers and databases

.5 Workstation computers

.6 Network connected system devices and controllers

.7 Wireless Access Points and wireless controllers

.8 Mobile phones and tablets

.9 Any IT System or endpoint connected to the network

1.38.5. Operational Technology (OT) Devices and Systems

.1 Apply the Cyber security measures listed in the clauses above, in part or in full, as possible, to a wide range of OT Network devices including:

.1 Industrial Control Systems such as:

.1 (PLC's) Programmable Logic Controllers are an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices.

.2 (SCADA) Supervisory Control and Data Acquisition is a control system architecture comprising of computers, networked data communications

and graphical user interfaces (GUI) for high level process supervisory management.

.3 (DCS) Distributed Control System is a computerized control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system.

.4 (CNC) Computer numerical Control is the automated control of machining tools (Drills, boring tools, lathes) and 3D printers by means of a computer.

.2 Building Management Systems (BMS) and Building Automation Systems (BAS)

.3 HVAC equipment

.4 Lighting controls for both internal and external applications

.5 Energy monitoring and metering equipment

.6 Transportation and parking systems

.7 Scientific equipment

.8 Any other OT System or endpoint that can be connected to the network

1.38.6. Report Cybercrime

.1 Advise the Owner and / or their representatives of any indication of a Cyber Incident of a criminal nature when performing any work on a network connected system.

1.38.7. Cyber Security Report Letter

.1 Provide a Cyber Security Report Letter in the closeout documents to the client stating which Cyber Security measures have been implemented, when implementing any and / or all of the Cyber Security Measures mentioned in this Specification.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

26 05 03.00 As-Built Drawings

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Refer to As-built Drawings in Section 01 70 00 (01 72 29.00) – CLOSEOUT SUBMITTALS.

1.3. RECORD OF REVISIONS ON SITE

1.3.1. Print and maintain two complete sets of white prints to mark the project progress, changes and deviations.

1.3.2. Maintain an updated copy of plans and schematics in the digital format for which the project is provided (i.e. AutoCAD or Autodesk Revit MEP) and be capable to produce documents in Adobe PDF upon request.

2. Products

2.1. AS-BUILT DRAWINGS

2.1.1. Request in writing from the Engineer's Representative all electrical AutoCAD drawings. Complete release form provided by Engineer's Representative and pay the Engineer's Representative directly the costs identified in this section below prior to receiving the drawings. After the final as-built drawings have been reviewed, send the Engineer's Representative a copy via electronic transfer for their records and send a minimum of one copy on USB key with each set of maintenance manuals. Provide additional copies if required under the General Conditions. Use the same version of AutoCAD software that the drawings were created in and provide electronic files saved in a version acceptable to the end user and engineer.

2.1.2. The contractor is to identify the cost of As-Built Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The following values are to be broken out:

$5,000	For Electrical Contracts up to $250,000
2% of Electrical Contract	For Electrical Contracts from $250,000 to $1,500,000
$30,000	For Electrical Contracts over $1,500,000

2.1.3. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received.

2.1.4. Final as-built prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Architect and Engineer must be deleted from the drawings.

2.1.5. Final as-built drawings to include all revisions made to the drawings during construction, including all approved changes. The as-built drawings are to also include the routing of all feeders except for branch circuits, all junction boxes to be shown, drawing legend to be updated to include all symbols and lines used to show as-built conditions, quantity of wires in each conduit, and circuit numbers of wires in each conduit. Include slab layout drawings in as-built drawing package.

2.1.6. CADD Requirements.

.1 A complete list of layer names and brief description of each layer's use shall accompany all files.

.2 Fonts for text shall be Autodesk standard. Custom fonts, shape files, etc., are not to be used.

.3 Final as-built drawings shall be returned on USB stick.

.4 Each USB stick shall include a file containing Engineer's Representative and Owner, Contract number, file names and Drawing number. Provide a "readme.txt" file in ASCII format. A printed copy of the readme file shall accompany each USB stick.

.5 All drawings shall be in the same units as issued on Bid Documents.

.6 Provide a complete list of symbol (block) names with a description of each symbol.

.7 Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.

2.1.7. Maintain records on site, as the job progresses, and record all changes and deviations from that shown on Contract Drawings. After review and approval of service lines in trenches, take "as-built" measurements, including all depths, prior to commencement of backfilling operations. Show the location of buried electrical ducts and conductors on the drawings and dimensioned from fixed points. Keep drawings up-to-date during construction and in addition to field measurements include Change Orders, Supplemental Instructions and all other changes.

2.1.8. On completion of the building, forward to the Engineer's Representative the digital drawings indicating all such changes and deviations for review by the Engineer's Representative.

2.1.9. If required, the Engineer's Representative will provide a quotation to this Contractor to transfer "As-Built" information from the mark-up documentation to the acceptable software.

.1 Include a cost of $400.00 per sheet for the transfer of marked up "As Built" information to AutoCAD and forwarding of the electrical information by the Engineer's Representative to the Owner

2.1.10. The Electrical Contractor may request from the Engineer's Representative the most current electrical drawings in AutoCAD sent via electronic transfer (at a nominal charge of $500.00).

2.1.11. The AutoCAD as-built documents shall meet all the Owner's and Engineer's Representative's requirements.

3. Execution

3.1. NOT USED

END OF SECTION

26 05 04.00 Submittals/Shop Drawings

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. RELATED WORK

1.2.1. Comply with Div. 00 for submittal requirements and as amended below.

2. Products

2.1. SHOP DRAWINGS

2.1.1. Shop Drawings shall be organized by Specification Section. Ensure shop drawing package for a given Specification Section is complete, including all equipment, products, materials, and systems to be used as part of that Specification Section, and submit as a single shop drawing package. Do not submit numerous separate shop drawings for the same Specification Section. Do not combine more than one section into one submission. Incorrect submissions will be returned without review.

2.1.2. Submittals/Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. SWBD-1A).

2.1.3. Submit shop drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:

.1 S+A project number and Contractor Shop Drawing Identifier in Subject Line

.2 Attachments shall be limited to 10MB

.3 Provide FTP hyperlink for all attachments in excess of 10MB with appropriate information for downloading the file (as required)

.4 Shop Drawing Submission to the following email address:

.1 ContractAdmin.Toronto@smithandandersen.com

2.1.4. Shop drawings submitted directly to Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.

2.1.5. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.

2.1.6. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation – for example: lighting control sequence of operation – the Engineer's Representative may also request that this information be added to the maintenance and operating manual.

2.1.7. Provide a cover sheet with the project name, issue date, issue number, specification section number, and title of section with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

3. Execution

3.1. SUBMISSION

3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that he has checked the drawing for conformance with all requirements of the Drawings and Specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical and mechanical co-ordination is complete before submitting drawings for review.

3.1.2. Scanned PDF versions are not acceptable.

3.1.3. Equipment shall not be released for manufacture until the shop drawing has been reviewed by Engineer's Representative. Contractor shall assume responsibility and cost for field changes. Installation of any equipment shall not start until after final review of Shop Drawings by the Engineer's Representative has been obtained.

3.1.4. As part of the electrical Engineer's Representative's scope of the work, shop drawings shall be reviewed no more than twice. Should three or more reviews be required due to reasons of Contractor omissions causing resubmission requests, the Contractor shall reimburse the electrical Engineer's Representative for time expended in these extra reviews.

END OF SECTION

26 05 05.00 Mounting Heights

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. NOT USED

3. Execution

3.1. MOUNTING HEIGHTS

3.1.1. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

3.1.2. If mounting height of equipment is not specified or indicated, verify with the Consultant before proceeding with installation.

3.1.3. Unless indicated otherwise on the drawings or within the specifications, install electrical equipment at following heights.

- .1 Local switches: 1050 mm.
- .2 Wall receptacles:
  - .1 General: 450 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
    - .1 Where these receptacles are located adjacent to and in close proximity to local switches, mount receptacles at the same elevation as the local switches to provide a neat, aligned, installation.
  - .4 In mechanical rooms: 1200 mm.
  - .5 In equipment storage rooms: 900 mm.
- .3 Receptacles for maintenance of equipment located on rooftops:
  - .1 Not less than 750 mm above the finished roof, per Electrical Code.
- .4 Panelboards: 2000 mm to top of panel.
- .5 Telephone and interphone outlets: 450 mm.
- .6 Wall mounted telephone and interphone outlets: 1050 mm.
- .7 Fire alarm stations: 1200 mm, measured to the top of the manual pull station.
- .8 Wall Mounted Fire alarm audible devices: 2300 mm and not less than 150 mm from the ceiling, measured to the top of the device.
- .9 Television outlets not mounted behind a wall mounted television: 450 mm.
- .10 Wall mounted speakers: 2100 mm.
- .11 Clocks: 2100 mm.

.12 Power Door Operator push buttons: 1050 mm.

.13 Wall mounted Exit Signs

.1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.

.2 For all ceilings heights greater than 2500 mm: 2400 mm.

.14 Wall mounted Battery Packs and Emergency Heads

.1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.

.2 For all ceilings heights greater than 2500 mm: 2400 mm.

.15 Wall mounted occupancy sensors: 1050 mm.

.16 Wall mounted visible signal devices: 2100 mm to centre of lens; or as allowed by CAN/ULC-S524 “Standard for Installation of Fire Alarm Systems” except where facility accessibility standards require otherwise.

.17 Top of remote annunciator and passive graphic panels shall be no more than 1800 mm above finished floor.

.18 Wall mounted emergency telephone (Fireman’s Handset): 1350 to 1500 mm.

END OF SECTION

26 05 21.00 Wires and Cables Under 2000 V

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables, latest edition.

1.2.2. CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables, latest edition.

1.2.3. CSA C22.2 No. 51, Armoured Cables, latest edition.

1.2.4. CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables, latest edition.

1.2.5. CSA C22.2 No. 96, Portable Power Cables, latest edition.

1.2.6. CSA C22.2 No. 123, Metal Sheathed Cables, latest edition.

1.2.7. CSA C22.2 No. 124, Mineral-Insulated Cable, latest edition.

1.2.8. CSA C22.2 No. 131, Type TECK 90 Cable, latest edition.

1.2.9. CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations, latest edition.

1.2.10. CAN/ULC S139 / UL 2196 (Binational Standard), Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables, latest edition.

1.2.11. ASTM B800 - Standard Specification for 8000 Series Aluminium Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. BUILDING WIRES

2.1.1. Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

2.1.2. Contractor to provide copper conductors on conductors sizes up to and including #8 AWG. Contractor to provide copper conductors for sizes larger than #8 AWG unless identified as aluminium or NUAL on the drawings.

2.1.3. All conductors to have size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 to CSA C22.2 No. 38 rated as follows:

.1 Insulation rated at 1000 V for 600 V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current.

.2 Insulation rated at 600 V for the other 600 V and 347/600 V distribution systems not covered under item #1 above.

.3 Insulation rated at 600 V for all systems rated at 480 V and less.

2.1.4. All aluminium or NUAL conductors to be an aluminium alloy with CSA certified as an Aluminium conductor material (ACM) and meet the requirements of the Aluminium Association Inc. AA8030 and ASTM B800 standards. Provide an anti-oxidant compound, Ideal NOALOX, on all aluminum conductor terminations.

2.1.5. RWU90 wiring is to be used for underground installations.

2.2. TECK CABLE

2.2.1. Cables to CSA C22.2 No.131.

2.2.2. Conductors:

.1 Bonding conductor: copper.

.2 Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.2.3. Insulation:

.1 Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.

2.2.4. Inner jacket: polyvinyl chloride material.

2.2.5. Armour: interlocking aluminum.

2.2.6. Overall covering: thermoplastic polyvinyl chloride material rated at a minimum of FT-4.

2.3. VARIABLE FREQUENCY DRIVE CABLES

2.3.1. Variable frequency drives are also known as variable speed drives.

2.3.2. Cables to CSA C22.2 No. 123 or No. 131, and to CSA C22.2 No. 174.

2.3.3. Conductors:

.1 Three (3) bare copper bonding conductor sized to Table 16 of the electrical code.

.2 Circuit conductors: copper, size as indicated on Drawings.

.3 Profile of VFD Cable cross section shall be entirely symmetrical.

2.3.4. Shield: Flat copper tape shield, or continuously corrugated and welded aluminum sheath, depending on cable construction.

2.3.5. Insulation:

.1 Chemically cross-linked thermosetting polyethylene (XLPE) with high dielectric strength to withstand repetitive high voltage spikes of 3.1 times the nominal system voltage rating due to VFD IGBT output.

.2 Type RW90 or RWU90 CSA rated for 1000 V, and suitable for voltage spikes mentioned in .1 above.

2.3.6. Where compliant with CSA C22.2 No. 123, Armour: continuously corrugated and welded aluminum.

2.3.7. Where compliant with CSA C22.2 No. 131, Inner jacket: polyvinyl chloride material.

2.3.8. Where complaint with CSA C22.2 No. 131, Armour: interlocking aluminum.

2.3.9. Overall covering: thermoplastic polyvinyl chloride (PVC) material rated at a minimum of FT-4.

2.3.10. Cable to be complete with manufacturer's cable termination kits including terminating connectors for proper termination of shield to ground. Termination kits to ensure common mode stray currents are drawn away from the motor to extend motor life-span. Termination kits to include self-terminating connectors that provide 360 degree contact to the shield / sheath.

2.4. MINERAL-INSULATED CABLES

2.4.1. Conductors: solid bare soft-annealed copper, size as indicated.

2.4.2. Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

2.4.3. Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 C.

2.4.4. Outer jacket: PVC applied over sheath, where installed in damp and wet locations.

2.4.5. Two (2) hour fire rating.

2.4.6. Conform to requirements of CSA C22.2 No. 124; and CAN/ULC S139.

2.4.7. All mineral-insulated cable larger than #6 AWG shall be single conductor. For conductors #6 AWG and smaller, multi-conductor mineral-insulated cable is acceptable.

2.4.8. Manufacturer / Product: nVent Pyrotenax System 1850.

2.5. FIRE RATED TYPE RC CABLE

2.5.1. Conductors: stranded annealed copper, size as indicated.

2.5.2. Insulation: low smoke silicon rubber.

2.5.3. Armour: continuously welded and corrugated copper sheath.

2.5.4. Outer Jacket: Provide black low smoke, zero halogen polyolefin, FT4 rated where installed in damp and wet locations.

2.5.5. Two (2) hour fire rating.

2.5.6. Conform to requirements of CSA C22.2 No. 123; and CAN/ULC S139 with hose stream.

2.5.7. Manufacturer / Product:

.1 Prysmian Draka Lifeline Type RC90.

.2 Berkshire Hathaway Marmon RSCC VITALink Type RC90.

2.6. ARMOURED CABLES

2.6.1. Cables to: CSA C22.2 No. 51.

2.6.2. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.6.3. Type: AC90 (BX).

2.6.4. Armour: interlocking type fabricated from aluminium strip.

2.6.5. Type: ACWU90 - PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

2.7. ALUMINUM SHEATHED CABLE

2.7.1. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.7.2. Insulation: type RA90 rated 1000 V.

2.7.3. Sheath: aluminium applied to form continuous corrugated seamless sheath.

2.7.4. Outer jacket of PVC applied over sheath for direct burial or wet locations.

2.8. DIESEL LOCOMOTIVE CABLES (DLO)

2.8.1. Cable: to CSA C22.2 No. 96 Portable Power Cables, rated to 2000 V.

2.8.2. Conductor: stranded tinned annealed copper, size and number as indicated

2.8.3. Separator: paper or polyester tape separates the conductor from the rubber insulation to aid in stripping.

2.8.4. Insulation: premium grade Ethylene Propylene Rubber (EPR), rated 90 deg. C.

2.8.5. Jacket: black, heavy duty chlorinated polyethylene (CPE), sunlight resistant, rated at a minimum of FT-4.

2.9. WIRING TERMINATION

2.9.1. Lugs, terminals, screws used for termination of wiring to be to be dual rated for Copper/Aluminum (Cu/Al).

2.9.2. Lugs, terminals, and screws used for termination of multiple wires must be rated for their intended use.

2.9.3. For lugs used in connecting power utility company equipment or services, provide lugs that have CSA Die Index stamped on lug to facilitate proper crimping.

3. Execution

3.1. GENERAL

3.1.1. Provide a minimum of one bonding conductor for each three ungrounded conductors on all conduit and cable runs. Provide separate bonding conductors for each ground fault circuit interrupter circuits. All bonding conductors to be copper and insulated with a green coloured insulation.

3.1.2. Size bonding conductor to applicable tables of the:

.1 Ontario Electrical Safety Code.

3.1.3. All equipment, junction boxes, pull boxes, liquid tight flex, etc. to be bonded to ground through bonding conductors.

3.1.4. Provide separate neutral conductor for each 120 volt circuit for all circuits feeding receptacles and power outlets.

3.1.5. Do not install cables or devices on the surface of, or within 100 mm of the underside of roof decks.

3.1.6. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.7. Provide a variable frequency drive (VFD) cable from each VFD unit to each motor. Wiring to be installed in accordance with the VFD and motor manufacturer instructions.

3.1.8. All cable terminations to be compression type fittings for wire sizes greater than #8 AWG. All compression type fittings to be two-hole long barrel type with lug inspection / viewing window. Where mechanical screw type lugs are allowed by the Engineer's Representative, they will be suitable for quantity of parallel runs of wire that are to be terminated under.

