
Char-Lan Recreation Centre Roof and Siding Replacement

The Township of South Glengarry

Contract No. 2025-15

Project No. 25097

Page 1 of 2

DIVISION INDEX

<u>SECTION NO.</u>	<u>TITLE</u>
00 40 00	Provision of Contract Documents
01 11 00	Summary of Work
01 14 00	Work Restrictions
01 21 00	Allowances
01 29 83	Testing and Laboratory Services
01 31 00	Project Management and Coordination
01 32 00	Construction Progress and Documentation
01 33 00	Submittals / Submittal Procedures
01 35 29	Health and Safety Requirements
01 35 43	Environmental Procedures
01 45 00	Quality Control
01 51 00	Temporary Utilities
01 52 00	Construction Facilities
01 56 00	Temporary Barriers and Enclosures
01 61 00	Common Product Requirements
01 71 00	Examination and Preparation
01 73 00	Execution
01 74 11	Cleaning
01 74 21	Construction/Demolition Waste Management and Disposal
01 77 00	Closeout Procedures
01 78 00	Closeout Submittals
01 79 00	Demonstration and Training
02 41 13	Selective Site Demolition
02 41 16	Structure Demolition
03 10 00	Concrete Forming and Accessories
03 20 00	Concrete Reinforcing
03 30 00	Cast-in-place Concrete
05 41 00	Structural Metal Stud Framing
05 50 00	Metal Fabrications
06 10 00	Rough Carpentry
07 21 16	Blanket Insulation
07 46 19	Steel Siding
07 61 00	Sheet Metal Roofing
07 62 00	Sheet Metal Flashing and Trim
07 84 00	Fire Stopping
07 92 00	Joint Sealants
08 11 00	Metal Doors and Frames

Char-Lan Recreation Centre Roof and Siding Replacement

The Township of South Glengarry

Contract No. 2025-15

Project No. 25097

Page 2 of 2

DIVISION INDEX

08 36 20	Sectional Metal Overhead Doors
08 71 00	Door Hardware
09 91 13	Exterior Painting
09 91 23	Interior Painting
	Sherwin-Williams Product Submittal
11 66 43	Scoreboard and Associated Equipment
23 05 00	Common Work Results for HVAC
23 05 13	Common Motor Requirements for HVAC Equipment
23 05 48	Vibration and Seismic Controls for HVAC
23 05 93	Testing, Adjusting, and Balancing for HVAC
23 08 00	Commissioning of HVAC
23 33 15	Dampers – Operating
23 34 00	HVAC Fans
23 37 20	Louvres
26 05 00	Common Work Requirements for Electrical
26 05 20	Wiring and Box Connectors, 0-1000V
26 05 21	Wiring and Cables 0-1000V
26 05 28	Grounding – Secondary
26 05 29	Hangers and Supports
26 05 31	Splitters, JBs, PBs and Cabs
26 05 32	Outlet Boxes and Fittings
26 05 34	Conduits, Fastenings, Fittings
26 27 26	Wiring Devices
26 28 14	Fuses, Low Voltage
26 28 16	Moulded Case Circuit Breakers
26 28 23	Disconnect Switches Fused and Non Fused
26 29 01	Contactors
26 29 03	Control Devices
26 29 10	Motor Starters to 600V
26 50 00	Lighting Equipment
26 80 00	Commissioning of Elec Systems
26 90 00	Wiring of Equip Supplied by Others
28 31 00.01	Fire Alarm System
31 23 33	Excavation, Trenching, and Backfilling
32 91 19	Topsoil
32 92 23	Sodding

PROVISION OF CONTRACT DOCUMENTS

PART 1 GENERAL**1.1 DESCRIPTION**

- .1 Following execution of the Contract, an “Approved for Construction” digital revision of the drawings and specifications, which incorporates all addenda issued during the tendering period, will be prepared by the Contract Administrator and provided to the contractor for their review. The contractor shall review the “Approved for Construction” drawings and specifications to confirm that all addenda are included and confirm his acceptance in writing to the Contract Administrator.
- .2 The “Approved for Construction” drawings will be provided to the contractor for their initial review no later than 3 weeks following execution of the contract. No claims for delays by the contractor will be considered relating to this schedule.
- .3 Following acceptance of the “Approved for Construction” drawings and specifications by the contractor, the Contract Administrator will supply the following items to the contractor:
 - .1 Access to download the entire set of “Approved for Construction” drawings and specifications in PDF format.
- .4 If the contractor requires printed copies of the drawings or specifications, they can be purchased, at the contractor’s expense, from the copying company used by the Contract Administrator. Alternatively, the contractor can reproduce the drawings from the PDF version provided.
- .5 Electronic drawings in AutoCAD/Revit format are available to the contractor if so requested. Contractor will be responsible to sign a release form provided by the Contract Administrator prior to receiving AutoCAD/Revit drawings. AutoCAD drawings will only be provided on a case-by-case basis at the Contract Administrators’ discretion and the contractor will be expected to justify the need for the AutoCAD drawings. Note that some ACAD drawings may require additional Autodesk software to be fully compatible (i.e. Civil3D 2010, Revit, etc.).

END OF SECTION

SUMMARY OF WORK

PART 1 GENERAL**1.1 SECTION INCLUDES**

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- .1 The following is a general but not necessarily complete description of the works to be completed under this contract:
 - Replacement of the rink area steel roof and insulation, exterior wall cladding and insulation and the interior liner panel.
 - Replacement of the workshop and ice plant steel roof and insulation, and exterior wall cladding and insulation
 - Replacement of one dehumidifier and various fans and louvers
 - Miscellaneous electrical upgrades

1.3 CONTRACTOR USE OF PREMISES

- .1 Contractor has unrestricted use of site provided that all relevant Township of South Glengarry municipal by-laws are adhered to including but not limited to noise, traffic, use of highways and accessibility.
- .2 Coordinate use of premises under direction of Contract Administrator.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 North building lobby, offices and 2nd level and south workshop and ice plant areas shall remain open and accessible by Township of South Glengarry staff for the duration of the project.
- .5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.

SUMMARY OF WORK

- .7 The contractor shall provide all work and/or material required to achieve this including but not limited to temporary pumping, flow diversion structures, temporary power, and intermediate alarming.
- .8 Provide 24hr monitoring of all temporary equipment that is not connected and monitored by the alarm monitoring and dialing device as require to ensure 24 hours per day 7 days per week monitoring of the system.

1.4 OWNER OCCUPANCY

- .1 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.5 ON-SITE DOCUMENTS

- .1 Maintain at job site documents as indicated in Section 01 31 00 – Project Management and Coordination.
- .2 Maintain at job site, a minimum of one copy of each document as follows:
 - .1 Contract Drawings
 - .2 Specifications
 - .3 Addenda
 - .4 Reviewed Shop Drawings
 - .5 List of Outstanding Shop Drawings
 - .6 Change Orders
 - .7 Other Modifications to Contract
 - .8 Field Test Reports
 - .9 Copy of Approved Work Schedule
 - .10 Health and Safety Plan and Other Safety Related Documents
 - .11 Documents as specified.
 - .12 On-going, up-to-date As-Built markups

1.6 PERMITS AND FEES

- .1 Owner will be responsible for the building permit.
- .2 The Contractor will be responsible for:
 - .1 electrical permits per the Electrical Safety Authority (ESA).
 - .2 All other applicable permit and connection fee's, including NG gas permits.

1.7 CONTRACT METHOD

- .1 Construct the work under the lump sum contact as outlined in the Form of Tender.

SUMMARY OF WORK

- .2 Work will be paid on a percent completion basis with a breakdown, as described in various specifications, with insufficient items and detail to track the work progress, at a minimum broken down by specification sections.

1.8 WORK BY OTHERS

- .1 Cooperate with other contractors in carrying out their respective works and carrying out instructions from the Contract Administrator.
- .2 Coordinate work with that of other Contractors. In any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Contract Administrator, in writing, any defect which may interfere with proper execution of Work.

1.9 PARTIAL OWNER OCCUPANCY [NOT USED]

- .1 Schedule and substantially complete designated portion so Work for Owner's occupancy prior to Substantial Performance of entire Work as require to phase and complete the project as per the approved schedule and in accordance with the Contract Administrator.

1.10 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING FACILITIES

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

1.11 EXISTING SERVICES

- .1 Notify the Contract Administrator and utility companies of intended interruption of services and obtain required permission and permits.
- .2 The contractor is responsible for disconnecting gas service to the building to facilitate gas line removals and re-installs as required to complete the work. Provisions have been made by the Township such that occupied areas are able to operate without gas service for the duration of the project. Hydro services shall be maintained with an allowance for two (2) separate instances of hydro disconnect for a maximum duration of 24hrs.
- .3 Where work involves breaking into or connecting to existing services, give the Contract Administrator a minimum 72 hours 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 vehicular traffic and services.
- .4 Provide alternative routes for vehicular traffic as required.
- .5 Establish location and extent of service lines in area of work before starting work. Notify Engineer of findings.

SUMMARY OF WORK

- .6 Submit schedule to and obtain approval of Contract Administrator for any shutdown or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .7 Provide adequate bridging over trenches or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise the Contract Administrator and confirm findings in writing. The contractor is responsible to be familiar with the existing As-Built/Facility Drawing package and shall assume that previously abandoned work has been left, buried underground.
- .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.

PRODUCTS (NOT APPLICABLE)**EXECUTION****1.12 RECOMMENDED SEQUENCE OF CONSTRUCTION**

- .1 Prepare schedule, sequencing and plan, complete preliminary planning for all required temporary electrical connections.

END OF SECTION

WORK RESTRICTIONS

Part 1 General**1.1 ACCESS AND EGRESS**

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

1.2 USE OF SITE AND FACILITIES

- .1 Hours of work are limited to Monday to Friday (excluding statutory holidays) 7:00AM to 5:00PM unless permission otherwise has been provided in writing by owner.
- .2 Execute work with least possible interference or disturbance to normal use of adjacent premises. Make arrangements with Consultant to facilitate work as stated.
- .3 Maintain existing services to adjacent buildings and provide for personnel and vehicle access.
- .4 Closures: protect work temporarily until permanent enclosures are completed.

1.3 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 72 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide and maintain all access for pedestrian and vehicular traffic outside construction area.
- .4 Construct barriers in accordance with Section 01 52 00 – Construction Facilities.

1.4 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.

1.5 PHOTOGRAPHY

- .1 Owner may provide pre-construction photographs of construction site and adjacent properties to establish record of conditions.

WORK RESTRICTIONS

- .2 The contractor is to ensure that no Township of South Glengarry employees or patrons are included in the preconstruction or construction photographs.
- .3 Owner reserves right to photograph Work to document progress.

1.6 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions: Smoking is not allowed inside existing building, nor on property.

END OF SECTION

ALLOWANCES

PART 1 **DEMOLITION**

- .1 Inclusion of Allowances in the Tender Price is not to be construed as implying that any or all of the Allowances will be expended.
- .2 Expend each allowance as directed by Contract Administrator.

PART 2 **CASH ALLOWANCES**

- .1 Cash Allowances cover only the net cost to the Contractor of the items, materials, services or contract referred to, as verified by invoices to be submitted to Contract Administrator.
- .2 The Contract Price, and not the cash allowances, includes all construction machinery and equipment, freight, handling, unloading, storage, installation, coordination, supervision, overhead and profit and other costs necessary to incorporate the allowance products, services, or contracts into the project, except as otherwise noted.
- .3 Each cash allowance will be adjusted to actual cost as defined hereunder and contract price will be amended accordingly by written order.
- .4 Contract Price will be adjusted by written order to provide for an excess or deficit to each cash allowance.
- .5 Progress payments for work and material authorized under cash allowances will be made in accordance with contract terms of payment.
- .6 The Contract Price and not cash allowance, includes contractor's overhead and profit in connection with such cash allowance.
- .7 Progress payments on accounts of work authorized under cash allowances shall be included in monthly certificate for payment.
- .8 Schedule shall be prepared jointly by Contract Administrator and Contractor to show when items called for under cash allowances must be authorized by Contract Administrator for ordering purposes so that progress of work will not be delayed.
- .9 Provide the following Cash Allowances.
 - .1 Include **\$70,000** excluding HST for the supply and install of one (1) new electric desiccant dehumidifier by the pre-selected refrigeration contractor. This allowance includes the following of work:
 - Supply one (1) Electrical Desiccant Dehumidifier
 - Supply labour to complete installation of new and removal of existing

ALLOWANCES

Supply lift equipment to complete installation of new and removal of existing

Isolate, decommission and remove existing dehumidifier (NW corner)

Dispose of existing unit

Lift new dehumidifier into position (GC responsible for platform modifications – wall removals, etc.)

Update electrical feed to unit

Install new required ducting/ventilation to exterior wall of building

Cut holes in exterior wall for venting

Install new humidistat

Disconnect, lockout, demo and remove existing power feeds as needed

Wire new 30A dehumidifier unit using BX

Upgrade the wiring for the unit requiring larger feed cable

Install local disconnect

Install 30A 600V breaker

Supply new breaker in 600V MCC

ESA permit

Test and commission new dehumidifier

Provide staff training and operations manual

Clean up job site

Exclusions:

Platform modifications (wall removals, new walls, new guards etc.)