3.1.9. Armoured Cable Type AC90 (BX) may only be used for individual drops from slab mounted junction box to recessed mounted light fixtures or where noted on the drawings where wiring is required to be installed within an existing wall. The maximum allowable distance of armoured cable is 3 m. Contractor to receive written approval from the Engineer's Representative to run armoured cable further than 3 m from junction box. Daisy chaining of fixtures is only acceptable in dry wall ceilings. Wiring in conduit is to be brought to a junction box to allow for the transition to armoured cable. Armoured cable is not to be installed directly into electrical panels or run in walls for receptacles.

3.1.10. Branch circuit wiring to be upsized as follows to address voltage drop when:

.1 The entire length of the circuit wiring exceeds 25 m – branch wiring to be a minimum of No. 10 AWG.

.2 The entire length of the circuit wiring exceeds 40 m – branch wiring to be a minimum of No. 8 AWG.

.3 The entire length of the circuit wiring exceeds 60 m – branch wiring to be a minimum of No. 6 AWG.

3.1.11. Where feeders or branch circuits are run underground, upsize conductors to comply with the requirements of electrical code Rule 4-004, Ampacity of wires and cables, using Diagrams D8 to D11 and Tables D8A to D11B of the electrical code. Where conductors are upsized due to Tables D8A to D11B, upsize conduits to comply with the requirements of electrical code Rule 12-910, Conductors and cables in conduit and tubing.

3.1.12. Where one (1) hour or two (2) hour conductor fire rating is indicated on the Drawings, provide fire rated Mineral-Insulated cables or fire rated MC cables. Fire rated Mineral-Insulated and MC cables shall be installed in accordance with the manufacturer's installation instructions and the fire rated cable product listing in order to maintain their fire rating. Special attention shall be paid to cable supporting method and fire rating of the structure from which the cables are supported.

3.1.13. Where conductors supply power to emergency lighting and the emergency lights are located on a different floor level than the power source (i.e. panel), then the conductors shall be fire rated for at minimum one (1) hour using fire rated Mineral-Insulated cables. Conductors with two (2) hour fire rating shall be used where indicated on Drawings. Provide fire rated Mineral-Insulated cables or fire rated MC cables where conductors require fire ratings.

3.1.14. Where alternatives to fire rated cables are indicated on the Drawings, such as running conduits within concrete cast in place slabs, under concrete slabs on grade, or within fire rated shaft/riser, care must be taken to ensure that the required fire rating is maintained. Where drawings call for conduits to be run within concrete cast in place slabs, the slabs must be of sufficient thickness to achieve the required fire rating and be no less than 51 mm (2 in.) of concrete cover both above and below conduits where one (1) hour fire rating is required and 102 mm (4 in.) concrete cover both above and below conduits where two (2) hour fire rating is required. The contractor shall submit a letter confirming the concrete coverage or construction of fire rated assembly provides the sufficient fire rating of the enclosed conduits.

3.1.15. Wire Splicing

.1 Splice up to and including No. 6 AWG with nylon insulated expandable spring type connectors.

.2 Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.

3.2. INSTALLATION OF BUILDING WIRES

3.2.1. Install all building wiring in conduit unless otherwise noted. Conduit to be sized to the electrical code unless noted on the drawings or in the specifications.

3.2.2. All conductors are to be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. INSTALLATION OF TECK 90 CABLE, VARIABLE FREQUENCY DRIVE CABLE, ARMOURED CABLE OR ALUMINUM SHEATHED CABLE

3.3.1. Group cables wherever possible on channels.

3.3.2. Terminate cables in accordance with manufacturer's installation instructions.

3.3.3. Fastenings:

.1 One-hole steel straps to secure surface cables 53 mm and smaller. Two-hole steel straps for cables larger than 53 mm.

.2 Channel type supports for two or more cables.

.3 Galvanized threaded rods: 6 mm diameter minimum to support suspended channels.

.4 Pre-engineered support systems complying with CSA C22.2 No. 18.4 "Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239)."

3.3.4. Connectors:

.1 Watertight, approved for respective cables.

3.3.5. For single conductor cables, ground the sheath at the upstream (source) panel and provide insulated fibre plate at the load end, so as to prevent circulating sheath currents.

3.3.6. Where TECK 90 cable is run through or passes through a plenum space, install TECK 90 cable in conduit and comply with electrical code conduit fill percentage rules.

3.4. INSTALLATION OF MINERAL-INSULATED CABLE SYSTEM AND FIRE RATED TYPE RC CABLE SYSTEM

3.4.1. General:

.1 Comply with: the requirements of the manufacturer's UL listing for the fire rated cable system and the manufacturer's written installation instructions.

.2 Provide all Products required by the manufacturer's UL listing to provide a fully certified system.

3.4.2. Handling:

.1 Cable shall be uncoiled by rolling or rotating supply reel. Do not pull from coil periphery or centre.

3.4.3. Splicing:

.1 Make all fire rated splices in the factory. In the event that a field splice is necessary, have the manufacturer's field technician make it in the field.

3.4.4. Terminations:

.1 Make field made terminations using the cable manufacturer's termination kits. Use stripping tools, crimping tools and compression tools, available from the manufacturer for proper cable termination.

.2 Connections to ferrous cabinets for single conductor cables shall incorporate brass plates. Install per manufacturer's drawing.

.3 At cable terminations, use thermoplastic sleeving over bare conductors.

3.4.5. Sheath induction reduction:

.1 When multi-phase circuits have paralleled single conductors, run cables in groups having one of each phase in each group.

.2 Separate each set of paralleled conductors by at least two single cable diameters.

3.4.6. Exposed or Surface Installations:

.1 Secure cable(s) to the fire rated building structure using:

.1 Supporting methods outlined in the manufacturer's UL listing for the fire rated system utilized.

.2 Support fire rated cables at the intervals required by the manufacturer's UL listing.

3.4.7. Wall or floor penetrations:

.1 Provide approved fire stopping of all penetrations.

.2 Neatly train and lace cable inside boxes, equipment, and panelboards.

.3 Where cables are buried in cast concrete or masonry, sleeve for entry of cables.

.4 When penetrating a fire rated wall or fire rated floor, the cable must extend a minimum of 305 mm beyond the fire rated wall or fire rated floor. The 305 mm dimension can be in any direction as 305 mm of cable length is required to allow for proper heat dissipation such that cable terminations do not overheat.

3.5. FIELD QUALITY CONTROL

3.5.1. Prior to energizing wires/cables, measure insulation resistance of each wire/cable. Ensure readings are acceptable per installation recommendations. Tabulate and submit for approval as a submittal.

3.5.2. All Wires and Cables to be tested on site as defined in Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE and herein. Contractor to oversee all testing and correct any deficiencies noted.

3.6. INSTALLATION OF CONTROL CABLES

3.6.1. Install control cables in conduit.

3.6.2. Ground control cable shield.

END OF SECTION

26 05 26.00 Grounding + Bonding

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 41– Grounding and Bonding of Equipment, latest edition.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

1.2.4. IEEE Standard 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, latest edition.

1.3. DESCRIPTION

1.3.1. Provide system grounding to meet requirements of current applicable codes.

1.4. SHOP DRAWINGS AND PRODUCT DATA

1.4.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.4.2. Submit shop drawings for ground bars and ground rod inspection wells for engineer's review prior to manufacture.

1.4.3. Submit main system ground test report as a shop drawing for engineer's review. Include final reviewed report in the project O&M manuals.

2. Products

2.1. GROUNDING & BONDING EQUIPMENT

2.1.1. Meet standard of CSA C22.2 No. 41 – Grounding and Bonding of Equipment, latest edition.

2.2. CONDUCTORS

2.2.1. Bare or insulated, stranded, soft drawn annealed copper wire, for: ground bus, electrode interconnections, metal structures, ground connections, telephone ground.

2.3. LUGS

2.3.1. All grounding connections to be made with compression type fittings and lugs with lug inspection / viewing window.

3. Execution

3.1. INSTALLATION

3.1.1. Install complete permanent, continuous, system and circuit, equipment, grounding and bonding systems including, conductors, connectors, and accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.

3.1.2. Provide main station ground grid as shown on drawing but the ground grid shall consist of a minimum of four (4) driven ground rods.Copper ground rods shall be not less than 3 m long and 19 mm in diameter and where practicable located adjacent to the equipment to be grounded (i.e. main electrical room). Interconnect all ground rods underground with a #2/0 AWG bare ground conductor.

.1 If main ground grid cannot be installed directly below the main electrical room, then provide a remote ground grid by installing the ground rods at the lowest floor level of the building and provide two grounding conductors of a minimum of #4/0 AWG copper to connect the ground grid to the main electrical room equipment. Run the two conductors through separate routes separated by a minimum of 5 m.

3.1.3. Supply and install a new ground bus system consisting of a length of copper bus, 25 mm thick ebony pad with chamfered edges as shown on the drawings. A minimum of two 1200 mm ground bars are to be provided in transformer vault(s), main electrical room(s) and generator room(s). Where a perimeter ground bus is shown on the drawings, supply and install a 50 mm x 6 mm copper bus on all walls attached at 1.5 m intervals on 13 mm standoffs. The perimeter ground bus shall be continuous around the room and shall be continued above or below all openings such as doors and vents.

3.1.4. Interconnect the ground bars to the ground grid with a minimum #2/0 AWG bare copper ground conductor if the ground grid is adjacent to the main electrical room(s). Where the ground grid is remote, connect the ground bars to the remote ground grid as described in 3.1.2.(1) above.

3.1.5. Supply and install inspection box for each ground rod. Inspection box is to be suitable for installation in heavy traffic areas and is to come complete with a lockable lid and security key.

3.1.6. Connect to the ground bus all metal equipment enclosures, as well as all other metal parts such as mechanical pipes, ducts, waste lines, door frames, railings, grilles, fences, etc. with minimum #2/0 AWG bare copper conductors.

3.1.7. For solidly grounded systems, transformer neutrals, main service entrance switchboard neutrals and all similar bonding connections, the bonding conductors shall be sized in accordance with Table 16 of the Electrical Code.

3.1.8. Provide cable grips to receive all grounding conductors. Identify all grounding conductors at the ground pad using lamacoid nameplates. Ground bus system to be provided in rooms as shown.

3.1.9. Terminate the following conductors at the ground bus system:

- Service neutral -as indicated on drawings

- Telecommunications ground -as per TIA Standard 607, latest edition

TBB/GE linear length m (ft)	TBB/GE size (AWG)
less than 4 (13)	6
4 – 6 (14 – 20)	4
6 – 8 (21 – 26)	3
8 – 10 (27 – 33)	2
10 – 13 (34 – 41)	1
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
20 – 26 (67 – 84)	3/0
26 – 32 (85 – 105)	4/0
32 – 38 (106 – 125)	250 kcmil
38 – 46 (126 – 150)	300 kcmil
46 – 53 (151 – 175)	350 kcmil
53 – 76 (176 – 250)	500 kcmil
76 – 91 (251 – 300)	600 kcmil
Greater than 91 (301)	750 kcmil

where,
TBB = Telecommunications Bonding Backbone

- Main system ground -#2/0 AWG or 2 x # 4/0 AWG for remote ground grids
- Bonding conductor -as per Table 16 of CSA C22.1

3.1.10. Ground all metallic water, gas, and waste systems with a minimum #6 AWG copper in accordance with code requirements.

3.1.11. Install bonding connections to typical equipment included in, but not necessarily limited to, following list: frames of motors, starters, control panels, building steel work, elevators, distribution panels and outdoor lighting.

3.1.12. Commission an approved certified testing Agency to perform a main system ground test. Submit the main system ground test report as a shop drawing for engineer's review. Provide a copy of the report in the maintenance manual. (Refer to Part 3.2).

3.1.13. Install connectors in accordance with manufacturer's instructions.

3.1.14. Ground rods to be interconnected by grounding grid conductors (sized as per sections above) and buried to a maximum depth of 600 mm below the rough station grade and a minimum depth of 150 mm below the finished station grade.

3.1.15. Protect exposed grounding conductors from mechanical damage.

3.1.16. Install bonding conductor for flexible conduit and connect at both ends to grounding bushing with solderless lug, clamp or cup washer and screw. Neatly cleat bonding conductor to exterior of flexible conduit.

3.1.17. Provide separate, insulated bonding conductor within each feeder and branch circuit raceway.

3.1.18. Interface with the lightning protection system, if one is installed for this building.

3.2. TESTING

3.2.1. The contractor shall pay for the testing and verification of the entire building ground system using a certified testing Agency. Tests shall include main ground grid and ground rods, and grounding connections between all electrical and communication rooms. The agency shall provide complete test reports indicating test methodology and results. All costs shall be included in contract bid.

3.2.2. Following are acceptable methods of testing the ground grid. Testing shall be in accordance with IEEE Standard 81 (latest edition).

.1 Two-Point Method

.2 Three-Point Method

.3 Ratio Method

.4 Staged Fault Tests

.5 Fall-of-Potential Method

END OF SECTION

26 05 29.00 Hangers and Supports

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

1.2.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2.2. Conduit and equipment provided under the Electrical division shall be complete with all necessary supports and hangers required for a safe and workpersonlike installation.

2. Products

2.1. MATERIALS

2.1.1. Provide “U” type support Strut as manufactured by Unistrut.

3. Execution

3.1. INSTALLATION

3.1.1. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.

3.1.2. Auxiliary structural members shall be provided under the electrical section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested.

3.1.3. Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.

3.1.4. Approved type expansion shields and bolts may be used for conduit up to 103 mm diameter where the pre-setting of concrete inserts is not practical. Submit Shop Drawings.

3.1.5. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer’s Representative. Drawings of the proposed method of suspension must be submitted for review.

3.1.6. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413 – Parking Structures (latest edition) and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval.

3.1.7. Suspending one hanger from another shall not be permitted.

3.1.8. All hangers, supports, brackets and other devices used outside the building wall shall be galvanized. If galvanized components cannot be used submit samples of proposed substituted for review before installation.

3.2. HORIZONTAL RUNS ON THE ROOF

3.2.1. Where conduit or cables are run horizontally across a roof, conduit or cable shall be supported from pre-manufactured UV resistant sleepers with closed cell foam base.

3.2.2. Sleepers shall be “E-Z Sleeper” product from Pipe-Ease Inc. or approved equivalent.

3.2.3. Wood Blocks are not acceptable.

END OF SECTION

26 05 31.00 Splitters, Junction, Pull Boxes and Cabinets

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 53.00 – IDENTIFICATION.

1.1.4. Section 26 05 63.00 – ACCESS DOORS AND ACCESSIBILITY.

1.2. REFERENCE

1.2.1. Ontario Electrical Safety Code, latest edition.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings and product data for cabinets in accordance with specification Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. SPLITTERS

2.1.1. Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Provide CSA Type 1 enclosures in non-sprinklered environments and CSA Type 4/12 in sprinklered environments.

2.1.2. Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated. Lugs to be dual rated for Copper/Aluminum (Cu/Al).

2.1.3. At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2. JUNCTION AND PULL BOXES

2.2.1. Welded steel construction with screw-on flat covers for surface mounting.

2.2.2. Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3. CABINETS

2.3.1. Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

2.3.2. Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface or flush mounting. The plywood backboard is to have a fire-resistant coating on the front. Do not paint over plywood fire rating certification stamp.

3. Execution

3.1. SPLITTER INSTALLATION

3.1.1. Install splitters and mount plumb, true and square to the building lines.

3.1.2. Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2. JUNCTION, PULL BOXES AND CABINETS INSTALLATION

3.2.1. Install pull boxes in inconspicuous but accessible locations.

3.2.2. Mount cabinets with top not higher than 2000 mm above finished floor.

3.2.3. Install terminal block as indicated in Type T cabinets.

3.2.4. Only main junction and pull boxes are indicated. Install pull boxes as follows:

.1 A conduit run exceeds 30 m and;

.2 360 degree of combined bends between pull boxes for power conduits or 180 degree of combined bends between pull boxes for communication and low voltage conduits.

3.3. IDENTIFICATION

3.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

3.3.2. Install identification labels indicating system name, voltage, and phase.

END OF SECTION

26 05 32.00 Outlet Boxes, Conduit Boxes and Fittings

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. Ontario Electrical Safety Code, latest edition.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

2. Products

2.1. OUTLET AND CONDUIT BOXES GENERAL

2.1.1. Size boxes in accordance with the electrical code.

2.1.2. Square or larger outlet boxes as required for special devices.

2.1.3. Gang boxes where wiring devices are grouped.

2.1.4. Blank cover plates for boxes without wiring devices.

2.1.5. 347 V outlet boxes for 347 V switching devices.

2.1.6. Combination boxes with barriers where outlets for more than one system are grouped.

2.2. SHEET STEEL OUTLET BOXES

2.2.1. Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 mm x 50 mm x 38 mm or as indicated. 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

2.2.2. Provide cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles connected to rigid conduit.

2.2.3. Provide electro-galvanized steel utility boxes for surface mounted boxes connected to surface-mounted EMT conduit, minimum size 100 mm x 54 mm x 48 mm.

2.2.4. Square or octagonal outlet boxes for lighting fixture outlets.

2.2.5. Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3. MASONRY BOXES

2.3.1. Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4. CONCRETE BOXES

2.4.1. Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5. FLOOR BOXES

2.5.1. Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

2.5.2. Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16 mm and 21 mm conduit. Minimum size: 73 mm deep.