Any programming for integration with existing control systems

- .2** Include **\$15,000** excluding HST for miscellaneous testing and inspection services including 3rd party roofing inspections, concrete testing, subgrade testing, backfill and compaction testing and Hydro and Gas Utility Charges (if applicable).

PART 3 **PRODUCTS (NOT APPLICABLE)****PART 4** **EXECUTION (NOT APPLICABLE)**

END OF SECTION

TESTING AND LABORATORY SERVICES

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Inspecting and testing by inspecting firms or testing laboratories designated by Contract Administrator

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Contract Administrator are specified under various sections.

1.3 APPOINTMENT AND PAYMENT

- .1 The contractor shall pay for testing and inspection services out of the prescribed testing and inspection allowance except as follows:

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 Contract Administrator to verify acceptability of corrected work.

1.4 CONTRACTOR'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work to be inspected and tested.
 - .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.
 - .5 Schedule and coordinate testing and inspection services with 3rd party testing and inspections companies designated by the contract administrator.
- .2 Notify Contract Administrator 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 Contract Administrator.

TESTING AND LABORATORY SERVICES

PRODUCTS (NOT APPLICABLE)

EXECUTION (NOT APPLICABLE)

END OF SECTION

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Coordination work with other contractors and subcontractors under administration of Contract Administrator.
- .2 Scheduled project meetings.

1.2 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work.
- .2 Section 01 79 00 – Demonstration and Training

1.3 DESCRIPTION

- .1 Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other contractors and subcontractors under instructions of Contract Administrator.

1.4 PROJECT MEETINGS

- .1 Project meetings to be held at times and locations as determined by Contract Administrator.
- .2 Contract Administrator will arrange project meetings, record and distribute minutes.

1.5 CONSTRUCTION ORGANIZATION AND START UP

- .1 Within fourteen (14) working days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Establish time and location of meetings and notify parties concerned minimum 5 days before meeting.
- .3 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 00 Construction Progress Documentation.
 - .3 Schedule of submission of shop drawings, samples, colour chips in accordance with Section 01 33 00 Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 51 00 Temporary Utilities.

PROJECT MANAGEMENT AND COORDINATION

- .5 Delivery schedule of specified equipment in accordance with Section 01 32 00 Construction Progress Documentation.
- .6 Site security in accordance with Section 01 52 00 Construction Facilities.
- .7 Proposed changes, change orders, procedures, approvals required, mark up percentages permitted, time extensions, overtime, and administrative requirements.
- .8 Record drawings in accordance with Section 01 78 00 Closeout Submittals.
- .9 Maintenance manuals in accordance with Section 01 78 00 Closeout Submittals.
- .10 Take over procedures, acceptance, and warranties in accordance with Section 01 77 00 Closeout Procedures and 01 78 00 Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, and holdbacks.
- .12 Appointment of inspection and testing agencies or firms in accordance with Section 01 45 00 Quality Control.
- .13 Insurances and transcript of policies.
- .4 Comply with Contract Administrator's allocation of mobilization areas of site; for field offices and sheds, for access, traffic, and parking facilities.
- .5 During construction coordinate use of site and facilities through Contract Administrator's procedures for intra project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .6 Comply with instructions of Contract Administrator for use of temporary utilities and construction facilities.

1.6 ON SITE DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.
 - .5 List of outstanding shop drawings.
 - .6 Change orders.
 - .7 Other modifications to Contract.
 - .8 Field test reports.
 - .9 Copy of approved Work schedule.
 - .10 Health and Safety Plan and other Safety related documents.
 - .11 Manufacturers' installation and application instructions.

PROJECT MANAGEMENT AND COORDINATION

.12 Labour conditions and wage schedules.

.13 Other documents as specified.

1.7 SCHEDULES

.1 Submit preliminary construction progress schedule in accordance with Section 01 32 00 Construction Progress Documents to Contract Administrator coordinated with Contract Administrator's project schedule. Schedule to show anticipated progress stages and final completion of work within time period required by contract documents.

.2 After review, revise and resubmit schedule to comply with project schedule requirements.

.3 During progress of Work revise and resubmit at project progress meetings or as directed by Contract Administrator.

1.8 SUBMITTALS

.1 Make submittal to Contract Administrator for review.

.2 Submit preliminary shop drawings, product data and samples in accordance with Section 01 33 00 – Submittal Procedures for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Contract Administrator.

.3 Submit requests for payment for review to Contract Administrator.

.4 Submit requests for interpretation of Contract Documents, and obtain instructions through Contract Administrator.

.5 Process change orders through Contract Administrator.

.6 Deliver closeout submittals for review by Contract Administrator.

.7 Coordinate commissioning through the Contract Administrator.

1.9 COORDINATION DRAWINGS

.1 Provide information required by Contract Administrator for preparation of coordination drawings.

.2 Review and approve revised drawings for submittal to Contract Administrator.

.3 Contract Administrator may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in contract documents.

PROJECT MANAGEMENT AND COORDINATION

1.10 CLOSEOUT PROCEDURES

- .1 Notify Contract Administrator when Work is considered ready for Substantial Performance.
- .2 Accompany Contract Administrator on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Contract Administrator's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Owner occupied areas.
- .4 Notify Contract Administrator of instructions of items of Work determined in Contract Administrator's final inspection.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION (NOT APPLICABLE)**

END OF SECTION

CONSTRUCTION PROGRESS AND DOCUMENTATION

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 77 00 – Closeout Procedures.

1.2 SCHEDULES REQUIRED

- .1 Submit schedules as follows:
 - .1 Construction Progress Schedule.
 - .2 Submittal Schedule for Shop Drawings and Product Data.
 - .3 Submittal Schedule for Samples.
 - .4 Product Delivery Schedule.
 - .5 Cash Allowance Schedule for purchasing Products.
 - .6 Shutdown or closure activity.

1.3 FORMAT

- .1 Prepare schedule in form of a horizontal bar chart.
- .2 Provide a separate bar for each major item of work, trade or operation.
- .3 Split horizontally for projected and actual performance.
- .4 Provide horizontal time scale identifying first work day of each week.
- .5 Format for listings: chronological order of start of each item of work.
- .6 Identification of listings: By Systems description.

1.4 SUBMISSION

- .1 Submit initial format of schedules within 14 working days after award of Contract.
- .2 Submit schedules in electronic format as PDF files.
- .3 Owner's Representative will review schedule and return review copy within ten (10) working days after receipt.
- .4 Resubmit finalized schedule within seven (7) working days after return of review copy.
- .5 Submit revised progress schedule with each application for payment.
- .6 Distribute copies of revised schedule to:
 - .1 Job site office.