2.6. OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

2.6.1. Electro-galvanized, sectional, screw ganging steel boxes, minimum size 75 mm x 50 mm x 63.5 mm with two double clamps to take non-metallic sheathed cables.

2.7. FITTINGS - GENERAL

2.7.1. Bushing and connectors with nylon insulated throats.

2.7.2. Knock-out fillers to prevent entry of debris.

2.7.3. Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

2.7.4. Double locknuts and insulated bushings on sheet metal boxes.

2.8. SERVICE FITTINGS

2.8.1. 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for duplex receptacles. Bottom plate with two knockouts for centered or offset installation.

2.8.2. Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate Amphenol jack connectors.

3. Execution

3.1. INSTALLATION

3.1.1. Support boxes independently of connecting conduits.

3.1.2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

3.1.3. For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

3.1.4. Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

3.1.5. Non-combustible electrical outlet boxes that penetrate a vertical fire separation or a membrane forming part of an assembly required to have a fire-resistance rating, do not require fire stops provided,

.1 they do not exceed:

.1 160 cm^2 (0.016 m^2) each in area, AND

.2 an aggregate area of 650 cm^2 (0.065 m^2) in any 9.3 m^2 of surface area, AND

.2 The annular space between the membrane and the box does not exceed 3 mm.

3.1.6. Where the conditions of clause 3.1.5 are not met, provide fire stops for the outlet boxes.

3.1.7. Opposing outlets on non-fire rated partition walls shall have a minimum 150 mm horizontal separation. Outlets shall not be mounted back to back.

3.1.8. Conform to the fire stopping requirements of the building code: unless provided with a fire stop in accordance with CAN/ULC-S115, “Fire Tests of Fire Stop Systems”, electrical outlet boxes on opposite sides of a vertical fire separation required to have a fire-resistance rating shall be separated by a horizontal distance of not less than 600 mm, or be installed in adjacent stud cavities.

END OF SECTION

26 05 34.00 Conduits, Conduit Fasteners and Fittings

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 31.00 – SPLITTERS, JUNCTION, PULL BOXES AND CABINETS

1.1.3. Section 26 05 32.00 – OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1.2. REFERENCES

1.2.1. CAN/CSA C22.2 No.18- Outlet Boxes, Conduit Boxes, and Fittings, latest edition.

1.2.2. CSA C22.2 No.45.1- Electrical Rigid Metal Conduit - Steel, latest edition.

1.2.3. CSA C22.2 No.56- Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, latest edition.

1.2.4. CSA C22.2 No.83- Electrical Metallic Tubing, latest edition.

1.2.5. CSA C22.2 No.211.2- Rigid PVC (Unplasticized) Conduit, latest edition.

1.2.6. CAN/CSA C22.2 No.227.3- Flexible Non-metallic Tubing, latest edition.

1.2.7. CSA C22.2 No.227.1 - Electrical Non-Metallic Tubing, latest edition.

2. Products

2.1. CONDUITS

2.1.1. Electrical rigid metal conduit: to CSA C22.2 No.45.1, galvanized steel or aluminum threaded.

2.1.2. Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.

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

2.1.4. Rigid PVC conduit: to CSA C22.2 No.211.2.

2.1.5. Flexible metal conduit: to CSA C22.2 No.56, steel or liquid-tight flexible metal.

2.1.6. Electrical non-metallic tubing (ENT): to CSA C22.2 No. 227, with couplings.

2.2. CONDUIT FASTENINGS

2.2.1. One-hole steel straps to secure surface conduits NPS 2 and smaller. Two-hole steel straps for conduits larger than NPS 2.

2.2.2. Beam clamps to secure conduits to exposed steel work.

2.2.3. Channel type supports for two or more conduits at 1 m on centre.

2.2.4. Hot dipped galvanized threaded rods, 6 mm dia. minimum, to support suspended channels.

2.2.5. For non-fire rated applications, pre-engineered support systems complying with CSA C22.2 No. 18.4 “Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239).”

2.3. CONDUIT FITTINGS

2.3.1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.3.2. Factory 90 degree elbow where 90 bends are required for 1” and larger conduits when a hydraulic bender is not used.

2.3.3. Connectors, and couplings for EMT conduit are to be set-screw steel type. Below the level of suspended ceilings, in a sprinklered environment, provide watertight fittings and “O” rings on all conduit runs and when conduit is terminated at any piece of electrical equipment.

2.3.4. Provide plastic bushings for all connectors, rigid nipples and rigid conduit 35 mm or larger.

2.4. EXPANSION FITTINGS FOR RIGID CONDUIT

2.4.1. Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

2.5. FISH CORD

2.5.1. Fish cord to be made of polypropylene.

3. Execution

3.1. INSTALLATION

3.1.1. All conduits on project to be surface mounted.Conduits are not allowed in cast in-place concrete or concrete slabs unless written consent is received from the Engineer’s Representative and Owner. Only once approved by the Engineer’s Representative and Owner do the clauses contained within this section and the respective sections relating to conduits in cast in-place concrete or concrete slabs apply.

3.1.2. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.1.3. Do not install conduits, associated raceway system, or devices on the surface of, or within 100 mm of the underside of roof decks.

3.1.4. Conceal conduits except in mechanical and electrical service rooms or in unfinished areas. Conduits to have their own support system and are to be supported independently of the ceiling grid or ceiling support system.

3.1.5. Where vertically run conduit passes through a slab, Contractor to provide a 100 mm high concrete pad with the pad extending 100 mm on all sides of the conduit.

3.1.6. Use electrical metallic tubing (EMT) conduit except where specified otherwise.

3.1.7. Use epoxy coated conduit in corrosive areas.

3.1.8. Use rigid galvanized steel threaded conduit where conduit is subject to mechanical damage.

3.1.9. Use rigid PVC conduit underground or in corrosive areas and where indicated.

3.1.10. Use flexible metal conduit for connection to motors or vibrating equipment in dry areas, connection to recessed luminaires without a prewired outlet box, connection to surface or recessed luminaires and work in movable metal partitions. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.11. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations. Use only liquid tight fittings when using liquid tight flexible metal conduit. Liquid tight flexible metal conduit to have a jacket with an FT6 rating when used in plenums otherwise provide a minimum FT4 rating. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.12. Use explosion proof flexible connection for connection to explosion proof motors.

3.1.13. Install conduit sealing fittings in hazardous areas. Fill with compound.

3.1.14. Minimum conduit size for lighting and power circuits: NPS 21 mm, unless otherwise noted on the Drawings.

3.1.15. Minimum conduit size for data / voice cabling: as indicated on drawings, otherwise 27 mm.

3.1.16. Install EMT conduit from a raised floor branch circuit panel to outlet boxes located in sub floor.

3.1.17. Install EMT conduit from a raised floor branch circuit panel to junction box in sub-floor. Run flexible metal conduit from junction box to outlet boxes for equipment connections in sub-floor.

3.1.18. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.1.19. Mechanically bend steel conduit over 21 mm diameter.

3.1.20. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

3.1.21. Install fish cord in empty conduits.

3.1.22. Run two 27 mm spare conduits up to ceiling space and two 27 mm spare conduits down to sub-floor space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes or in case of an exposed concrete slab, terminate each conduit in flush concrete or surface type box.

3.1.23. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

3.1.24. Dry conduits out before installing wire.

3.1.25. All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Landlord and/or structural Engineer's Representative before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Landlord. Check and verify the location of existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all tenant areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebar to minimize cutting of rebar when core drilling. Provide x-ray study before drilling or cutting where required by the Landlord and/or structural Engineer's Representative.

3.1.26. Provide sleeves for all new conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.

3.1.27. Where cables and conduits pass through partitions and through floors that are not fire rated, provide an air-tight seal around the cables and conduits.

3.1.28. Where cables and conduits pass through floors and fire rated walls, pack space between conduit (or cable) and sleeve with an approved fire stop as specified in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.1.29. Prior to installation of any wire or cable in the ducts, pull through each duct a flexible mandrel not less than 300 mm long and size for the internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Provide photo and video evidence of compliance with this clause and send to Engineer's Representative for review within 24 hours of Work occurring.

3.2. SURFACE CONDUITS

3.2.1. Run parallel or perpendicular to building lines.

3.2.2. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

3.2.3. Run conduits in flanged portion of structural steel.

3.2.4. Group conduits wherever possible on suspended or surface mounted channels.

3.2.5. Do not pass conduits through structural members, except as indicated.

3.2.6. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.2.7. Conduits must not be used to support other conduits.

3.3. CONCEALED CONDUITS

3.3.1. Run parallel or perpendicular to building lines.

3.3.2. Do not install horizontal runs in masonry walls.

3.3.3. Do not install conduits in terrazzo or concrete toppings.

3.4. CONDUITS IN CAST-IN-PLACE CONCRETE

3.4.1. Locate to suit reinforcing steel. Install in centre one third of slab.

3.4.2. Protect conduits from damage where they stub out of concrete.

3.4.3. Install sleeves where conduits pass through slab or wall.

3.4.4. Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

3.4.5. Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

3.4.6. Encase conduits completely in concrete with minimum 25 mm concrete cover.

3.4.7. Organize conduits in slab to minimize cross-overs.

3.5. CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

3.5.1. Run conduits 27 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.6. CONDUITS UNDERGROUND

3.6.1. Slope conduits to provide drainage.

3.6.2. For all non-PVC conduits run underground, provide waterproof joints with heavy coat of bituminous paint.

END OF SECTION

26 05 53.00 Identification

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. Ontario Electrical Safety Code.

1.2.2. Ontario Building Code.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. EQUIPMENT IDENTIFICATION

2.1.1. Identify electrical equipment with nameplates as follows:

.1 Lamacoid 3 mm thick plastic engraved sheet, black or red face, white core, mechanically attached with self-tapping screws or rivets.

.2 White letters 12 mmhigh for major switchboards, panelboards and power transformers.

.3 White letters 12 mm high for terminal boxes, junction boxes, grid boxes, splitter boxes, disconnect switches starters and contactors.

.4 Allow for an average of fifty (50) to one hundred (100) letters per nameplate.

.5 Identification to be in English.

.6 Black nameplates for normal power.

.7 Red nameplates for emergency power.

.8 Blue nameplates for UPS Power.

.9 Sample:

SWITCHBOARD AA

3000A, 600/347V, 3 PH, 4W, 50kA

FED FROM SWITCHBOARD AAA

MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-####

.10 Wording on nameplates to be approved by Engineer’s Representative prior to manufacture.

.11 Nameplates for splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.

.12 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.13 Transformers: indicate capacity, primary and secondary voltages, and upstream source where Transformer is fed from.

.14 Mechanical equipment: indicate equipment name and full circuit number including panel board identification.

.15 Switchboards, Distribution Panels, and Panelboards: Name designation, rated ampacity, voltage, number of phases, and number of wires, if neutral is rated for 200%, interrupting capacity in units of kA, upstream source from which panelboard is fed, month and year manufactured, and serial number.

.16 Automatic Transfer Switches (ATS): Name designation, rated ampacity, voltage, transfer switch arrangement (e.g. 3 pole with no neutral, 3 pole with solid neutral, 3 pole with overlapping neutral, 4 pole), withstand rating in units of kA, upstream normal power source from which ATS is fed, upstream emergency power source from which ATS is fed, month and year manufactured, and serial number.

.17 Generators:

.1 Indicate kW rating, kVA rating, voltage, number of phases, number of wires, generator neutral grounding arrangement, year and month manufactured, and engine and alternator serial number.

.2 Indicate Maximum Site Design Load (as defined in CSA C282) in units of kW; engineering firm responsible for Maximum Site Design Load calculation; drawing number, issuance title (e.g. Issued for Construction, Electrical Contactor As-Built, Issued for CCN-E01,etc.), and issuance date which Maximum Site Design Load is based on. It is very important for future renovations and load additions that it is clear when the Maximum Site Design Load is from and what drawing it is based on.

.3 Sample nameplate:

Generator G1

600 kW / 750 kVA

600/347V, 3 PH, 4W, Wye solidly grounded

Connected to ATS-PHXA

MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-####

Maximum Site Design Load 420 kW

.18 Provide nameplates on all electrical equipment including:

.1 Splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes

.2 Disconnects, starters and contactors, and Mechanical equipment

.3 Transformers

.4 Switchgear, Switchboards, Distribution Panels, and Panelboards

.5 Automatic Transfer Switches

.6 Generators

.7 UPS equipment

.8 Lighting control systems

2.1.2. Labels:

.1 A printed label, similar to a Brady label 6 mm high letters unless specified otherwise, for internal components, such as relays, fuses, terminal blocks.

2.2. WIRING IDENTIFICATION

2.2.1. Identify wiring with permanent legible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

2.2.2. Maintain phase sequence and colour coding throughout.

2.2.3. Colour code: in conformance with the electrical code.

2.2.4. Use colour coded wires in communication cables and control wiring, matched throughout system.

2.3. CONDUIT AND CABLE IDENTIFICATION

2.3.1. Colour code conduits, boxes and metallic sheathed cables.

2.3.2. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

2.3.3. Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour:

.1 up to 250 V Normal Power = Green

.2 up to 600 V Normal Power = Blue

.3 up to 250 V Emergency Power = Black

.4 up to 600 V Emergency Power = Orange

.5 High Voltage, greater than 750 V = Large independent label clearly identifying the voltage

.6 Telephone/Data = White

.7 Fire alarm = Red

.8 Other security systems = Yellow

.9 Controls = Purple

2.4. RECEPTACLE IDENTIFICATION

2.4.1. For health care projects, conform to requirements of Section 26 05 21.01 – PATIENT CARE WIRING.

2.4.2. All receptacles including systems furniture receptacles and whip connections are to be labelled with the respective circuit numbers with a printed label, similar to a Brady label, with 12 mm characters. Circuit number to include full circuit number including panel board identification.

2.4.3. Label to be placed on wall above cover plate or on cover plate. Location of label to be consistent throughout project.

2.5. MANUFACTURERS AND CSA LABELS

2.5.1. Visible and legible after equipment is installed.

2.6. WARNING SIGNS

2.6.1. Provide warning signs, as specified, and/or to meet the requirements of the Inspection Authorities.

2.7. FUSE SIZE LABELLING

2.7.1. Contractor to install a label on all equipment with fuses to identify the fuse sizes and class that are installed in the respective equipment.

2.7.2. Contractor to also install a label on all equipment with fuses to identify the maximum allowable fuse size based on the size of the respective feeders.

3. Execution

3.1. NOT USED

END OF SECTION

26 05 63.00 Access Doors and Accessibility

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

1.2.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2.2. Submit drawings showing size, type and location of all access doors, for review, before installation.

2. Products

2.1. MATERIALS

2.1.1. Access doors shall be Acudor, or LeHage or Mifab. Coordinate with other trades on site. All access doors on site shall be from the same manufacturer.

2.1.2. Doors in solid walls shall be equal to Acudor Model UF5000 with 14 U.S. gauge, prime painted steel door panel, rust resistant concealed hinges and screwdriver operated lock .

2.1.3. Doors in plaster partitions or ceiling shall be equal to Acudor model AP5010 16 US gauge, prime painted steel, concealed hinges and screwdriver operated lock.

2.1.4. Doors in drywall partitions or ceiling shall be equal to Acudor model DW 5040, 20 US gauge, prime painted steel, concealed hinges and screwdriver operated lock .

2.1.5. Access doors in fire rated walls or ceilings shall be equal to Acudor Model FW 5050 and ULC labeled with insulated door panel, concealed hinge, self-closing, self-latching, and prime painted. Provide master key operated catch in areas accessible to the public.

2.1.6. All doors in tiled walls shall be 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock.

2.1.7. Minimum size of doors shall be 300 mm x 450 mm. Wherever possible 600 mm x 600 mm doors shall be used.

3. Execution

3.1. INSTALLATION

3.1.1. All parts of the installation requiring periodic maintenance shall be accessible. Wherever pull boxes, junction boxes and other appurtenances are concealed by building construction, access doors shall be furnished by this section and installed under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.). This section is responsible for the proper location of the access doors.

3.1.2. Wherever possible, items requiring access shall be located in easily accessible areas (i.e. exposed or T-bar ceilings).

3.1.3. Group items in order to minimize the number of access doors required.

3.1.4. Each access door shall be installed to provide complete access to equipment for maintenance and servicing.

3.1.5. Make any changes to locations of access doors as directed by the Engineer's Representative.

3.1.6. The final installed locations of all access doors shall be shown on the As-Built Drawings.

END OF SECTION

26 05 83.00 Sleeves

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. Sleeves passing through stud partitions shall be 0.75 mm 22 US Gauge steel.

2.1.2. Sleeves passing through masonry walls shall be Schedule 40 steel pipe.

2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal or factory fabricated reusable type.

2.1.4. Where a housekeeping pad cannot be installed, sleeves passing through floors with waterproof membrane shall have a flashing collar, 50 mm wide at the membrane level. Flashing collar shall be continuously welded to sleeve. Sleeves shall extend 50 mm above the finished floor and shall be Schedule 40 steel pipe.

2.1.5. Where conduits pass through exterior foundation walls 6 mm thick steel sleeve of inside diameter not less the 75 mm greater than the outside diameter of the pipe shall be used and shall be complete with anchor collar. Thunderline Link-Seal wall seal or approved equal shall be used for the annular space between the sleeve and the conduit. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.

2.1.6. Provide adequate bracing for support of sleeves during concrete and masonry work.

2.1.7. Unless otherwise specified on the drawings, sleeves passing through the roof shall be liquid tight flexible conduit flashing consisting of a gooseneck shaped aluminum flashing sleeve with an integral deck flange, EPDM end cap seal and EPDM base seal.

3. Execution

3.1. INSTALLATION

3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Electrical Division for the Electrical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.

3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer’s Representative.

3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers. At non-rated barriers fill the annular space between the service and the sleeve with fire rated insulation as specified for rated separations and caulk around the edges with a minimum 12 mm thick of fire rated compound or acoustic non-setting mastic.

3.1.4. Through all fire or smoke separations, after testing, the annular space between conduit sleeves shall be fire stopped.

3.1.5. Where-holes are to be installed in existing structure, contractor is to core drill the-holes required. Contractor is required to scan all areas prior to coring and confirm layout with structural engineer prior to completing work. When installing sleeves in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.

3.1.6. All sleeves are to extend 150 mm above finished floor to accommodate a 100 mm concrete pad. Contractor to pour the concrete pad with the pad extending 100 mm on all sides of the sleeve.

END OF SECTION

26 05 88.00 Cutting and Patching

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Div. 00, and Section 26 05 01.00, and shall be carried out by experienced workers.

2.1.2. Include for all cutting and patching for all Electrical services.

3. Execution

3.1. INSTALLATION

3.1.1. Cut all openings no larger than is required for the services. Core drill for individual services.

3.1.2. Obtain approval from the structural Engineer's Representative before cutting or core drilling any openings or-holes in slabs or structural elements.

3.1.3. Locate all openings in structure elements requiring cutting and patching, and x-ray the structure to obtain Structural Engineer's Representative's approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar, and completely avoiding electrical conduit.

.1 Cut-holes through slabs only.

.2 Do not cut-holes through beams.

.3 Holes to be cut are 200 mm (Diameter) or smaller only.

.4 Maintain at least 100 mm clear from all beam faces. Space at least 3-hole diameters on Centre.

.5 For-holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.

.6 For-holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.

3.1.4. X-ray scanning:

.1 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity. The company shall be licensed by the Canadian Nuclear Safety Commission (CNSC), and all radiography work shall be performed in accordance with the Nuclear Safety and Control Act.

.2 Follow any safety requirements stipulated by the property manager.

.3 Minimum requirements: All people must be evacuated within a radius of 10 m from each exposure location. Prior to conducting exposures verify this "safe zone". If the 10 m

radius includes public areas such as a sidewalk, lobby, or elevator, these areas must be controlled (e.g. elevators shut down or prevented from stopping on floors at which exposures are taking place). In addition, if exposure locations are near the walls of adjacent tenants, ensure the notification and evacuation of people within the 10 m radius. The 10 m radius applies to the camera floor and the floor directly below only. The qualified technician shall ensure adequate precautions for the additional floors above and below the camera floor.

3.1.5. Patch all openings after services have been installed to match the surrounding finishes.

3.1.6. In existing areas all cutting, and core drilling for individual services except where specifically noted, is part of this division work.

3.1.7. The cost of x-ray scanning, cutting, patching and finishing is included in this division contract.

END OF SECTION

26 08 00.00 Commissioning

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 03.00 – AS-BUILT DRAWINGS.

1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.4. Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.

1.2. SCOPE

1.2.1. The commissioning process for the Electrical Systems shall include:

.1 Verification that the installation meets the requirements of the contract documents.

.2 Verification that the systems performance meets the design intent.

.3 Provision of building operator training.

.4 Provision of As-Built documentation, operating and maintenance manuals, and systems operating manuals.

1.2.2. The Contractor, Engineer's Representative and Commissioning Agent shall provide the services to complete the process. The execution portion of this Section defines the areas of responsibility.

1.2.3. Provide labour, equipment and material to conduct the Contractor commissioning process as outlined in this Section.

1.2.4. The Owner will hire a Commissioning Agent who will provide services identified in the article within this section.

2. Products

2.1. MATERIALS

2.1.1. The Contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests as specified in the Electrical Sections. The Contractor shall advise the Engineer's Representative or Commissioning Agent of instrumentation to be used and the dates the instruments were calibrated.

3. Execution

3.1. INSTALLATION

3.1.1. This Section describes the commissioning process to be performed by the Contractor. The process shall provide a high level of quality control during the construction.

3.1.2. The commissioning process shall consist of:

.1 Shop Drawings/As-Built Drawings.

.2 Installation inspection and equipment verification.

.3 Power distribution system commissioning.

.4 Emergency Power system commissioning.

.5 Fire alarm system verification and commissioning.

.6 Commissioning Agent performance testing.

.7 Commissioning meetings.

.8 Operating and maintenance manuals.

.9 Training.

.10 Systems acceptance.

3.2. INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

3.2.1. The Contractor shall complete the equipment verification forms for each piece of equipment. The completed forms shall be forwarded to the Engineer's Representative for review and be included in the operating and maintenance manual.

3.3. TEST FORMS AND VERIFICATION FORMS

3.3.1. The Commissioning Agent will prepare a test form manual, which will contain a form for every test identified in the Specification. A copy of this manual will be given to the Contractor, the General Contractor and the Engineer's Representative.

3.3.2. The Contractor shall prepare test forms for every test identified in this Specification. The Contractor shall complete each form as tests are completed and forward a copy to the Engineer's Representative for review on a monthly basis.

3.3.3. The forms shall be signed by either the authorities, the Engineer's Representative or the Commissioning Agent.

3.4. TESTING OF EQUIPMENT AND SYSTEMS

3.4.1. Conform to Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.

3.4.2. The Contractor shall hire the services of the manufacturer's technicians to test the equipment and associated systems. The technician shall record the results of the tests on the testing forms. The tests shall be witnessed by the Engineer's Representative or the Commissioning Agent. When the tests have been completed satisfactorily the technician and witnessing authority shall sign the forms.

3.4.3. When equipment or systems fail a test, the test shall be repeated after repairs or adjustments have been made. The additional tests shall be witnessed by the Engineer's Representative or the Commissioning Agent.

3.4.4. Tests which have not been witnessed shall not be accepted and shall be repeated.

3.5. COMMISSIONING MEETINGS AND SCHEDULING

3.5.1. The Contractor shall include the schedule for all tests and equipment start-up tests in the construction schedule.

3.5.2. The commissioning meetings shall occur during the regular construction meetings. The testing schedules and results of all tests shall be reviewed.

3.6. OPERATING AND MAINTENANCE MANUALS

3.6.1. Conform to Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.

3.6.2. Submit Operating and Maintenance Manuals to Commissioning Agent for review.

3.7. OPERATOR TRAINING

3.7.1. Conform to Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.

3.7.2. Submit Operating and Maintenance manuals to Commissioning Agent for review.

3.7.3. The training shall be conducted in a classroom and at the equipment or system.

3.7.4. Training will begin when the operating and maintenance manuals have been delivered to the Owner and reviewed by the Engineer's Representative.

3.7.5. Submit a course outline to the Engineer's Representative before training commences. Provide course documentation for up to eight people.

3.7.6. Each training session will be structured to cover:

.1 The operating and maintenance manual.

.2 Operating procedures.

.3 Maintenance procedures.

.4 Trouble-shooting procedures.

.5 Spare parts required.

3.7.7. The training sessions will be scheduled and co-ordinated by the Commissioning Agent. The Commissioning Agent will video tape the session.

3.7.8. Training shall be provided for the following systems:

System	Minimum Training Times
Diesel Generator	4 hours
Automatic Transfer switches	4 hours
Fire alarm	4 hours
The electrical system	8 hours
UPS systems	4 hours
LV lighting control system	4 hours

3.8. COMMISSIONING AGENT

3.8.1. A Commissioning Agent will be hired by the Owner.

3.8.2. The commissioning agent responsibilities shall include:

.1 Preparing the commissioning plan.

.2 Co-ordinating with the contractor to schedule tests.

.3 Preparing a test form manual.

.4 Witnessing selected tests.

.5 Receiving all test forms.

.6 Conducting performance test.

.7 Co-ordinating the contractors training.

.8 Attend commissioning meetings.

.9 Preparing the systems operating manuals.

3.8.3. The Contractor shall co-ordinate and co-operate with the Commissioning Agent.

3.9. PERFORMANCE TESTING

3.9.1. The Commissioning Agent will conduct performance tests on each electrical system to verify that the design intent performance has been met. The performance tests will cover all seasonal modes.

3.9.2. The Contractor shall conduct performance tests on all electrical systems and document the results on the performance forms provided by the Commissioning Agent in accordance with this Specification.

3.9.3. The Contractor shall provide assistance to the Commissioning Agent and have personnel available during the performance testing procedures during construction and the warranty period.

3.9.4. Performance testing will begin when all electrical systems have been completed, tested by the Contractor reviewed by the Engineer's Representative and substantial completion has been achieved.

3.10. COMMISSIONING PROCESS ALLOCATION

3.10.1. The commissioning process shall be allocated a value equal to 8% of the contract. This value shall be itemized in the Statement of Prices which form the basis for progress payment for the various portions of work. The Contractors may draw from this allocation as the commissioning process is completed.

.1 The Contractors shall submit all test and verification forms. The Engineer's Representative will use these forms to calculate a percentage complete.

.2 The Contractor may claim up to 5% of the contract, as per Schedule of Breakdown, on a monthly basis, from this allocation leading up to performance testing. The remaining 3% shall not be paid out until the performance testing, O&M manuals and training have been completed satisfactorily.

END OF SECTION

26 24 17.00 Panelboards – Breaker Type

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 05.00 – MOUNTING HEIGHTS.

1.1.4. Section 26 05 53.00 – IDENTIFICATION.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 29 – Panelboards and Enclosed Panelboards, latest edition.

1.2.2. CSA C22.2 No. 5 – Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3.3. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

2. Products

2.1. PANELBOARDS

2.1.1. Panelboards: product of one manufacturer.

2.1.2. Install circuit breakers in panelboards before shipment.

2.1.3. In addition to CSA requirements manufacturer's nameplate must show fault current that the panel including all breakers have been built to withstand.

2.1.4. Panelboards to have the following minimum ratings for interrupting capacity or as indicated on the drawings or panel schedules.

.1 120/208 V panelboards – 10 kA

.2 347/600 V panelboards – 22 kA

2.1.5. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

2.1.6. Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated. Provide an additional 20% of space within each panelboard in addition to what is shown on the drawings when a separate panel schedule is not provided for a specific panelboard.

2.1.7. Two keys for each panelboard and key panelboards alike.

2.1.8. Panelboards to be copper bus unless identified otherwise.

2.1.9. Where identified on the drawings or schedules, provide a copper neutral bus sized to 200% of the mains rating for panels.

2.1.10. Mains: suitable for bolt-on breakers.

2.1.11. Trim with concealed front bolts and hinges, for all panelboards other than those used in residential suites.

2.1.12. Trim and door finish: baked grey enamel.

2.1.13. Enclosure to be CSA Type 1 with drip hood with the exception of recessed panel enclosures which are to be CSA Type 1.

2.1.14. Provide Surge Protection Device where shown on Drawings.

2.1.15. Series ratings may be acceptable. Panels to be labeled as such. Manufacturing to supply supporting data.

2.1.16. All lugs to be dual rated for Copper/Aluminum (Cu/Al).

2.2. MOULDED CASE CIRCUIT BREAKERS

2.2.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.

2.2.2. Common-trip breakers: with single handle for multi-pole applications.

2.2.3. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.2.4. Main breaker, where indicated: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.2.5. Lock-on devices for 10 % of 15 to 30 A breakers installed. Turn over unused lock-on devices to Owner.

2.2.6. Where breakers are identified to feed high intensity discharge (HID) lighting, provide breakers that are rated and designed for use with HID lighting.

2.2.7. Provide one breaker per designated breaker space. Multiple breakers contained in one housing or twin breakers are not acceptable.

2.2.8. Breaker terminals to be dual rated for Copper/Aluminum (Cu/Al).

2.3. EQUIPMENT IDENTIFICATION

2.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

2.3.2. Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4. MANUFACTURERS

2.4.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

3.1.2. Install surface mounted panelboards on galvanized unistrut stand-offs or on fire rated plywood backboards. The plywood backboards are to be as per Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.1.3. Mount panelboards at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS.

3.1.4. Connect loads to circuits.

3.1.5. Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

26 25 00.00 Busways

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 28 23.00 – DISCONNECT SWITCHES - FUSED AND NON-FUSED.

1.2. REFERENCES

1.2.1. CSA C22.2 No.27 Busways, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. Indicate in detail exact routing of busways throughout building and in relation to column lines and structural slabs and walls. Provide voltage drop test results for each size of busway.

2. Products

2.1. BUSWAYS CHARACTERISTICS

2.1.1. Provide a full capacity neutral where shown.

2.1.2. Busway shall be totally enclosed in CSA Type 1, sprinkler proof enclosure.

2.1.3. Provide plug-in low impedance bus for risers and feeder style for horizontal runs.

2.1.4. Joints shall be silver-plated and of single bolt type construction.

2.1.5. Feeder type busway shall be constructed to join with plug-in type busway without additional fittings.

2.1.6. Line to line voltage drop shall not exceed 3 V per 30 m at rated current with concentrated load at one end at unity system power factor.

2.1.7. The busway shall be designed for one length or fitting to be removed without disturbing rest of run.

2.1.8. Bus shall have copper bars with 98% minimum conductivity.

2.1.9. Provide internal fire barriers at floor/wall penetrations complete with floor or wall flanges.

2.1.10. Provide expansion joints on vertical and horizontal busway runs at locations recommended by manufacturer and where busway crosses building expansion joints.

2.1.11. Fittings shall be factory manufactured to suit type of busway used and as indicated - transformer tap-offs, tap-off boxes, elbows, tees, offsets, enclosures, flanged end connections to switchboards, transfer switches, and motor control centres.

2.1.12. Provide hangers to suit mounting position and type of busway, edgewise, flatwise or vertical. For vertical bus provide spring hangers and floor flanges. Where distance between floors exceeds 3 m provide intermediate spring hanger supports.

2.1.13. All lugs and terminals to be dual rated for Copper/Aluminum (Cu/Al).

2.2. FEEDER TYPE BUSWAYS

2.2.1. Feeder type busways: to CSA C22.2 No.27, low impedance single bolt per sandwich.

2.3. PLUG-IN TYPE BUSWAYS

2.3.1. Plug-in busways shall conform to CSA C22.2 No.27. Provide 10 plug-in openings per 3 m section with 5 per side for connection of plug-in units. Plug-in openings shall be provided with access covers and rigid moulded insulators. All openings to be usable at same time.

2.3.2. Plug-in units shall permit connection of disconnect switches to Section 26 28 23.00 – DISCONNECT SWITCHES - FUSED AND NON-FUSED.

2.3.3. Plug-in units shall comply with CSA C22.2 No.27, with grounding spring to ground unit to busway housing before plug-in jaws make contact with bus bars. Provide interlock so that unit can be inserted or withdrawn only in the de-energized position.

2.4. MANUFACTURERS

2.4.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Install busways and associated fittings, supports and accessories in accordance with manufacturer's recommendations.

3.1.2. Space hangers in accordance with manufacturer’s recommendations. Maximum spacing shall be 3 m.

3.1.3. Tighten busway joint bolts to values recommended by busway manufacturer.

3.1.4. Cover busways with plastic envelope until building is clean and bus ready to be megger tested and energized.

3.1.5. Megger bus duct in presence of Engineer’s Representative and have readings approved.

3.1.6. Re-torque single bolt sandwich type busway as recommended by manufacturer.

END OF SECTION

26 27 02.00 Surge Protective Device

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. STANDARDS

1.2.1. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

.1 Institute of Electrical and Electronic Engineers (ANSI/IEEE), latest edition

.1 C62.11 Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV), C62.41.1 Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits, latest edition.

.2 C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits, latest edition.

.3 C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits, latest edition.

.2 Federal Information Processing Standards Publication 94 (FIPS PUB 94) – Guideline on Electrical Power for ADP Installations, latest edition.

.3 National Fire Protection Association, latest edition:

.1 75 Standard for The Protection of Information Technology Equipment, latest edition.

.2 780 Standard for the Installation of Lightning Protection Systems, latest edition.

.4 MIL Standard 220B Method of Insertion Loss Measurement, latest edition.

.5 Underwriters Laboratories UL 1283 – Standard for Electromagnetic Interference Filters and UL 1449 – Standard for Surge Protective Devices, latest edition.

.6 CSA C22.2 No. 269 Series – Surge protective devices, latest editions.

.7 cUL.

1.3. OVERVIEW

1.3.1. The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy Surge Protective Devices (SPD) formerly called Transient Voltage Surge Suppressors (TVSS). The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B and C environments.

1.3.2. SPDs are designed for repeated limiting of transient voltage surges on 60 Hz Power circuits not exceeding 1000 V and designated as follows:

.1 Type 2 – SPDs hard-wired to distribution equipment after the load side of the service equipment overcurrent device.

.2 Type 3 – Plug-in SPDs.

.3 Type 4 – Component SPDs and component assemblies.

1.4. ENVIRONMENTAL REQUIREMENTS

1.4.1. The operating temperature range shall be -25 deg. C. to 60 deg. C.

1.4.2. The unit shall be capable of operation up to 3,960 m above sea level.

1.4.3. No appreciable magnetic fields shall be generated.

1.5. SHOP DRAWINGS AND PRODUCT DATA

1.5.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.5.2. Product Data: Provide catalogue sheets and supporting documentation showing:

.1 System voltage.