CONSTRUCTION PROGRESS AND DOCUMENTATION

- .2 Subcontractors.
- .3 Other concerned parties.
- .7 Instruct recipients to report to Contractor within ten (10) working days, any problems anticipated by timetable shown in schedule.

1.5 CRITICAL PATH SCHEDULING

- .1 Include complete sequence of construction activities.
- .2 Include dates for commencement and completion of each major element of construction.
- .3 Show projected percentage of completion of each item as of first day of month.
- .4 Indicate progress of each activity to date of submission schedule.
- .5 Show changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .6 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other prime contractors.

1.6 SUBMITTALS SCHEDULE

- .1 Include schedule for submitting shop drawings, product data, and samples.
- .2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION (NOT APPLICABLE)**

END OF SECTION

SUBMITTALS / SUBMITTAL PROCEDURES

PART 1 GENERAL**1.1 SECTIONS INCLUDE**

- .1 Shop drawings and product data.
- .2 Samples.
- .3 Certificates and transcripts.
- .4 Request for Information

1.2 RELATED SECTIONS

- .1 Section 01 32 00 – Construction Progress Documentation.
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 78 00 – Closeout Submittals

1.3 ADMINISTRATIVE

- .1 This section specifies general requirements and procedures for contractor's submissions of shop drawings, product data, samples and mock-ups to Contract Administrator for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with work until relevant submissions are reviewed by Contract Administrator.
- .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 Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project and tagged will be returned without being examined and shall be considered rejected.
- .6 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

SUBMITTALS / SUBMITTAL PROCEDURES

- .7 Verify field measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review of submission, unless Contract Administrator gives written acceptance of specific deviations.
- .10 Make any changes in submissions which Contract Administrator may require consistent with Contract Documents and resubmit as directed by Contract Administrator. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.
- .11 Notify Contract Administrator, in writing, when resubmitting, of any revisions other than those requested by Contract Administrator.
- .12 Keep one reviewed copy of each submission on site.

1.4 SUBMITTALS

- .1 The term "shop drawings" means equipment cut-sheets, 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 Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow fifteen (15) working days for Contract Administrator review of each submission.
- .5 Adjustments made on shop drawings by Contract Administrator are not intended to change contract price. If adjustments affect value of Work, state such in writing to Contract Administrator immediately after receipt of approval of shop drawings. If value of work is to change, a change order must be issued prior to proceeding with work.
- .6 Structural Attachments:

SUBMITTALS / SUBMITTAL PROCEDURES

- .1 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's (and subcontractors) name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Equipment / Product unique tag number
- .8 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Specification section, subsection, unique tag number to be coordinated with the Contract Administrator, and other identifying numbers.
 - .4 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .5 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .6 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .9 After Contract Administrator review, distribute copies.
- .10 Submit one electronic copy in PDF format of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.

SUBMITTALS / SUBMITTAL PROCEDURES

- .11 Submit electronic copy in PDF format of product data sheets or brochures for requirements requested in Specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Delete information not applicable to project.
- .13 Identify the particular product selections, all feature codes and details.
- .14 Supplement standard information to provide details applicable to project.
- .15 Cross-reference product data information to applicable portions of Contract Documents.
- .16 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of work may proceed. All resubmissions must be complete, resubmission of parts of the shop drawing is not acceptable, whole submissions are required.
- .17 Samples: examples of materials, equipment, quality, finishes, workmanship. Label samples with origin and intended use.
- .18 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of contract documents.
- .19 Where colour, pattern or texture is criterion, submit full range of samples.
- .20 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .21 Make changes in samples, which Contract Administrator may require, consistent with Contract Documents.
- .22 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.
- .23 Submit drawings stamped and signed by Professional Engineer registered or licensed in the Province of Ontario.

1.5 MOCK-UPS

- .1 Mock-up: Field erection example of work complete with specified materials and workmanship.

SUBMITTALS / SUBMITTAL PROCEDURES

- .2 Provide mock-ups requested in various sections of specifications and as may be reasonably required by the Owners Representative.
- .3 Erect mock-ups at locations acceptable to the Owners Representative.
- .4 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.
- .5 Erect mock-ups in accordance with Section 01 45 00 - Quality Control.

1.6 SAMPLES

- .1 Submit samples requested in various sections of specification and as may be reasonably required by the Contract Administrator.
- .2 Submit samples of adequate size and range of colours or textures to represent material in intended use on project.
- .3 Unless the precise colour and pattern is specifically described in the contract documents, wherever a choice of colour or pattern is available in a specified product, submit accurate colour and pattern charts to the Engineer for selection.
- .4 Material used on project shall match approved samples for quality, colour and texture, finish and performance. Do not proceed with work until samples are approved.

1.7 PROGRESS PHOTOGRAPHS

- .1 Progress photograph to be electronically formatted and labelled as to location and view. These should be submitted monthly with the progress payment certificate.

1.8 SHOP DRAWINGS REVIEW

- .1 The review of shop drawings by Contract Administrator is for the sole purpose of ascertaining conformance with the general concept. This review shall not mean that Contract Administrator approves the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and contract documents. Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains to fabrication processes or to techniques of construction and installation and for co-ordination of the work of all sub-trades.

1.9 STRUCTURAL ATTACHMENTS

- .1 Contractor to engage a third party Professional Structural Engineer, licensed to practice in the Province of Ontario, for submission of stamped and signed shop

SUBMITTALS / SUBMITTAL PROCEDURES

drawings indicating acceptable mounting procedures for all equipment which is suspended, mounted or otherwise attached, as per Section 01 91 13 – Commissioning (Cx) Requirements. The Structural Engineer to also verify correct installation of the equipment.

1.10 DOCUMENTATION REQUIRED BEFORE CONSTRUCTION START

- .1 Insurance Forms
- .2 Performance Bond and Labour & Material Payment Bond as called for in the Information for Tenders and the General Conditions.
- .3 WSIB Clearance Certificate, naming the project. This will also be required with each monthly progress claim, Workplace Safety and Insurance Board Clearance Certificate.
- .4 Ministry of Labour Project Notice and Site-Specific Health and Safety Items.

1.11 STATUTORY DECLARATION

- .1 Submit, with each monthly progress claim, a Statutory Declaration certifying that claim all payments for any liability for which the Owner might become responsible, if unpaid, have been paid.

1.12 AS-BUILT DRAWINGS

- .1 Maintain contract drawings at site office for record purposes. Record accurately deviations from contract documents caused by site conditions, change orders, site instructions, and addenda. Mark in red ink. Provide one table for this set to be placed on. The As-Built records must be maintained up-to-date and prepared as the work progresses. In order for any progress payment to be issued, the contractor is required to review the as-built drawings with the Contract Administrator prior to submitting any/all progress claims.
- .2 Consult Mechanical and Electrical Divisions for other particular requirements.
- .3 Prior to start of Testing and Commissioning, finalize production of as-built drawings.
- .4 Identify each drawing in lower right hand corner in letters at least 12mm high as follows: - AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW AS INSTALLED WORK" (Signature of Contractor) (date).
- .5 Submit to Contract Administrator for approval and make corrections as directed.
- .6 Commissioning to be performed using as-built drawings.
- .7 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

SUBMITTALS / SUBMITTAL PROCEDURES

- .8 Submit copies of as-built drawings for inclusion in final Operation and Maintenance Manuals.

1.13 SCHEDULE OF VALUES

- .1 Itemize separately: individual sections of specifications, different phases of the work, bonds & permits, mobilization field supervision and layout, temporary facilities and controls, major equipment, material costs delivered, installation costs, each allowance, clean up, hand over and commissioning.
- .2 Prior to submission of the first progress draw, submit a cash flow of all anticipated progress draw values by month for the entire project duration before deduction of holdback amounts and exclusive of anticipated changes.

1.14 PROGRESS REPORTS

- .1 Contractor shall prepare daily reports of their operations. Daily report shall contain at least the following information:
- weather conditions
 - manpower on the job in each trade
 - major items of equipment on the job
 - a brief summary of work accomplished that day
 - materials, equipment, or owner-furnished items arriving or leaving site
 - inspection reports
 - significant events
 - any tests made and their final results, if known
 - any oral instructions received
 - visitors to the job
- .2 Contractor shall maintain a file of copies of all daily reports on the site and make it available to the Contract Administrator upon request.
- .3 Commissioning forms, as further described in sections 01 91 13, 01 91 33, and 01 91 41, shall be prepared and submitted at appropriate times.

SUBMITTALS / SUBMITTAL PROCEDURES

1.15 OPERATIONS AND MAINTENANCE MANUALS

- .1 Prior to substantial performance, inspection, submit to Consultant, three (3) hard copies and a searchable, digital PDF of the of Instruction and Maintenance Manuals as follows:
 - .1 Bind data in 215 x 279mm, vinyl covered, locking three-ring loose-leaf binders.
 - .2 Enclose title sheet, labelled “Instruction and Maintenance Manual” with project name, list of contents, date and names of Owner, Consultant, and Contractor.
 - .3 Organize contents into applicable sections of work to parallel project specification breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .2 All operation and maintenance manuals to be submitted in English only.
- .3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturer’s literature.
- .4 Contents:
 - .1 As called for in individual sections of these specifications.
 - .2 Maintenance instructions for all products and equipment.
 - .3 Operating and maintenance instructions for mechanical and electrical and equipment.
 - .4 Colour schedule; hardware schedule.
 - .5 Copies of all guarantees and warranties.
 - .6 Complete set of final approved shop drawings, bound separately, indicating corrections and charges made during fabrication and installation.
 - .7 Names, addresses, and phone numbers of sub-contractors and suppliers.
 - .8 WHMIS Manual described in Section 01 35 30.

1.16 MAINTENANCE MATERIALS

- .1 Compile a complete list of all materials and spare parts contained within the various sections of the contract. Turn over these materials and spare parts to the Owners Representative and obtain receipt transmittal. Submit materials in unbroken cartons or if not available in cartons, strongly packed. Identify item, function, colour, room number, unit number, tag number and area materials used on an indelible tag affixed to the packaging.

1.17 DOCUMENTS REQUIRED FOR SUBSTANTIAL PERFORMANCE

- .1 Documents required prior to Substantial Performance include:
 - .1 As-Built Record Drawings.
 - .2 Manuals of Instruction and Maintenance including:

SUBMITTALS / SUBMITTAL PROCEDURES

- .1 Warranties
- .2 Final approved shop drawings
- .3 Schedules
- .4 WHMIS Manual.
- .3 Post construction survey drawings.
- .4 Mechanical
 - .1 Testing, Adjusting and Balancing (TAB) reports
 - .2 Operation and Maintenance Manual
 - .3 Demonstration and Operating and Maintenance Instruction
 - .4 Individual equipment certification and training session outlined in Mechanical Sections and mechanical process section.
- .5 Electrical
 - .1 Operation and Maintenance Manual
 - .2 Electrical Inspection Certificate
 - .3 F/A verification certificate (where applicable)
 - .4 Demonstration and Operating and Maintenance Instruction

PRODUCTS (NOT APPLICABLE)**EXECUTION (NOT APPLICABLE)**

END OF SECTION

HEALTH AND SAFETY REQUIREMENTS

Part 1 General**1.1 REFERENCE STANDARDS**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Canadian Standards Association (CSA): Canada.
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .3 National Building Code 2015 (NBC).
 - .1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.
- .4 National Fire Code 2015 (NFC).
 - .1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.
- .5 Province of Ontario.
 - .1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter 0.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
 - .2 O. Reg. 490/09, Designated Substances.
 - .3 Workplace Safety and Insurance Act, 1997.
 - .4 Municipal statutes and authorities.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and before commencement of Work. Health and Safety Plan to include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
 - .3 Measures and controls to be implemented to address to identify safety hazards and risks.
- .3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .4 Submit copies of incident and accident reports.
- .5 Submit WHMIS Safety Data Sheets (SDS) in accordance with Section 01 47 15 - Sustainable Requirements - Construction.
- .6 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.1.3 before commencement of work. Submit copies of the Fire Safety Plan to the Owner not later than 14 days before commencing work.
- .7 Contractor's and Sub-contractors' Safety Communication Plan.
- .8 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with the Owner's Emergency Response Requirements.

HEALTH AND SAFETY REQUIREMENTS

- .9 Submit names of personnel and alternates responsible for site safety and health.
- .10 Submit records of Contractor's Health and Safety meetings when requested.
- .11 Owner will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 14 days from date of submission.
- .12 Owner's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .13 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel before commencement of Work, and submit additional certifications for any new site personnel to Owner.
- .14 Submit copies of incident and accident reports.
- .15 Submit Workplace Safety and Insurance Board (WSIB) – Experience Rating Report.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities before beginning of Work.
- .2 Contractor to be responsible and assume the main Contractor role for the entire site. Contractor to provide a written acknowledgement of this responsibility to the Owner within 3 weeks of Contract award.
- .3 Work zone locations includes the entire site.
- .4 Contractor to install proper site separation and identification in order to maintain time and space throughout duration of project.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Owner before commencement of Work.