.2 UL1449 listing.

.3 UL 1449 Voltage Protection Ratings.

.4 UL 1449 I-n rating.

.5 Dimensions showing construction, lifting and support points, and enclosure details.

.6 Per mode and per phase peak surge current ratings.

.7 Modes of discrete suppression circuitry.

.8 Warranty period and replacement terms.

.9 Conductor size, conductor type, and recommended lead length.

.10 SPD is suitable for the application including system grounding configuration.

1.5.3. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Indicate maximum size of circuit breaker or fuse to be connected for each unit.

1.5.4. List and detail all protection systems such as fuses, disconnecting means and protective features.

1.5.5. Provide verification that the SPD device complies with the required UL1449 latest edition, latest revision, and CSA or cUL approvals.

1.5.6. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -40 dB at 100 kHz.

1.5.7. For retrofit and side-mounting applications, provide electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

1.5.8. Operation and maintenance manuals shall include details for each SPD shipped.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Equipment shall be handled and stored in accordance with manufacturer’s written instructions. One (1) copy of manufacturer’s written instructions shall be included with the equipment at time of shipment.

1.7. QUALITY ASSURANCE AND WARRANTY

1.7.1. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

2. Product

2.1. GENERAL

2.1.1. The SPD shall be listed by CSA or cUL to UL's 1283 and UL's 1449 standards, and not merely the components or modules. Listing must be verified by a third party approved laboratory.

2.1.2. The SPD shall be CSA or cUL/UL 1449 labelled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD.

2.1.3. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnect do not meet the intent of this specification.

2.1.4. Obtain all surge suppression devices from a single manufacturer.

2.1.5. The maximum continuous operating voltage (MCOV) of all components for solidly grounded systems shall not be less than 125 % for a 120 V system and 120 % for 220 and 240 V systems, and 125 % for 347 and 600 V systems. All components for resistance grounded systems shall have an MCOV not less than 125 % of the line-to-line voltage.

2.1.6. Provide delta connected SPDs where a resistance grounded system is shown on the Drawings.

2.1.7. All SPD's shall be equipped with a comprehensive monitoring system which shall include a visual panel display providing information on unit status and phase loss/protection loss.

2.1.8. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

2.1.9. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

2.1.10. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

2.1.11. The SPD shall protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N and N-G, and have bidirectional, positive and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only 4 modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

2.1.12. Nominal Discharge Current (In) – All SPDs applied to the distribution system shall have a 20 kA In rating regardless of their SPD Type (includes Types 2 and 4) or operating voltage. SPD shall be UL 1449 labelled with this kA I-nominal (I-n) rating.

2.1.13. ANSI/UL 1449 Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	2500

2.1.14. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations or distribution equipment rated at 1,000 Amps or more.	300 kA	150 kA
B	Distribution equipment rated less than 1,000 Amps but greater than 400 Amps	200 kA	100 kA
A	Branch Location Panelboards, MCCs, Busway rated at 400 Amps or less	100 kA	50 kA

2.1.15. Internal Fusing - Overcurrent Protection

.1 Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnect do not meet the intent of this specification.

2.1.16. SPD shall be separate from or integral to the electrical equipment. Where an Integral SPD is supplied, unit shall be UL 1449 labelled as Type 1 intended for Type 2 applications without need for external or supplemental overcurrent controls.

2.1.17. The suppressor shall include Form C dry contacts (N.O. or N.C.) for remote monitoring capability.

2.1.18. SPD lugs and terminals shall be dual rated for Copper/Aluminum (Cu/Al).

2.2. CATEGORY C LOCATIONS

2.2.1. Provide SPD on the service entrance equipment or distribution equipment rated at 1,000 Amps or more.

2.2.2. The SPD shall have an internal audible alarm with mute on front cover.

2.2.3. SPD’s for service entrance locations shall have a transient event counter with LCD panel display and reset button on the front cover.

2.3. CATEGORY B LOCATIONS

2.3.1. SPDs for distribution equipment rated less than 1,000 Amps but greater than 400 Amps shall be as indicated on project Drawings.

2.3.2. The SPD shall have an internal audible alarm.

2.4. CATEGORY A LOCATIONS

2.4.1. SPDs for the branch location panelboards, MCCs, busway rated at 400 Amps or less shall be as indicated on project drawings and panel schedules.

2.4.2. The SPD shall have an internal audible alarm.

2.5. DATA & SIGNAL LINE PROTECTION (FOR 24 V APPLICATIONS)

2.5.1. The unit shall have a data transmission rate up to 10.0 Mbps.

2.5.2. Each conductor shall have less than 2.4 ohm of internal series resistance per wire, and each pair of conductors shall have a peak surge current of no less than 10,000 amps per wire (20,000 amps per pair), 8 x 20 µs waveform.

2.5.3. SPD Voltage Protection level shall be less than < 46 V.

2.5.4. The response time of the components of the unit shall be less than one nanosecond.

2.6. PHONE LINE PROTECTION

2.6.1. The unit shall be listed under UL 497A, Standard for Secondary Protectors for Communications Circuits.

2.6.2. The unit shall have a data transmission rate up to 16.0Mbps.

2.6.3. Each conductor shall have less than 1 ohm of internal series resistance per wire.

2.6.4. Each pair of conductors shall have a peak surge current of no less than 200 amps, 8 x 20 µs waveform.

2.6.5. The maximum let-through voltage on an IEC 10 x 700 µs impulse (2kV/80A) shall be 260 volts tip-ring, 260 volts tip to ground, and 260 volts ring to ground.

2.6.6. The response time of the components of the unit shall be less than one nanosecond.

2.7. ENCLOSURES

2.7.1. All enclosed equipment shall have CSA Type 1 with drip hood, sprinkler proof enclosure, unless otherwise noted.

2.7.2. For integral mounted SPD unit, it should be mounted in separate compartment with separate removable cover. For remote mounted SPD unit provide separate enclosure mounted as near to the electrical equipment as possible.

2.8. MANUFACTURERS

2.8.1. Approved Vendors:

.1 Advanced Protection Technologies

.2 Eaton Cutler-Hammer

.3 Innosys Power Inc.

.4 Schneider Electric

.5 Siemens

.6 Surge-Pure

3. Execution

3.1. INSTALLATION

3.1.1. Install the SPD with the conductors as short and straight as practically possible. Gently twist conductors together. SPD performance is drastically reduced with increased conductor length.

3.1.2. Installer shall reasonably rearrange breaker locations to minimize the lead length to SPDs.

3.1.3. Follow the SPD manufacturer's recommended installation practice as outlined in the equipment installation manual. The Electrical Contractor shall ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

3.1.4. Main service entrance units shall be installed on a breaker, or, where indicated, shall be installed on a fused disconnect switch that meets or exceeds the fault current rating of the switchgear. Size of breaker to be confirmed by manufacturer and coordinated with distribution equipment supplier.

3.1.5. Distribution, branch panel, and motor control center units shall be installed on dedicated circuit breakers. Size of breaker to be confirmed by manufacturer and coordinated with distribution equipment supplier. A 3-pole breaker position shall be provided for connection of SPD.

3.1.6. The installing contractor shall comply with all applicable codes.

END OF SECTION

26 27 19.00 Multi-Outlet Assemblies

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 27 26.00 – WIRING DEVICES.

1.1.4. Section 26 05 21.00 – WIRES AND CABLES UNDER 2000 V.

1.2. REFERENCE

1.2.1. CSA C22.2 No. 62 – Surface Metal Raceways, latest edition.

1.2.2. ANSI/TIA 569-C – Commercial Building Standard for Telecommunications Pathways and Spaces, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. If variations from the reviewed shop drawings occur during the installation of the system, final as built drawings shall be submitted for each floor that has been altered.

2. Products

2.1. SURFACE RACEWAY FOR WIRING DEVICES

2.1.1. The raceway and all system components must be CSA listed.

2.1.2. Raceway to be constructed of galvanized steel unless stainless steel is identified on the drawings. Raceway base shall have a minimum thickness of 1.3 mm (0.050 in.) and the cover shall have a minimum thickness of 1 mm (0.040 in.).

2.1.3. Raceways shall be painted with the colour to be determined by the architect at the time of shop drawing stage. Submit available colour selections with the shop drawing submittal.

2.1.4. The raceway shall have a minimum of two compartments unless additional compartments are identified on the drawings. Assembled base and cover shall be a 120 mm (4¾ in.) wide for two section raceway and additional 60 mm (2-3/8 in.) for every additional compartment with a minimum depth of 45 mm (1¾ in.) unless specified otherwise on the drawing.

2.1.5. The raceway shall be a modular design with separate covers for each compartment divided with fixed barriers. The compartment covers to be snap on design, which snap side by side on a common base. Raceway covers shall be enhanced tamper resistant form, where screws are only necessary on access plates and the covers of certain fittings, but not on standard cover lengths. A tool shall be provided to form the shape in the cover flange necessary to maintain enhanced tamper resistance when the cover is field cut. Another tool shall be provided for cutting covers to ensure square field cuts.

2.1.6. Provide all required fittings including, but not limited to flat, internal and external elbows, couplings for joining raceway sections, wire clips, blank end fittings, entrance fittings, and a full complement of device mounting brackets and plates. All fittings shall be an enhanced tamper resistant form and shall be divided with barriers and made to match the size of the accompanying raceway base.

2.1.7. Provide full capacity corner elbows and tee fittings to maintain a controlled 50 mm (2 in.) cable bend radius, which meets the specifications for Fiber Optic cabling and exceeds the TIA 569 requirements for communications pathways.

2.1.8. Device brackets shall be provided in sizes to match the width of the raceway and with mounting-holes appropriately located to ensure proper mounting of devices in all compartments.

2.1.9. Device plates shall be made in any length from 152.4 mm (6 in.) to 1.5 m (60 in.) with cut outs to accommodate various combinations of power and/or communication devices in all compartments. Device plates shall be 152.4 mm (6 in.) and 304.8 mm (12 in.) long with a flange to overlap the joint of the adjacent cover. Provide 5% additional device plates for future additions or modifications for all types of devices installed.

2.2. MANUFACTURERS

2.2.1. The following are approved manufacturers:

.1 CER - Canadian Electric Raceways.

.2 Legrand – Wiremold.

.3 Hubbell.

3. Execution

3.1. INSTALLATION

3.1.1. Prior to and during installation, refer to system layout or approval drawings containing all elements of the system. Installer shall comply with detailed manufacturer’s instruction sheets, which accompany system components, as well as complete system instruction sheets, whichever is applicable.

3.1.2. All raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, also in accordance with manufacturer’s installation sheets.

3.1.3. All metal raceway shall be electrically continuous and bonded in accordance with the respective electrical code for proper grounding.

3.1.4. Provide a separate insulated bonding conductor in the entire length of the raceway.

3.1.5. Raceway shall be securely supported at intervals not exceeding 1500 mm (5 ft.) or in accordance with manufacturer’s installation sheets.

3.1.6. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer’s installation sheets. All unused raceway openings shall be closed.

3.1.7. Locate wireway and wiring devices as shown.

3.1.8. Install supports, elbows, tees, connectors and fittings. Keep the number of elbows, offsets and connections to a minimum.

3.1.9. Install wiring and wiring devices as indicated.

3.1.10. Install barriers to separate different wiring systems.

END OF SECTION

26 27 26.00 Wiring Devices

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 05.00 – MOUNTING HEIGHTS.

1.1.4. Section 26 05 53.00 – IDENTIFICATION.

1.1.5. Section 26 51 13.00 – LIGHTING EQUIPMENT.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 42, General use receptacles, attachment plugs, and similar wiring devices, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. SWITCHES

2.1.1. 20 A, single pole, double pole, three-way, or four-way specification grade switches. Voltage rating of the switch to be as per the contract documents.

2.1.2. Manually-operated general purpose switches with following features:

.1 Terminal-holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Decora Style specification grade Rocker switch.

.6 Colour to be selected by Architect/Engineer’s Representative.

2.1.3. Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2. RECEPTACLES

2.2.1. All receptacles to be specification grade.

2.2.2. Duplex receptacles, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Thermoplastic with impact-resistant nylon face moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Eight back wired entrances, four side wiring screws.

.4 Triple wipe contacts and riveted grounding contacts.

2.2.3. Duplex receptacles with USB charging outlets, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Thermoplastic with impact-resistant nylon face moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Six back wired entrances, four side wiring screws.

.4 Triple wipe contacts and riveted grounding contacts.

.5 One USB A charging outlet and one USB C charging outlet, 5 V DC, 6 A shared between the two ports.

2.2.4. Hospital grade receptacles: As indicated in Section 26 05 21.01 – PATIENT CARE WIRING.

2.2.5. Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Thermoplastic moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

2.2.6. Other receptacles with ampacity and voltage as indicated.

2.2.7. Receptacles to be coloured as follows:

.1 Normal Power – Colour to be selected by Architect/Engineer's Representative.

.2 Emergency/Essential Power – Red.

.3 Isolated Ground – Orange.

.4 Switched – Gray.

.5 UPS – Blue.

2.2.8. All dwelling receptacles of CSA configuration 5-15R and 5-20R shall be tamper resistant receptacles and shall be so marked; receptacles dedicated for microwaves, refrigerators, freezers or those receptacles located in an attic or crawl space shall not be required to be tamper-resistant.

2.2.9. All dwelling receptacles rated 125V, 20A or less shall be provided with arc-fault protection, except for the following:

.1 Bathroom and washroom basin receptacles.

.2 Kitchen counter receptacles

.3 Refrigerator receptacles

2.2.10. Arc-fault protection for dwelling unit receptacles shall be provided by:

.1 A combination-type arc-fault circuit interrupter

.2 An outlet branch-circuit interrupter installed at the first outlet on the branch circuit, where the wiring method for the portion of branch circuit between the branch circuit overcurrent device and the first outlet consists of metal raceway, armoured cable, or non-metalic conduit or tubing.

2.2.11. Electrical Contractor shall coordinate with furniture supplier to identify switched circuits prior to installation.

2.3. MANUFACTURERS

2.3.1. The switches and wiring devices shall be of one manufacturer throughout the project.

2.3.2. The following are acceptable manufacturers:

.1 Legrand.

.2 Hubbell.

.3 Cooper.

.4 Leviton.

2.4. DIMMERS

2.4.1. Dimmers shall be 600 W, 1500 W, 2000 W.

.1 Full range, continuously variable control of light intensity.

.2 Vertical slider allowing the light level to be set by the user.

.3 Slide to Off.

.4 Capable of operating at rated capacity.

.5 Power failure memory.

.6 Dimmers shall be available for direct control of incandescent, magnetic low voltage, electronic low voltage, fluorescent, and LED.

2.4.2. Electronic (solid-state) Low Voltage (ELV) transformer dimmers (incandescent).

.1 Circuitry designed to control the input of Electronic (solid state) Low Voltage transformers.

.2 Control up to 600 W of Electronic Low Voltage load.

.3 Reset-able overload protection when capacity is exceeded.

2.4.3. LED dimmers.

.1 Slide to Off only. Must match driver and LED requirements.

2.4.4. Manufacturers

.1 Lutron Maestro Series.

.2 Leviton True Touch Series.

2.5. SPECIAL WIRING DEVICES

2.5.1. Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type.

2.6. COVER PLATES

2.6.1. Cover plates for wiring devices.

2.6.2. Cover plates from one manufacturer throughout project.

2.6.3. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

2.6.4. Provide stainless steel cover plates, suitable for the respective device, for all devices mounted in flush-mounted outlet boxes located in finished areas.

2.6.5. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.6.6. Weatherproof rain tight while-in-use metal cover, complete with gaskets for duplex receptacles located outside or as indicated.

2.6.7. Weatherproof rain tight while-in-use metal cover, complete with gaskets for single receptacles or switches located outside or as indicated.

3. Execution

3.1. INSTALLATION

3.1.1. 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 Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.

.4 Mount toggle switches at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated.

3.1.2. Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

3.1.3. Dimmers:

.1 Install dimmers as indicated. Provide suitable clearances in multi-gang boxes as recommended by the manufacturer to maintain the dimmer rating.

.2 Coordinate the dimmer selection with the ballast/driver to be controlled, to ensure compatibility.

.3 Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.

3.1.4. 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.

3.1.5. Labelling

.1 Provide labels with panel name and circuit number on all receptacles in conformance with Section 26 05 53.00 – IDENTIFICATION.

END OF SECTION

26 28 14.00 Fuses Low Voltage

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 248, Low Voltage Fuses, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. Submit fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics, I2t (for fuse coordination), and peak let-through current.

1.4. MAINTENANCE MATERIALS

1.4.1. Three spare fuses of each type and size installed 600 A. and above.

1.4.2. Six spare fuses of each type and size installed up to and including 400 A.

1.5. DELIVERY AND STORAGE

1.5.1. Ship fuses in original containers.

1.5.2. Do not ship fuses installed in switchboard.

1.5.3. Store fuses in original containers in moisture free location.

2. Products

2.1. FUSES GENERAL Fuses: product of one manufacturer.

2.1.2. Fuses to have an indicating window to identify when the fuse has been blown.

2.2. FUSE TYPES

2.2.1. Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

2.2.2. Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

2.2.3. Class R fuses. For UL Class RK1 fuses, peak let-through current and I2t values not to exceed limits of CSA C22.2 No. 248.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

2.2.4. Class C fuses.

2.2.5. Fuses for Motors:

.1 All fuses for motor loads are to be time-delay type.