1.6 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.
- .2 Comply with the Acts and regulations of the Province of Ontario.
- .3 Comply with specified standards and regulations to ensure safe operations at site.

1.7 GENERAL REQUIREMENTS

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

HEALTH AND SAFETY REQUIREMENTS

1.8 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 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.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.
- .2 Comply with Occupational Health and Safety Regulations, 1996.
- .3 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Ontario having jurisdiction and advise Owner verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in accordance with Acts and Regulations of Ontario having jurisdiction and advise Owner verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with.
 - .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 Certified Industrial Hygienist Registered Occupational Hygienist site supervisor.

1.12 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Owner.

HEALTH AND SAFETY REQUIREMENTS

1.13 CORRECTION OF NON-COMPLIANCE

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

1.14 BLASTING

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

1.15 POWDER ACTUATED DEVICES

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

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**

- .1 Not used.

Part 3 Execution**3.1 NOT USED**

- .1 Not used.

END OF SECTION

ENVIRONMENTAL PROCEDURES

Part 1 General**1.1 REFERENCES****.1 Definitions:**

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

.2 Reference Standards:

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-2020 Stipulated Price Contract.
- .2 Ontario Provincial Standard Specification 805-10, Construction Specification For Temporary Erosion And Sediment Control Measures.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Consultant.

1.3 ENVIRONMENTAL PROTECTION PLAN:

- .1 Include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .2 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .3 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 in accordance with requirements of article "Drainage".

ENVIRONMENTAL PROCEDURES

- .6 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
 - .1 Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
- .7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
- .8 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .9 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .10 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
- .11 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.
- .12 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.
- .13 Pesticide treatment plan: to be included and updated, as required.
- .4 Consultant's review of Contractor's Environmental Protection Plan, shall not be construed as approval and does not reduce Contractor's overall responsibility for construction environmental protection.

1.4 FIRES

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

1.5 NOISE CONTROL

- .1 Limit hours of Work activities in accordance with Section 01 14 00 – Work Restrictions to minimize noise disturbance to wildlife and humans.
- .2 Maintain equipment and machinery to minimize unnecessary noise pollution.
- .3 Apply noise control technology on heavy machinery and equipment where possible.
- .4 Complete Work shall in accordance with local municipal noise bylaws.

1.6 DRAINAGE

- .1 Develop Erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided.

ENVIRONMENTAL PROCEDURES

- .2 Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Municipal laws and regulations, and Ontario Provincial Standard Specification 805.
- .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.

1.7 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, and storage areas, 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.

1.8 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 and waterways 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.

1.9 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 approval by Consultant.
 - .1 Take action only after receipt of written approval by Consultant.
- .3 Consultant will issue stop order of work until satisfactory corrective action has been taken.

ENVIRONMENTAL PROCEDURES

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

Part 2 Products

- .1 Not Used.

Part 3 Execution**3.1 CLEANING AND WASTE MANAGEMENT**

- .1 Progress and Final Cleaning: clean in accordance with Section 01 74 11 – Cleaning and 01 74 20 – Construction/Demolition Waste Management and Disposal.

END OF SECTION

QUALITY CONTROL

PART 1 GENERAL**1.1 SECTIONS INCLUDE**

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

1.2 RELATED SECTIONS

- .1 Section 01 21 00 – Allowances.
- .2 Section 01 33 00 – Submittal Procedures
- .3 Section 01 78 00 – Closeout Submittals

1.3 INSPECTION

- .1 Allow Contract Administrator 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 Contract Administrator instructions.
- .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 Contract Administrator may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Contract Administrator shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Contract Administrator (Paid by the contractor through a cash allowance) for purpose of inspecting and/or testing portions of Work.

QUALITY CONTROL

- .2 Allocated costs: to Section 01 21 00 – Allowances and Section 01 29 83 – Payment Procedures: Testing and Inspection Services.
- .3 Provide equipment required for executing inspection and testing by appointed agencies.
- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no cost to Contract Administrator. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

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

1.6 PROCEDURES

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

1.7 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Contract Administrator 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 Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Contract Administrator.

QUALITY CONTROL

1.8 REPORTS

- .1 Submit 3 copies of inspection and test reports to Contract Administrator, plus electronic copies in PDF format.
- .2 Provide copy to Subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.
- .3 Include copy of all inspection and test reports in Commissioning Manuals.

1.9 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in all locations acceptable to Contract Administrator as specified in specific Section.
- .3 Prepare mock-ups for Contract Administrator 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 Remove mock-up at conclusion of Work or when acceptable to Contract Administrator
- .6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.
- .7 Reviewed and accepted mock-ups will become standards of workmanship and material against which installed work will be verified.
- .8 Mock-ups may remain as part of Work.

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Mechanical – coordinate with mechanical division.
- .3 Electrical – coordinate with electrical division.

1.11 FIRE SEPARATIONS

- .1 Provide fire separation labelling/stenciling as per Sections 07 84 00 Fire Stopping.

QUALITY CONTROL

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

TEMPORARY UTILITIES

PART 1 GENERAL**1.1 RELATED SECTIONS**

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

1.2 INSTALLATION AND REMOVAL

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

1.3 DEWATERING (NOT APPLICABLE)

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
- .2 Refer to the attached Permit to Take Water Application for detailed dewatering requirement.

1.4 WATER SUPPLY (NOT APPLICABLE)**1.5 TEMPORARY HEATING AND VENTILATION**

- .1 Pay for costs of temporary heat and ventilation used during construction, including costs of installation, fuel operation, maintenance and removal of equipment. Use of direct, fired heaters discharging waste products into work areas will not be permitted unless prior approval is given by Contract Administrator.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10°C and relative humidity less than 60% in areas where construction is in progress.

TEMPORARY UTILITIES

- .1 Maintain minimum temperature of 10°C or higher where specified as soon as finished work is commenced. Maintain until acceptance of structure by Contract Administrator.
- .2 Maintain ambient temperature and humidity levels as required for comfort of office personnel.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to Work due to failure in providing adequate heat, humidity and protection during construction.
- .8 Use of new or existing systems for temporary heating, ventilating or air conditioning will not be permitted.

1.6 TEMPORARY POWER AND LIGHT

- .1 If applicable, arrange for connection with Utility company. Pay all costs for installation, maintenance and removal of cables, distribution and branch panel boards, poles, lighting, heating and general power receptacles as required.
- .2 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx. Temporary lighting to consist of wiring, pig tail sockets and 75 watt shatterproof incandescent lamps to provide a minimum light level of 162 lux.

TEMPORARY UTILITIES

- .4 Electrical power and lighting systems installed under this contract may be used for construction requirements only with prior approval of Contract Administrator provided that guarantees are not affected. Make good damage to electrical system caused by use under this contract. Replace lamps which have been used for more than 3 months.
- .5 General contractor responsible for payment of all electrical energy charges associated with temporary power up to date of substantial completion.

1.7 FIRE PROTECTION

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

1.8 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Contract Administrator.

1.9 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment necessary for own use and use of Contract Administrator.

1.10 SITE SIGN AND NOTICES (NOT APPLICABLE)

- .1 Contractor is responsible for the construction of job sign frame and the installation of the plywood job sign. Locate job sign as directed by Contract Administrator so as to ensure good visibility by passing traffic.
- .2 Construct timber job sign frame using two (2) 140 x 140mm timber posts set vertically in concrete to a ground depth of 1000mm or below the frost line, whichever is greater. Install three (3) 38 x 89mm horizontal timber braces. Attach plywood sign to timber frame using galvanized nails. Paint timber frame with two (2) coats of white paint if using untreated timber. Backfill compact and level ground around job sign frame to the satisfaction of the Contract Administrator.

TEMPORARY UTILITIES

1.11 REMOVAL OF TEMPORARY FACILITIES

- .1 Remove temporary facilities from site when directed by Contract Administrator.
- .2 When project is closed down at end of construction season keep temporary facilities operational until close down or removal is approved by Contract Administrator.

PRODUCTS (NOT APPLICABLE)**EXECUTION (NOT APPLICABLE)**

END OF SECTION

CONSTRUCTION FACILITIES

PART 1 GENERAL**1.1 SECTION INCLUDES**

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

1.2 RELATED SECTIONS

- .1 Section 01 35 29.06 – Health and Safety Requirements
- .2 Section 01 51 00 - Temporary Utilities.
- .3 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 INSTALLATION AND REMOVAL

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 SCAFFOLDING

- .1 Provide and maintain scaffolding in rigid, secure and safe manner.
- .2 Erect scaffolding independent of walls. Remove promptly when no longer required. Refer to Section 01 35 29.06 – Health and Safety Requirements.

1.5 HOISTING

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

CONSTRUCTION FACILITIES

1.7 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of work and/or access to operational facilities.
- .2 Provide and maintain adequate access to project site.
- .3 Build and maintain temporary roads where indicated or directed by Contract Administrator 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 Contractor's use of roads.

1.8 CONTRACTOR'S SITE OFFICES

- .1 The contractor shall arrange with the owner a designated space within the building for an office space.
- .2 The contractor shall supply their own sanitary facility as they will not have access to the building facilities.
- .3 Provide suitable space for weekly construction meetings for up to 12 persons (table, chair, A/V equipment)
- .4 Provide a clearly marked and fully stocked first-aid case in a readily available location.
- .5 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.9 CONTRACT ADMINISTRATOR SITE OFFICE (NOT APPLICABLE)

- .1 Provide temporary office for Contract Administrator.
- .2 Inside dimensions minimum 4.8 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4 - 50% opening windows and one lockable door.
- .3 Insulate building and provide heating system to maintain 22°C inside temperature at -20°C outside temperature.
- .4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19mm thick plywood.
- .5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.
- .6 Site office to have washroom facility complete with running water and sewage disposal. Maintain supply of washroom supplies.

CONSTRUCTION FACILITIES

- .7 Equip office with drawing laydown table, file cabinet, two chairs, telephone, high speed internet.
- .8 Maintain in clean condition.

1.10 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.11 SANITARY FACILITIES

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

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION (NOT APPLICABLE)**

END OF SECTION

TEMPORARY BARRIERS AND ENCLOSURES

PART 1 GENERAL**1.1 SECTION INCLUDES**

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

1.2 RELATED SECTIONS

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

1.3 INSTALLATION AND REMOVAL

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

1.4 SECURITY

- .1 Provide temporary gates at the access to the site.

1.5 GUARD RAILS AND BARRICADES

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

1.6 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 Erect enclosures to allow access for installation of materials and working inside enclosure.

TEMPORARY BARRIERS AND ENCLOSURES

- .4 Design enclosures to withstand wind pressure and snow loading.

1.7 DUST TIGHT SCREENS

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

1.8 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.
- .2 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.9 PUBLIC TRAFFIC FLOW

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

1.10 FIRE ROUTES

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

1.11 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.

1.12 PROTECTION OF BUILDING FINISHES

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

TEMPORARY BARRIERS AND ENCLOSURES

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL**1.1 SECTION INCLUDES**

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

1.2 RELATED SECTIONS

- .1 Section 01 45 00 – Quality Control.
- .2 Section 01 73 00 – Execution.

1.3 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.4 QUALITY

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .4 Within seven (7) working days of written request by Contract Administrator, submit following information for material and equipment proposed for supply:
 - .1 Name and address of manufacturer.
 - .2 trade name, model and catalogue number,
 - .3 performance, descriptive and test data,

COMMON PRODUCT REQUIREMENTS

- .4 manufacturer's installation or application instructions,
- .5 evidence of arrangements to procure.
- .5 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.
- .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.

1.5 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Contract Administrator 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 Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6 STORAGE, HANDLING AND PROTECTION

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

COMMON PRODUCT REQUIREMENTS

- .9 Touch-up damaged factory finished surfaces as per the manufacturer's factory requirements and to Contract Administrator satisfaction. Use touch-up materials to match original. Do not paint over name plates.
- .10 For all mechanical or electrical equipment stored on site, refer to manufacturer's recommendations regarding maintenance required during storage, and prepare maintenance schedule detailing the rotation, lubrication and/or exercise requirements of the equipment while stored. Provide schedule to Contract Administrator, and demonstrate that the schedule is being followed during storage.

1.7 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.8 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Contract Administrator 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 Contract Administrator if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.

1.10 CO-ORDINATION

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

COMMON PRODUCT REQUIREMENTS

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 Contract Administrator if there is interference. Install as directed by Contract Administrator.

1.12 REMEDIAL WORK

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

1.13 LOCATION OF FIXTURES

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 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 Contract Administrator of conflicting installation. Install as directed.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Contract Administrator.

1.14 FASTENINGS GENERAL

- .1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior work, unless stainless steel or other material is specifically requested in affected specification section.
- .2 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood plugs are not acceptable.
- .3 Conceal fasteners where indicated. Space evenly and lay out neatly.
- .4 Fastenings which cause Spalding or cracking are not acceptable.
- .5 Obtain Contract Administrator's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166.