2.3. FUSE STORAGE CABINET

2.3.1. Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door, B-LINE model 243012 + 2 shelves FCS2412, finished in accordance with Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.4. FUSE PULLER

2.4.1. Provide a fuse puller for each size of fuse to be located in the fuse storage cabinet. Fuse puller to be clearly labelled for the appropriate building and fuse cabinet. Fuse puller to be equal to the Ideal Safe-T-Grip Fuse Puller.

2.5. MANUFACTURERS

2.5.1. The following are acceptable manufacturers:

.1 Mersen

.2 Cooper-Bussman

.3 Littelfuse

3. Execution

3.1. INSTALLATION

3.1.1. Install fuses in mounting devices immediately before energizing circuit.

3.1.2. Ensure correct fuses fitted to physically match mounting devices.

.1 Install Class R rejection clips for Class R fuses.

3.1.3. Ensure correct fuses fitted to assigned electrical circuit.

3.1.4. Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

END OF SECTION

26 28 21.00 Moulded Case and Insulated Case Circuit Breakers

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 5 – Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS

1.3.2. Include time-current characteristic curves for breakers with ampacity of 400 A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.

1.3.3. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

2. Products

2.1. BREAKERS GENERAL

2.1.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.

2.1.2. Common-trip breakers: with single handle for multi-pole applications.

2.1.3. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

2.1.4. Circuit breakers with interchangeable trips as indicated.

2.2. THERMAL MAGNETIC BREAKERS

2.2.1. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3. MAGNETIC BREAKERS

2.3.1. Moulded case circuit breakers to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4. FUSED THERMAL MAGNETIC BREAKERS

2.4.1. Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit breaker. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. The removal of fuse cover, blowing of a fuse or removal of a fuse, shall trip the breaker.

2.5. SOLID STATE TRIP BREAKERS

2.5.1. Circuit breaker to operate by means of an adjustable solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition.

2.5.2. Electronic trip with true RMS sensing.

2.5.3. Use current transformers to ensure accurate measurement from low current up to high currents.

2.5.4. Electronic trip with thermal memory/imaging.

2.5.5. Adjustable solid state trip unit complete with:

.1 Adjustable long time pick-up

.2 Adjustable long time delay

.3 Adjustable short time pick-up (where S indicated on Drawings)

.4 Adjustable short time delay (where S indicated on Drawings)

.5 Adjustable instantaneous pick-up (where I indicated on Drawings)

.6 Adjustable ground fault pick-up (where G indicated on Drawings)

.7 Adjusable ground fault delay (where G indicated on Drawings)

.8 Long time, short time, instantaneous tripping for phase and ground fault short circuit protection as noted above.

2.5.6. Trip unit consisting of adjustable protection settings set by rotating switch or digital keypad, and rating plug.

2.5.7. Provide features listed below:

.1 Provide instantaneous maintenance mode (arc flash reduction maintenance system) including settings as low as 2.5 times breaker rating plug with switch built into respective switchboard. Provide LED light that confirms that maintenance mode is engaged.

.2 Provide instantaneous maintenance mode (arc flash reduction maintenance system) including settings as low as 2.5 times breaker rating plug, enabled remotely through 24 V DC circuit and remote switch. Provide LED light that confirms that maintenance mode is engaged.

.3 Provide trip unit with local trip indication and ability to locally and remotely indicate reason for trip (e.g. overload, short circuit, or ground fault).

2.6. INSULATED CASE CIRCUIT BREAKERS GENERAL

2.6.1. Use insulated case circuit breakers where shown on the Drawings.

2.6.2. Provide draw out type electrically operated circuit breaker with remote open/close key switch.

2.6.3. Provide circuit breaker operating mechanisms that are two-step, fully-stored energy devices for quick-make, quick-break operation with a maximum of a five-cycle closing time. Open-close-open (O-C-O) cycle possible without recharging. Provide motor operator that automatically charges when circuit breaker is closed. Charge the closing springs (step one) upon actuation of the operating handle or an operation cycle of the circuit breaker motor and close the circuit breaker contact (step two) upon operation of a local "close" button. Automaticaly charge the opening springs when closing the circuit breaker contacts.

2.6.4. Provide breaker that is 100 % continuous current rated in its enclosure.

2.6.5. Provide kirk keys where indicated on the Drawings.

2.6.6. Completely isolate current-carrying components from the accessory mounting area and double insulate current-carrying components from the operator with accessory cover in place.

2.6.7. Provide padlocking provisions furnished to receive up to three padlocks when circuit breaker is in the open position, positively preventing unauthorized closing of the circuit breaker contacts.

2.6.8. Provide provisions for up to two key locks allowing locking in the disconnected position. Provide provisions for locking in the connected, test and disconnected positions by padlock or key lock.

2.6.9. Provide buttons, with lockable clear cover, located on the face of the circuit breaker, to open and close the circuit breaker and indicators to show the position of the circuit breaker contacts, status of the closing springs, and circuit breaker position in the cell. Provide an indicator that shows "charged-not OK to close" if closing springs are charged but circuit breaker is not ready to close. Provide circuit breaker racking system that has positive stops at the connected, test, disconnected and withdrawn positions.

2.6.10. Equip circuit breaker with an interlock to discharge the stored energy spring before the circuit breaker can be withdrawn from its cell. Provide circuit breaker that provides a positive ground contact check between the circuit breaker and cell when the accessory cover is removed while the circuit breaker is in the connected, test or disconnected positions.

2.6.11. Provide interlocks to prevent circuit breaker draw out when in closed position and to prevent closing unless fully engaged or in test position. Provide breaker that is trip free during racking operation.

2.6.12. Provide as an option, primary connectors that can be rotated to provide flexible vertical or horizontal connections. Ensure front connections are available as an option for shallow depth equipment designs.

2.6.13. Provide ready-to-close contact that indicates remotely that the circuit breaker is "ready to close." The circuit breaker is ready to close when it is open, spring mechanism is charged, a maintained closing order is not present, a maintained opening order is not present, and the circuit breaker is in an operational position.

2.6.14. Provide secondary control wiring that is front accessible and available in cage clamp or ring terminal connections. Provide secondary wiring that is inaccessible when switchboard door is closed.

2.6.15. Provide long service life circuit breaker. Provide circuit breakers certified to perform a minimum of 10,000 operations without maintenance where circuit breaker frames are 3000 A and below.

2.6.16. Equip circuit breaker with a visual contact wear indicator.

2.6.17. Provide circuit breaker arc chutes that don’t contain asbestos.

2.6.18. Trip Unit

.1 Comply with the requirements noted above in the Solid State Trip Breakers section.

.2 Provide trip units that are removable to allow for field upgrades.

.3 Provide trip units that are capable of the following types of ground-fault protection: residual, zero sequence, source ground return, and modified differential. Ground-fault sensing systems may be changed in the field.

.4 Ensure neutral current transformers are available for four-wire systems.

.5 Provide trip units that have real time metering and metering functions that include current, voltage, power and frequency. Provide metering accuracy of 1.5 % current, 0.5 % voltage, and 2 % power. Accuracies listed are total system including CT and meter and are of reading, not full scale, in a range of 5 – 500 %.

.6 Provide trip unit with provisions for communications on a network.

2.7. ACCESSORIES

2.7.1. Include:

.1 shunt trip, when electrically operated or when indicated.

.2 auxiliary switches, when electrically operated or when indicated.

.3 motor-operated mechanism, when electrical operation indicated.

.4 on-off locking device.

.5 handle mechanism.

.6 Where a breaker serves a fire pump, the breaker is to come complete with auxiliary contacts that are to be monitored by the fire alarm system.

2.8. MANUFACTURERS

2.8.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Install circuit breakers as indicated.

3.1.2. Contractor to wire any neutral CT’s to the breaker trip unit where required by the breaker ground fault detection system or as otherwise required by the manufacturers instructions.

END OF SECTION

26 28 23.00 Disconnect Switches – Fused and Non-Fused

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 53.00 – IDENTIFICATION.

1.2. REFERENCE

1.2.1. CSA C22.2 No. 4 – Enclosed Switches, latest edition.

1.2.2. CSA C22.2 No. 39 – Fuse-holder Assemblies, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

2. Products

2.1. DISCONNECT SWITCHES

2.1.1. Fusible, horsepower rated disconnect switch in CSA Type 3R enclosure, size as indicated.

2.1.2. Non-fusible, horsepower rated disconnect switch in CSA Type 3R enclosure, with minimum 10 kA Short Circuit Current Rating (SCCR), with manufacturer listed series rating with upstream breaker / fuse where available fault current exceeds 10 kA and with UL series rating label on disconnect switch, size as indicated.

2.1.3. Provision for padlocking in on-off switch position by three locks.

2.1.4. Mechanically interlocked door to prevent opening when handle in ON position.

2.1.5. Fuses: size as indicated, class J, current limiting, in accordance with Section 26 28 14.00 – FUSES - LOW VOLTAGE.

2.1.6. Fuse-holders: suitable without adaptors, for type and size of fuse indicated.

2.1.7. Quick-make, quick-break action.

2.1.8. ON-OFF switch position indication on switch enclosure cover.

2.2. EQUIPMENT IDENTIFICATION

2.2.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

2.2.2. Indicate name of load controlled on nameplate.

2.2.3. Provide a Lamacoid nameplate that indicates the replacement fuse size as well as the maximum allowable fuse size for that disconnect based upon the sizing of the feeder.

2.3. MANUFACTURERS

2.3.1. The following are acceptable manufacturers:

.1 Schneider Electric.

.2 Eaton Cutler-Hammer.

.3 Siemens.

3. Execution

3.1. INSTALLATION

3.1.1. Install disconnect switches complete with fuses if applicable.

END OF SECTION

26 51 13.00 Lighting Equipment

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.

1.1.2. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.3. Section 26 05 04.00 – SUBMITTALS – SHOP DRAWINGS.

1.1.4. Section 26 05 21.00 – WIRES AND CABLES UNDER 2000 V.

1.1.5. Section 26 06 05.16 – LUMINAIRE SCHEDULE.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 74 – Equipment for Use with Electric Discharge Lamps, latest edition.

1.2.2. The Consortium of Energy Efficiency (CEE) guidelines, latest edition.

1.2.3. IESNA LM-79 – Approved Method: Electric and Photometric Measurements of Solid-State Lighting Products, latest edition.

1.2.4. IESNA LM-80 – Approved Method: Measuring Lumen Maintenance of LED Light Sources, latest edition.

1.2.5. The Certified Ballast Manufacturers Association (CBM) standards, latest edition.

1.2.6. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts, latest edition.

1.2.7. CSA C22.2 No. 141 – Emergency Lighting Equipment, latest edition.

1.3. SUBSTITUTION

1.3.1. The lighting equipment for this project and specified herein has been carefully selected for its ability to meet the project's luminous environment requirements. Manual and computer calculations have been performed to ensure that the lighting equipment that has been specified complies with established criteria. The Engineer's Representative reserves the right not to accept any alternates or substitutions in accordance with the requirements of the Luminaire Schedule. If alternates or substitutions are entertained, then it is the responsibility of the Contractor/Supplier to provide: a comparison table showing the specified and the proposed luminaire performance information, IES files for the proposed luminaires, the information required herein, and detailed layouts and lighting calculations demonstrating that the performance of the alternate luminaire meets or exceeds the original lighting design while not consuming any additional energy. An extra review fee, per luminaire submitted, will be charged to the Contractor (with no additional costs to the Project Owner). Reviewed alternates may be rejected, regardless of the payment fee received, when alternates do not meet the project requirements. Invoices must be paid prior to Consultant's review starting or changes in the design documents to incorporate the proposed alternates after their review. The Contractor/Supplier is responsible to ensure the light levels provided in the alternate submittal package will achieve the design light levels. Where the light levels are not achieved, the Contractor is responsible to replace the luminaire with a luminaire that will meet the required levels with no increase in energy use at no cost to the Owner. Rather than replacing the luminaires, the Engineer's Representative may accept the installation of additional luminaires by the Contractor at no cost to the Owner in order to achieve the required light levels.

1.3.2. Accompanying the request for a luminaire or lamp substitution, the contractor shall submit a complete lighting calculation report with photometric modeling of the space showing light levels including average, maximum, minimum and max to min values.

1.4. SHOP DRAWING AND PRODUCT DATA

1.4.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.4.2. Submit a Shop Drawing for each luminaire specified, including lamp.

1.4.3. Luminaire submittals are to consist of a physical description, manufacturer's specification sheets, dimensioned drawings, and complete photometric data from an independent test laboratory in the form of IES computer files of the equipment being submitted and hard copy of the photometric report. Coordinate ceiling types to ensure proper supports and luminaire framing.

1.4.4. Lamp submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, rated life, colour temperature, base type, lamp shape, CRI, and voltage.

1.4.5. LED submittals are to consist of manufacturer's technical data for diodes and drivers with respective luminaire shop drawing. Submittal to include operating wattage, voltage, maximum distance from drivers, wiring diagrams and lumen output at time of delivery.

1.4.6. Ballast submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, input voltage, ballast efficiency, maximum distance for remote ballasts, power factor, and operating temperature.

1.4.7. Where samples are indicated on the luminaire schedule, they are to be provided with shop drawings at time of shop drawing submittals unless noted otherwise.

1.4.8. Where luminaires consist of multiple field assembled components, include manufacturer supplied installation manual detailing the assembly procedure.

1.5. OPERATION AND MAINTENANCE DATA

1.5.1. Provide operation and maintenance data for lighting equipment in accordance with Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS for incorporation into the manual.

1.5.2. Operation and maintenance instructions shall include documentation related to warranty claim process.

1.6. FIXED PER UNIT COST LUMINAIRES

1.6.1. Listed in the luminaire schedule are a fixed per unit cost for certain luminaire types. Electrical Contractor is responsible for completing a take-off of the drawings to determine quantity of each luminaire type and use the listed fixed unit price to calculate the total cost per luminaire type. The total cost for all luminaires shall be carried in the bid for the electrical contract. Provide a breakdown of the total cost, per luminaire type, that is carried under the electrical contract. All luminaires are to be included in the electrical contract including all luminaires identified with fixed unit costs. The Electrical Contractor is to include fixed per unit cost luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.6.2. The fixed per unit cost excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost luminaires. Show the applicable taxes as a separate line item.

1.7. CASH ALLOWANCE LUMINAIRES

1.7.1. Listed in the luminaire schedule are ‘cash allowance’ fixtures for certain luminaire types. A complete take-off of the drawings has been done to determine the quantity of each ‘cash allowance’ luminaire type and the total cost has been carried in the Div-0/1 cash allowance value. The total cost for all ‘cash allowance’ luminaires are NOT to be carried in the bid for the electrical contract.

1.7.2. After tender award to the successful Electrical Contractor, the Consultant shall provide the Electrical Contractor the exact manufacturer/model number(s) of all ‘cash allowance’ luminaires and the Electrical Contractor shall be responsible for purchasing the fixtures through the monies from the cash allowance.

1.7.3. Provide a breakdown of the total cost, per luminaire type, that is carried under the base electrical contract. All luminaires are to be included in the base electrical contract excluding all luminaires identified as ‘cash allowance’ luminaires. However the Electrical Contractor is to include ‘cash allowance’ luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS once the Consultant provides the Electrical Contractor with the exact manufacturer/model number(s).

1.7.4. The cash allowance value carried excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all ‘cash allowance’ luminaires. Show the applicable taxes as a separate line item.

1.8. WARRANTY

1.8.1. The manufacturer shall provide a warranty against defects in material and workpersonship, starting at substantial completion. Parts warranty shall be 5 years and labour warranty shall be 1 year.

1.8.2. LED’s, Drivers, Lamps and ballasts showing signs of premature failure shall be replaced at no cost to the owner.

1.8.3. LED Drivers must have a 5 year warranty.

2. Product

2.1. GENERAL

2.1.1. All products must be CSA or CUL approved.

2.2. LAMPS AND LEDS

2.2.1. All Lamps are to meet the standards of the Consortium of Energy Efficiency (CEE) guidelines.

2.2.2. Refer to luminaire schedule for project specific details, and lamps required.

2.2.3. Lamps are to be in accordance with the lamp specifications detailed in the Luminaire Schedule and as noted below. Luminaire schedule shall take precedence where differences occur.

2.2.4. All lamps are to be new and are to be from the same manufacturing batch to avoid colour differences. Replace all lamps that exhibit colour shift, or exhibit premature lumen intensity decline, at no cost to the owner.

2.2.5. Light Emitting Diodes (LED)

.1 LEDs shall meet the standards of IESNA LM-79 and LM-80.

.2 All LED drivers shall be tested and comply with the maximum in-rush current limits as stated in NEMA 410.

.3 LED's shall be manufactured by Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, or Samsung. Colour temperature shall be as indicated on the luminaire schedule. Lamps are to be binned with no visible colour variance (+/- 100K from specified colour temperature). Rated life for 1 watt white LED shall be 50,000 hours. Lumen output to be maximum based on latest technology at time of delivery.

.4 All LED luminaires that present signs of failure on site, within the warranty period, must be replaced at no cost to the owner. If temporary luminaires are required to replace any failed LED luminaires, during the waiting time for parts (i.e. drivers, boards, heat sinks, etc.), the labour cost including installation, temporary luminaire supply, temporary luminaire removal and reinstallation of the LED luminaire must be provided at no cost of the owner. Additional electrical costs, associated with higher Wattage temporary luminaires, must be reimbursed with interest to the owner by the manufacturer.

.5 In case of failure of an LED luminaire, complete or part thereof, an independent third party testing Laboratory (approved by Smith + Andersen) shall be commissioned by the manufacturer or vendor to perform tests on samples taken from the failed luminaires installed on corresponding site. All reporting including the test results must be submitted to Smith + Andersen for evaluation and final approval.

.6 Any additional time involved by Smith + Andersen will be billed at our hourly rates to the manufacturer or vendor.

2.3. DRIVERS

2.3.1. All drivers are to be tested and comply with maximum in-rush current limits within NEMA 410 standards. This is to be clearly indicated on shop drawing submittal.

2.3.2. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

2.3.3. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

2.3.4. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

2.3.5. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

2.3.6. Total Harmonic Distortion less than 20 % percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.

2.3.7. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:

.1 Adjustment of forward LED voltage, supporting 3 V through 55 V.

.2 Adjustment of LED current from 200 mA to 1.05 A at the 100 percent control input point in increments of 1 mA.

.3 Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

2.3.8. Driver must be able to operate for a (+/- 10%) supply voltage of 120 V through 277 VAC at 60 Hz.

2.3.9. Driver must be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.

2.3.10. Driver shall include ability to provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts or less in this standby. Control deadband between 0.5 V and 0.65 V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

2.3.11. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 % relative light output, or 100 – 1 % light output and step to 0 % where indicated. Driver shall respond similarly when raising from 0 % to 100 %

.1 Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.

2.3.12. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels

2.3.13. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.

2.3.14. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:

.1 LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.

.2 Base specification: Flicker index shall less than 5% at all frequencies below 1000 Hz.

.3 Preferred specification: Flicker index shall be equal to incandescent, less than 1% at all frequencies below 1000 Hz.

2.3.15. Control Input

.1 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers

.1 Must meet IEC 60929 Annex E for General White Lighting LED drivers

.2 Connect to devices compatible with 0 to 10 V Analog Control Protocol, Class 2, capable of sinking 0.6 mA per driver at a low end of 0.3 V. Limit the number of drivers on each 0-10 V control output based on voltage drop and control capacity.

2.3.16. Must meet ESTA E1.3 for RGBW LED drivers

2.3.17. Provide drivers manufactured by Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, Samsung, or Eldoleds.

2.4. BALLASTS

2.4.1. All Ballasts shall comply with CSA C22.2 No. 74 and are to meet or exceed the standards of the Certified Ballast Manufacturers Association (CBM).

2.4.2. All ballasts shall be tested and comply with maximum in-rush current limits as stated in NEMA 410.

2.4.3. Not all ballasts could be used, refer to luminaire schedule for project specific details.

2.4.4. All ballasts shall be manufactured by Osram/Sylvania, Philips, Advance, GE, Lutron or Magnetek unless indicated otherwise. Ballasts shall operate at voltage and control lamps as noted in the Luminaire Schedule.

2.4.5. Ballasts shall contain no PCB's and audible rating will be class A or better.

2.4.6. Racks are to be provided for remote ballasts.

2.4.7. Ballasts with unacceptable noise levels are to be replaced at no cost to the owner.

2.5. LUMINAIRES

2.5.1. All luminaires are to be complete with mounting brackets, transformers, supports, trims, louvers, lenses and other accessories as required to make luminaire operational and allow it to be installed in the respective location.

2.5.2. Luminaires shall be suitable for the environment where installed, include seals and gaskets, and corrosion resistant baked-on finish as required and as specified.

2.5.3. Louvers, lenses and diffusers must be of suitable thickness to prevent sagging.

2.5.4. Where drawings show luminaires mounted end-to-end, luminaires shall be suitable for continuous, seamless and tandem mounting.

2.5.5. All poles are to come complete with internal vibration dampeners to accommodate wind conditions to avoid damage due to wind-induced vibrations.

2.5.6. All concrete bases for poles and bollards shall be designed to accommodate the height, weight, etc. of the pole/bollard and its accessories for the soil conditions for which it is installed. Engineered shop drawings shall be provided that is signed by a structural engineer registered in the local jurisdiction.

2.5.7. Where cameras are shown to be installed on poles, the poles shall be stiffened to reduce vibration and sway, and shall be rated for video recording cameras.

2.5.8. The supply and installation of fixed per unit cost and 'cash allowance' luminaires shall comply with all standards set forth in Electrical Specifications. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost and 'cash allowance' luminaires.

2.5.9. Provide exit signs that comply with building code requirements, including CSA C22.2 No. 141.

2.5.10. The following is a list of generic type designation for luminaires. The project specific luminaire schedule is to be referenced for the specific types and designations and the respective specifications.

.1 Designations beginning with the letter 'L' denote LED type.

.2 Designations beginning with the letter 'X' denote exit sign.

3. Execution

3.1. INSTALLATION

3.1.1. It is the responsibility of the contractor to obtain the information related to the luminaire and luminaire trim finishes/colours from the Interior Designer or Architects prior to the fabrication of luminaires. The Contractor shall provide adequate time for the design team to review and comment on luminaire and luminaire trim finishes.

3.1.2. The contractor will provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and other related lighting equipment as specified herein. Lamps for all equipment will be provided and installed by the contractor according to equipment manufacturer's instructions.

3.1.3. The Electrical Contractor shall be responsible for the supply and installation of all concrete bases for poles and bollards. Unless otherwise shown on the drawings, concrete bases to be ArtForm style or Approved Equal and shall extend a minimum 900 mm above grade in parking lots and a minimum 150 mm above grade in pedestrian walkways.

3.1.4. Poles and bollards are to be installed on independent concrete bases unless indicated otherwise on the drawings or schedules. Coordinate brackets for cameras and supports for banners with pole manufacturer.

3.1.5. Install remote ballasts in racks and wire luminaires to ballasts in conduit. Provide wiring as per manufacturer's recommendations.

3.1.6. Locate luminaires in accordance with the Architect's Drawings. Coordinate exact locations on site. Refer to Architect's drawings for dimensions of coves and valences.

3.1.7. Install in accordance with Manufacturer's Instructions, Local Codes, Electrical Division Drawings and Specifications.

3.1.8. All suspended luminaires shall have cables and support stems vertically aligned.

3.1.9. Suspend luminaires in mechanical rooms after all the mechanical equipment and ductwork are installed. Luminaires are not to be suspended from mechanical pipes, ductwork or other building services.

3.1.10. All luminaires shall be installed underneath other services located within ceiling space. Contractor is responsible for interference drawings to ensure all services in ceiling are coordinated.

3.1.11. Any dimensions provided in the drawings or schedules are intended as general guidelines. For exact dimensioning refer to the Architectural drawings. The detailed information shall be cross referenced with the electrical specifications and the Luminaire Schedule applying the most stringent requirement.

3.1.12. It is the responsibility of the Electrical Contractor to coordinate luminaire trims and mounting system with ceiling finishes. Luminaires delivered on site with the wrong ceiling mounting system shall be replaced without additional costs for the owner. Restocking fees will not be accepted.

3.1.13. For suspended ceiling installations support luminaires from structural slab in accordance with local inspection requirements.

3.1.14. Where luminaires are mounted in tandem, align luminaires mounted in continuous rows to form straight uninterrupted line.

3.1.15. Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.1.16. Ensure light leakage does not occur from openings and trim rings. Contractor is responsible to repair the ceiling at no cost to the Owner if cut-out is too large.

3.1.17. Connect luminaires to lighting circuits.

3.1.18. Provide all wiring in conduit with junction boxes on a grid pattern to limit the run of flexible armoured cable drops from the ceiling mounted junction box to each luminaire to a maximum of 3 m in length unless approved otherwise in writing from the Engineer's Representative.

3.1.19. Modular wiring systems shall be employed only where indicated or with approval of the Engineer's Representative.

3.1.20. Luminaires are not to be used as temporary construction lighting. After being tested to ensure acceptable operation, luminaires will not be used until substantial completion unless permission is received from the owner, architect or Engineer's Representative.

3.1.21. Lamps are to be installed after luminaire is cleaned.

3.1.22. Clean all luminaires, inside and out at time of substantial completion. Replace all scratched or damaged luminaires, lenses, louvers and diffusers at no cost to the owner.

3.1.23. Installation of exit signs

.1 Rough-in and installation of exit signs shall be carefully coordinated on site such that after installation of all equipment/services, including equipment/services from other trades (i.e. sprinkler lines, plumbing pipes, way-finding signs, etc.), shall not interfere with the line-of-sight visibility of the exit sign(s) from approach of the intended egress pathway(s).

.2 If exit sign(s) have been installed and do not meet the satisfaction of the Engineer's Representative/Architect, the Contractor shall lower, raise or relocate the exit sign(s) such that proper and adequate visibility of the exit sign(s) is achieved at no additional cost to the Owner.

END OF SECTION

26 52 01.00 Unit Equipment for Emergency Lighting

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 21.00 – WIRES AND CABLES UNDER 2000 V.

1.1.4. Section 26 05 34.00 – CONDUITS, CONDUIT FASTENERS AND FITTINGS.

1.2. REFERENCES

1.2.1. CSA Standard C22.2 No.141 – Emergency Lighting Equipment, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. Submit Shop Drawings for equipment and accessories specified in this Section. Include photometric data for all luminaires not named as approved in this specification.

1.3.3. Data to indicate system components, mounting method, source of power and special attachments.

1.3.4. Manufacturer/Contractor to ensure runtime capacity of battery unit is sized accordingly to meet the runtimes specified within this section and/or drawings/schedules.

1.4. WARRANTY

1.4.1. For batteries, the warranty period shall be extended to 120 months, with a no-charge replacement during the first 5 years and a pro-rata charge on the second 5 years.

2. Products

2.1. EQUIPMENT

2.1.1. Supply voltage: 120 V, ac.

2.1.2. Output voltage: 24 V dc.

2.1.3. Operating time: 120 minutes, unless otherwise noted in schedules.

2.1.4. Battery: 10 year sealed, valve regulated, lead calcium.

2.1.5. Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10 % input variations. Recharges battery within 24 hours in accordance with CSA.

2.1.6. Solid state transfer circuit.

2.1.7. Low voltage disconnect: solid state, modular, operates at 80 % battery output voltage.

2.1.8. Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

2.1.9. Lamp heads: integral on unit and remote as indicated, 345 horizontal and 180 vertical adjustment. Lamp type: LED MR16, wattage to be 6 W unless noted otherwise on drawings or in the “Battery Unit Schedule.”

2.1.10. Directional remote head lamps to have narrow beam spread distribution.

2.1.11. Recessed remote head lamps to have flood beam spread distribution.

2.1.12. Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

2.1.13. Finish: Baked white enamel.

2.1.14. Auxiliary equipment:

.1 Ammeter.

.2 Voltmeter.

.3 Test switch.

.4 Time delay relay.

.5 Battery disconnect device.

.6 Ac input and dc output terminal blocks inside cabinet.

.7 Bracket.

.8 Cord and single twist-lock plug connection for ac.

.9 RFI suppressors.

2.2. WIRING OF REMOTE HEADS AND EXIT SIGNS

2.2.1. Conduit: As per Section 26 05 34.00 – CONDUITS, CONDUIT FASTENERS AND FITTINGS.

2.2.2. Conductors: As per Section 26 05 21.00 – WIRES AND CABLES UNDER 2000 V, sized as per manufacturer’s recommendation and compliant to the applicable electrical codes.

3. Execution

3.1. INSTALLATION

3.1.1. Install unit equipment and remote mounted fixtures. Interconnect all heads with central battery pack.

3.1.2. Direct heads to optimize illumination of egress pathways to minimum building code requirements.

3.1.3. Connect exit lights to unit equipment.

3.1.4. Contractor is to include the supply and installation of one additional head or an additional 5% of the total number of heads shown on the drawings, whichever is greater in the bid price. The installation is to include all wiring and conduit required to install the heads. If the heads are not installed during construction then the spare heads are to be turned over to the Owner at the end of the project.

3.2. TESTING AND COMMISSIONING

3.2.1. Contractor shall commission and test the entire system and adjust as necessary.

3.2.2. Trip breaker(s) feeding battery unit(s) to simulate power failure to building. Test the operation of each unit to document the duration of runtime. Testing shall be performed during non-daylight hours.

3.2.3. Inform Engineer's Representative 10 days in advance prior to testing being performed in order for Engineer's Representative to make arrangements to witness testing of emergency lighting system.

3.2.4. Provide Engineer's Representative with signed test report by Contractor that each unit successfully operated for the required duration of time.

3.2.5. Re-test voltage of battery units 24 hours after initial testing to verify rated nominal voltage of unit. If battery unit has not recharged properly, replace unit and re-test as stated above at no additional cost to Owner.

END OF SECTION

33 05 23.00 Excavation and Backfill for Electrical Work

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 31 00 00.00 – EXCAVATION/EARTHWORKS.

1.2. SCOPE

1.2.1. This Section governs requirements for all excavating and backfilling Work required for the installation of buried power and communication services and backfill.

1.2.2. Assume that material to be excavated is earth. When rock is encountered during construction, payment will be made on unit price basis to the extent of net difference in cost between dry earth excavation and solid rock excavation, all as indicated in Contract Documents.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. Provide Shop Drawings indicating proposed method of bedding and backfilling.

2. Products

2.1. SOILS

2.1.1. To the requirements for Granular “A”, “B” (Type 1), “M” and “Select Subgrade Material”.

2.1.2. Requirements for Pea Gravel: Granular, well-graded clean rounded pea gravel or stone with not more the 2% material that will pass 75 um (No. 200) sieve, maximum 6 mm (1/4 in.), containing no other deleterious material, and subject to testing that specified density can be achieved without compaction.

2.1.3. Requirements for Sand Fill: Uniform quality and unwashed river sand or any clean sand containing less than 5% organic materials, clay or silt (passing 125 um sieve) is acceptable. It can contain a limited amount of small stones or rocks as it comes from the pit. Sharp, clean, coarse sand, water washed, free from clay, salts and organic matter, and in accordance with CSA A179 – Mortar and Grout for Unit Masonry, for masonry sand is also acceptable.

3. Execution

3.1. INSTALLATION

3.1.1. All excavation and backfilling for all services shall be in accordance with Site Work Division.

3.1.2. Protection:

.1 Provide protection to existing structures and services. Be responsible for rectifying any damage to existing structures and services resulting from this operation.

3.1.3. Excavation in Soil:

.1 Excavation carried below the correct inverts shall be backfilled with 2000 psi (13.5 mPa) concrete to the underside of the pipe lines, unless otherwise directed in writing.

3.1.4. Excavation in rock:

.1 All excavation in rock is included under separate Section, (the Site Work Division Section 31 00 00.00 – EXCAVATION/EARTHWORKS) and is taken to a minimum of 150 mm below the correct pipe invert. This Division shall use a bedding material to the correct trench invert.

3.1.5. Backfilling

.1 Backfill with sand from the bottom of the trench or excavation up to a point 300 mm above the top of service line or appurtenance.

.2 Backfill duct trenches with sand to a depth 300 mm above the ducts. The sand shall be thoroughly tamped around and over the pipes in 150 mm layers.

.3 Backfill the remainder of trench or excavation up to top of subgrade or bottom of floor slabs on-grade.

END OF section

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Structural Drawings – Cast-in-Place Concrete.

.2 Structural Drawings – Concrete Reinforcing.

.3 Section 03 35 00 – Concrete Finishing.

.4 Division 31.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.2 ASTM D1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.2 Canadian Standards Association (CSA Group):

.1 CSA-A23.1-14/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA-A3000-18, Cementitious Materials Compendium, Includes Update No.1 (2021).

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meeting: Convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor, Consultant and Installer to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Review and document conditions of existing conditions of sidewalks, curbs and asphalt.

.4 Co-ordination with other building subtrades.

.2 Coordination: Coordinate with local Authorities Having Jurisdiction requirements for standard sidewalks and curbs.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit design mixes for each concrete pavement mixture including alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances require adjustments.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures:

.1 Submit samples of exposed aggregate in 4.5 kg bags for review and acceptance by Consultant.

.3 Certificates: Submit to Consultant, test data and certification that the following material meets requirements of this section prior to starting concrete work:

.1 Cementitious materials.

.2 Supplementary cementing material.

.3 Steel reinforcement and reinforcement accessories.

.4 Admixtures.

.5 Joint Sealants.

.6 Curing Materials.

.7 Joint Filler.

1.5 QUALITY ASSURANCE

.1 Use ready mixed concrete producers in accordance with CSA A23.1, CSA A23.2 and CSA A3000 requirements for production facilities and equipment, and which is a member of the Ready Mixed Concrete Association of Ontario.

.2 Installer Qualifications: Company or person specializing in Portland cement concrete sidewalks with five years documented experience who has completed systems similar in materials, design and extent to that indicated for Project and with a record of successful performance.

.3 Testing: Compaction testing of base, and testing of concrete, will be performed in accordance with respectively Sections.

.4 Mock-Ups:

.1 Provide field mock-up for architectural finished concrete indicating forming methods and materials, and procedures proposed to achieve architectural finish in accordance with Section 01 45 00 – Quality Control, and to comply with the following requirements, using materials indicated for completed work.

.2 Cast mock-ups of full size sections of concrete sidewalks to demonstrate typical joints, surface finish, texture, colour, and standard of workmanship, and as follows:

.1 Build mock-ups in location and size indicated or; if not indicated, as directed by Consultant.

.2 Notify Consultant seven days in advance of dates and times when mock-ups will be constructed.

.3 Obtain Consultant's review of mock-ups before starting construction.

.4 Maintain acceptable mock-ups during construction in an undisturbed condition as a standard for judging the completed sidewalks.

.5 Acceptable mock-ups may become part of the completed Work if undisturbed at time of Substantial Performance.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packaging Waste Management

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Waste Management and Disposal.

1.7 SITE CONDITIONS

.1 Prevent damage to buildings and adjacent property.

.2 Protect surfaces of fresh concrete against damage by rain, dirt and dust, debris and traffic until sufficient strength attained to resist damage.

.3 Use winter concreting methods in accordance with CSA A23.1 section 7.4.2.5 when the mean daily temperature falls below 5°C. Concrete shall not be considered a seasonal deficiency and shall be installed with heating and hoarding as part of the Contract.

Part 2 Products

2.1 MATERIALS

.1 Forms

.1 Material: Plywood, metal, metal framed plywood, or other acceptable panel type materials to provide full depth, continuous, straight, smooth exposed surfaces.

.2 Use flexible or curved forms for curves with a radius of 30 m or less.

.3 Form Release Agent: Commercially formulated form release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

.2 Steel Reinforcement: as specified on Structural Drawings.

.3 Concrete Materials and Mixes: as specified on Structural Drawings and as follows:

.1 Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

.1 Aggregate Sizes: Nominal 6 to 10 mm.

.2 Aggregate Shape, and Colour: Rounded, dark grey to black colour.

.4 Accessories:

.1 Poured Joint Filler: Asphalt elastic compound.

.2 Preformed Joint Filler: asphalt impregnated type to ASTM D1751.

.3 Curing Compound: to ASTM C309, Type Two white pigmented, Class B resin-based, liquid membrane-forming type.

Part 3 Execution

3.1 PROTECTION

.1 Protection of In-Place Conditions:

.1 Prevent damage to buildings and adjacent property.

3.2 SUBGRADE PREPARATION

.1 Construct subgrade to elevation and grade indicated.

.2 Compact subgrade to 95% Standard Proctor Maximum Dry Density.

.3 Excavate soft spots and fill with 50 mm crushed gravel compacted to 95% Standard Proctor Maximum Dry Density.

3.3 SAND AND GRANULAR CUSHION

.1 Place 50 mm thick sand layer and crushed gravel layer on prepared subgrade, and compact to 95% Standard Proctor Dry Density.

3.4 CONCRETE PLACEMENT

.1 Install steel reinforcement in accordance with CSA A23.1 for fabricating, placing, and supporting reinforcement and Structural Drawings.

.1 Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

.2 Perform concrete work in accordance with Structural Drawings.

.3 Immediately after rough floating, provide uniform broom finish to produce regular surface texture not exceeding 1.5 mm deep, by drawing broom in direction normal to centre line.

.4 Provide edging as indicated with 25 mm radius edging tool.

.5 Tolerances: as specified in Section 03 35 00 – Concrete Finishing.

3.5 JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff but still plastic, at intervals shown on Drawings.

.2 Construct joints true to line with faces perpendicular to surface. Construct transverse joints at right angles to longitudinal joints, unless otherwise indicated.

.3 Align curb and sidewalk joints.

3.6 FINISHING

.1 Do not add water to concrete surfaces during finishing operations.

.2 Begin second floating operation when bleed water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations, and as follows:

.1 Float surface with power driven floats, or by hand floating if area is small or inaccessible to power units

.2 Finish surfaces to true planes.

.3 Cut down high spots and fill low spots.

.4 Re-float surface immediately to uniform granular texture.

.3 Apply following finishes as indicated on Drawings:

.1 Medium-to-Fine Textured Broom Finish: Draw a soft bristle broom across float finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

.2 Provide additional finish to sidewalks as indicated on Drawings.

3.7 SPECIAL FINISHES

.1 Monolithic Exposed Aggregate Finish: Expose coarse aggregate in surfaces as follows:

.1 Immediately after float finishing, spray-apply chemical surface retarder to sidewalk in accordance with manufacturer's written instructions.

.2 Cover surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.

.3 Remove excess mortar by lightly brushing surface with a stiff, nylon bristle broom without dislodging aggregate.

.4 Fine spray surface with water and brush; repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.

3.8 CURING

.1 Cure freshly deposited concrete in accordance with CSA A23.1.

.2 Apply curing compound immediately after finishing, in accordance with manufacturer's instructions. Promptly re-coat areas subjected to heavy rainfall within three hours after initial application.

.3 When ambient air temperature is at or below 5°C, or when there is a probability of it falling to 5°C within 24 hours of placing, provide cold weather protection until a period of seven days of concrete temperature at or above 10°C has been attained. Protection shall meet requirements of CSA A23.1.

.4 Estimate rate of surface moisture evaporation in accordance with CSA A23.1 and provide protection from drying as required.

.5 Keep traffic off sidewalks until sidewalks have cured sufficiently to support such loads.

3.9 FIELD QUALITY CONTROL

.1 Testing Agency: Engage qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article in accordance with CSA A23.2.

.2 Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Consultant with costs being paid for by the Contractor.

.3 Remove and replace concrete pavement where test results indicate that it does not meet specified requirements.

.4 Additional testing and inspecting, at Contractor's expense, will be performed to determine acceptance of replaced or additional work with specified requirements.

3.10 REPAIRS

.1 Remove and replace concrete sidewalks and curbs that are broken, damaged, or defective or that does not comply with requirements in this Section.

3.11 PROTECTION

.1 Protect concrete from damage.

.2 Protect surfaces of fresh concrete against damage by rain, dirt and dust, debris and traffic until sufficient strength attained to resist damage.

.3 Maintain concrete free of stains, discolouration, dirt, and other foreign material.

.4 Sweep concrete a maximum of two days before date scheduled for Substantial Performance.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Topsoil.
.2 Soil amendments.
.3 Stripping of topsoil.
.4 Preparation of existing grade.
.5 Finish grading.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 32 16 - Construction Schedule.

1.3 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

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

.2 Quality control submittals:

.1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in Part 2 - SOURCE QUALITY CONTROL.

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

1.4 QUALITY ASSURANCE

.1 Qualifications: Provide proof of qualifications during the course of the work of this Section when requested by Consultant.

.2 Contractor Qualifications:

.1 Landscape Contractor: to be a Member in Good Standing of the Canadian Nursery Landscape Association at the time of bidding and during installation.

.2 Landscape Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Softscape Installation designation or equivalent.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

Part 2 Products

2.1 TOPSOIL

.1 Topsoil: mixture of particulates, micro-organisms 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 20 to 70% sand, minimum 7% clay, and contain 2 to 10% organic matter by weight.

.3 Contain no toxic elements or growth inhibiting materials.

.4 Finished surface free from:

.1 Debris and stones over 50 mm diameter.

.2 Coarse vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.3 Consistency: friable when moist.

2.2 SOIL AMENDMENTS

.1 Fertilizer:

.1 Fertility: major soil nutrients present in following amounts:

.1 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.

.2 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.

.3 Potassium (K): 75 to 110 micrograms of potassium 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 range of 6.5 to 8.0.

.2 Peatmoss:

.1 Derived from partially decomposed species of horticultural grade Sphagnum Mosses.

.2 Texture ranging from porous to spongy fibrous, fairly elastic, and substantially homogeneous.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

.5 pH range of 3.5 to 6.5.

.2 Sand: washed coarse silica sand, medium to coarse textured.

.3 Organic matter: compost Category A, In accordance with CCME PN1340 unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.

.4 Use composts meeting Category B in accordance with CCME requirements for landfill reclamation and large scale industrial applications.

.5 Limestone:

.1 Ground agricultural limestone.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.6 Use industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

.1 Advise Consultant of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to imported soil(s) as specified.

.3 Conduct soil testing by recognized testing facility for pH, Nitrogen (N), Phosphorous (P), and Potassium (K), and organic matter.

.4 Carry out testing of topsoil by testing laboratory designated by Consultant.

.1 Perform soil sampling, testing and analysis in accordance with applicable Provincial standards.

Part 3 Execution

3.1 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as directed by Consultant after area has been cleared of stumps, rocks 50 mm and over, invasive and noxious plants and their reproductive parts, brush, weeds and grasses and removed from site.

.2 Strip topsoil to depths as directed by Consultant.

.1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.3 Stockpile in locations as directed by Consultant.

.1 Stockpile height not to exceed 2 m.

.2 Protect stockpile from adverse weather conditions, contamination from invasive plant material, and compaction.

.3 Avoid placing stockpile in low areas where natural drainage or storm water could pond, or erode these materials during inclement weather.

.4 Dispose of unused topsoil in an environmentally responsible manner but do not use as landfill as directed by Consultant.

3.2 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.1 If discrepancies occur, notify Consultant and do not start work until instructed by Consultant.

.2 Grade soil, eliminate uneven areas and low spots, ensure positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than [75] mm above surface.

.3 Dispose of removed material off site.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Consultant has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 Keep topsoil 15 mm below finished grade for sodded areas.

.4 Spread topsoil as indicated to the following minimum depths after settlement.

.1 150 mm for sodded areas.

.5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

.6 Avoid spreading or grading in wet, frozen, or saturated state.

3.4 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Consultant.

.1 Leave surfaces smooth, uniform and firm against deep footprinting.

3.5 ACCEPTANCE

.1 Consultant will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.6 SURPLUS MATERIAL

.1 Dispose of surplus materials off-site except where directed by Consultant.

3.7 CLEANING

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

.1 Leave Work area organized and tidy at end of each day.

.2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

.2 Upon completion remove surplus materials, rubbish, tools and equipment.

.1 Clean and reinstate areas affected by Work.

.3 Waste Managements:

.1 Divert unused soil amendments from landfill to official hazardous material collections site approved by Consultant.

.2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Consultant.

.3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at an appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes sod, sod placement, preparation and maintenance.

.2 Related Requirements:

.1 Section 32 91 19 - Topsoil Placement and Grading.

1.2 REFERENCES

.1 Canadian Food Inspection Agency (CFIA); Plant Production Division, Fertilizer Section:

.1 Canadian Fertilizer Act and Fertilizer Regulations.

.2 Canadian Fertilizer Quality Assurance Program.

.2 Canadian Nursery Landscape Association (CNLA):

.1 Canadian Standards Stock Standard, 9TH Edition-2017.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Construction Meetings: Conduct a preinstallation meeting in accordance with Section 01 31 19 – Project Meetings to verify project requirements, installation instructions and maintenance required for warranty period.

.2 Coordination: Coordinate sodding to coincide with preparation and grading of soil surface and when frost is not present in ground in accordance with Section 32 91 19 – Topsoil Placement and Grading.

1.4 ACTION SUBMITTALS / INFORMATIONAL Submittals

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit product data relating to fertilizer and fertilizer application rates based on soils analysis of topsoil used for the project.

.2 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.1 Submit one m^2 samples of biodegradable geotextile fabric used for the project for Consultant's review and acceptance.

.3 Informational Submittals: Provide the following submittals during the course of the work:

.1 Certificates: Submit product certificates signed by manufacturer certifying that materials supplied to the project comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: Use only fertilizers, pesticides, micro-nutrients and supplements that are registered by the Canadian Food Inspection Agency and that meet requirements of referenced acts and regulations.

.2 Qualifications: Provide proof of qualifications during the course of the work of this Section:

.1 Sod Grower: Use a grower that is a member in good standing of the Canadian Nursery Landscape Association at the time of bidding and during installation.

.2 Landscape Supervisor: Landscape Horticulturist Journeyperson or Landscape Industry Certified Technician with Softscape Installation designation or equivalent.

.3 Commercial Grade Sod: Use only nursery grown turf sod that contains a maximum of Five broadleaf weeds or ten other weeds per 40 m^2; that has a density sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm and that has attached soil between 6 mm to 15 mm in thickness.

1.6 WARRANTY

.1 Special Warranty: Provide warranty from sod supplier and from sod installer covering a period of three months after completion of maintenance period required by this Section for patching or replacement of sod that fails to grow or dies within the same growing season; it is recognized that the following conditions are outside of the supplier's and installer's control and will be considered as specific exclusions to the warranty and are not covered by the Special Warranty:

.1 Sod that is damaged by subsequent construction activities, negligence by the Owner, damage by animals or insects, or extreme weather events.

.2 Sod that is damaged by herbicides, pesticides or fertilizers that are not supplied and properly applied by this Section.

.2 Sod that fails to grow after one month in subsequent growing season after wintering and proof of growth during the previous fall planting season will be covered by the same warranty conditions as listed above.

Part 2 Products

2.1 MATERIALS

.1 Commercial Grade Sod: Provide sod that has not been seeded and cultivated in nursery sod fields as a Number One Turf Grass crop, but has matured under environmental conditions similar to that of the project; containing a maximum of 20% native grasses and that has been mown to a height of 65 mm within 36 hours prior to lifting with clippings removed.

2.2 ACCESSORIES

.1 Sod Establishment Support: Provide biodegradable geotextile fabric and pegs as required to prevent washouts and to establish strong root growth.

.2 Water: Provide water from local source or from trucked source as required during maintenance period and until vigorous growth has been established.

.3 Fertilizer: Provide slow release fertilizer that contains a minimum of 65% water insoluble nitrogen, and other nutrients required to establish vigorous growth in proportions necessary to amend topsoil as determined by analysis.

2.3 SOURCE QUALITY CONTROL

.1 Obtain sod only from CNLA listed grower that can provide certification of seed source with growing location in close proximity to project site; provincial associations belonging to CNLA are acceptable for this requirement.

.2 Provide a nutrient analysis of topsoil and provide test data and recommended fertilizer application constituents and rates to Consultant before delivering materials to the project site.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that grades are correct and prepared ready for placement of sodding materials.

.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 PREPARATION

.1 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations [indicated] to tolerance of ±15 mm for Commercial Grade Sod; and to allow surface to drain naturally.

.2 Remove and dispose of weeds, debris, stones larger than 50 mm Ø, soil contaminated by oil, gasoline and other deleterious materials off site and in accordance with requirements of local Authority Having Jurisdiction.

3.3 INSTALLATION

.1 Sod Placement:

.1 Lay sod within 24 hours of being lifted if air temperature exceeds 20°C.

.2 Lay sod sections in rows with joints staggered and ends butted closely without overlapping or leaving gaps between sections; cut out irregular or thin sections with sharp implements.

.3 Roll sod as required to obtain close contact between sod and soil using light rolling; use of heavy rolling to correct irregularities in grade is not permitted.

.2 Sod Placement on Slopes:

.1 Install and secure geotextile fabric in areas having a slope greater than 3:1 to prevent soil erosion in accordance with manufacturer's instructions.

.2 Lay sod starting from bottom of slopes.

.3 Peg sod on slopes steeper than 3:1, within 1 metre of catch basins and within 1 metre of drainage channels and ditches to following pattern:

.1 First sod sections along contours of slopes: 100 mm below top edge at 200 mm on centre.

.2 Areas above first sod sections: Not less than 3 to 6 pegs/m2.

.3 Areas at drainage structures Not less than 6 to 9 pegs/m2.

.4 Adjust pattern as required to obtain firm contact with topsoil and to prevent movement.

.4 Drive pegs to 20 mm above soil surface of sod sections.

.3 Fertilizing Program: Fertilize during establishment and warranty periods at a rate and frequency established by source quality control testing and until vigorous growth is established.

.4 Maintenance during Establishment Period: Perform following operations from time of installation until vigorous growth is established:

.1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.

.2 Cut grass to 65 mm mm when or prior to it reaching height of 90 mm; remove clippings that have potential to smother grassed areas.

.3 Maintain sodded areas 80% weed free.

.4 Fertilize areas in accordance with fertilizing program listed above; spread half of required amount of fertilizer in one direction and remainder at right angles and water in well where rainfall is not expected within two to three hours of fertilizing.

.5 Acceptance: Consultant will accept installation provided that:

.1 Commercial Grade Sod: Sodded areas are properly established and free of bare and dead spots with no surface soil visible from height of 1500 mm when grass has been cut to height of 65 mm; when sodded areas are cut a minimum of two times prior to acceptance; and that fertilizing in accordance with fertilizer program has been carried out at least once.

.6 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.4 PROJECT CLOSEOUT ACTIVITIES

.1 Maintenance during Warranty Period: Perform following operations from time of acceptance until end of warranty period:

.1 Water Commercial Grade Sod at weekly intervals to obtain optimum soil moisture conditions listed above.

.2 Repair and reapply sod to dead or bare spots before expiration of warranty period.

.3 Cut grass and remove clippings that have potential to smother grass to heights listed above.

.4 Cut grass at two week intervals or as otherwise required to maintain grass at correct growing height at intervals so that approximately one third of growth is removed in single cut.

.5 Eliminate weeds by mechanical means to extent acceptable listed above.

.2 Cleaning: Remove surplus materials, rubbish, tools and equipment barriers after completion of work of this Section.

END OF SECTION