COMMON PRODUCT REQUIREMENTS

1.15 FASTENINGS - EQUIPMENT

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

1.16 PROTECTION OF WORK IN PROGRESS

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

1.17 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute work at times directed by local governing authorities, with minimum of disturbance to work.
- .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.
- .3 Submit schedule to and obtain approval from Contract Administrator for any shut-down or closure of active services or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Where unknown services are encountered, immediately advise Contract Administrator and confirm findings in writing.
- .5 Remove abandoned services lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Contract Administrator.

1.18 SELECTION OF MATERIAL AND EQUIPMENT

- .1 Material and equipment will be specified in the tender documents, and selected by Contractor, by one or more of the following methods:
 - .1 Specification by reference to a relevant Standard, such as CSA, ASTM, ULC, etc., select any material or equipment that meets or exceeds the specified.
 - .2 Specification by reference to an accepted product evaluation publication, such as the CGSB "Qualified Products List", or CCMC Registry of Product Evaluations", - select any manufacturer's product so listed.

COMMON PRODUCT REQUIREMENTS

- .3 Specification by Prescriptive or Performance specification – select any material or equipment meeting or exceeding specification.
- .4 Specification by identification of one or more Manufacturer's specific product(s) as an "Acceptable Product", along with a listing of other manufacturers who may offer equivalent products – select any product so named, or select from equivalent product(s) of other listed manufacturers.
- .2 "Acceptable Product" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name, or any combination thereof, and will constitute the minimum standard of acceptance.
- .3 Contract Administrator will determine acceptability of Contractor's selection of material and equipment at time of Shop Drawing review.
- .4 When material or equipment is specified by a Standard, Prescriptive or Performance specification, upon request of the Contract Administrator, obtain from manufacturer an independent laboratory reporting, showing that material or equipment meets or exceeds the specified requirements.

1.19 SUBSTITUTION OF MATERIAL AND EQUIPMENT

- .1 **Prior to Tender** closing bidders may propose addition of other manufacturer's names to those listed in the tender documents providing requests are made in writing at least 10 days prior to tender closing date. Contract Administrator will inform all prospective bidders of decision by the final addendum.

Where no manufacturer's names are listed, the onus is on contractor to provide material and equipment to meet performance specification.

- .2 **After Contract award** substitutions of material or equipment, other than as selected by Contractor from those specified, will be considered by Contract Administrator only if:
 - .1 material or equipment selected from those specified are not available
 - .2 delivery date of material or equipment selected from those specified would unduly delay completion of the Contract; or
 - .3 alternative material or equipment to those specified, provided they are determined by the Contract Administrator to be equivalent to or better than those specified, and will result in a credit to the Contract amount.
- .3 Requests for substitutions after Contract award must be accompanied by sufficient information in the form of shop drawings, manufacturer's literature, samples or other data to permit proper investigation of the substitutes used. Requests must also include statements of respective costs of material or equipment originally specified and the proposed substitution.
- .4 Should a proposed substitution be accepted after Contract award either in part or in whole, assume full responsibility and costs when substitution affects other work

COMMON PRODUCT REQUIREMENTS

on Project. Contractor to pay for design or drawing changes required as a result of the substitution.

- .5 Amounts of all credits arising from approval of substitutions after Contract award will be determined by Contract Administrator and the Contract amount will be reduced accordingly.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION (NOT APPLICABLE)**

END OF SECTION

EXAMINATION AND PREPARATION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Recording of subsurface conditions found.

1.2 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practise in the Province of Ontario.

1.3 EXISTING SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by authorities having jurisdiction, with minimum of disturbance to pedestrian and vehicular traffic.
- .2 Before commencing work, establish location and extent of service lines in area of Work and notify Contract Administrator of findings.
- .3 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Contract Administrator.

1.4 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 Contract Administrator 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 Contract Administrator.

1.5 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

1.6 SUBMITTALS

- .1 On request of Contract Administrator, submit documentation to verify accuracy of field engineering work.

EXAMINATION AND PREPARATION

1.7 SUBSURFACE CONDITIONS

- .1 Promptly notify Contract Administrator in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 The Contractor is required to be familiar with the existing As-Built and documents.
- .3 After prompt investigation, should Contract Administrator determine that conditions do differ materially, instructions will be issued for changes in Work.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION (NOT APPLICABLE)**

END OF SECTION

EXECUTION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 01 33 00 - Submittal Procedures.

1.3 SUBMITTALS

- .1 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 X-ray all penetrations to identify rebar layout.
 - .6 Work of Owner or separate contractor.
- .2 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.4 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.

EXECUTION

- .5 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.
- .6 Obtain Contract Administrator approval before cutting, boring or sleeving load-bearing members.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.
- .14 Make cuts with clean, true, smooth edges.
- .15 Where new work connects with existing, and where existing work is altered, cut, patch and make good to match existing work.

EXECUTION

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION (NOT APPLICABLE)**

END OF SECTION

CLEANING

PART 1 GENERAL**1.1 GENERAL**

- .1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- .2 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .3 Provide adequate ventilation during use of volatile or noxious substances. Use for building ventilation systems is not permitted for this purpose.

1.2 RELATED SECTION

- .1 Section 01 77 00 - Closeout Procedures.
- .2 Section 01 74 21 – Construction Waste

1.3 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2 Remove waste materials and debris from site at the end of each working day. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

CLEANING

- .10 Vacuum clean interior of building areas of dirt when ready to receive finishes and continue vacuum cleaning at least daily until building is ready for substantial completion or occupancy. Sweep floors and pavements clean on a daily basis.
- .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 Areas in which electrical and mechanical equipment area located and ready for start-up and commissioning must be cleaned of all dusts and debris prior to any equipment being started up. After start up the areas are to be maintained dust free, filters replaced on a weekly basis, the internal areas of control panels, and equipment filters/fans etc. shall be vacuum cleaned on a weekly basis. If in the opinion of the Contract Administrator, there is excessive amounts of dust being drawn into the building through openings, penetrations or due to ambient construction activities outside the operating areas, the contractor will be responsible to provide additional air filtration to achieve a dust free environment.
- .13 **The contractor shall employ suitable means to protect the existing building elements from precipitation, moisture, wind, dust and other airborne particles. Use tarps, coverings, etc. to protect all elements within and around the work zone. Final cleaning at the completion of the project is the responsibility of the contractor. A detailed pre-construction survey shall be completed by the contractor and owner/contract administrator.**

1.4 FINAL CLEANING

- .1 Refer to General Conditions.
- .2 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .4 When the Work is Totally Performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.
- .5 Remove waste materials from the site at regularly scheduled times or dispose of as directed by the Owner's Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Leave the work broom clean before the inspection process commences.

CLEANING

- .8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .9 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.
- .10 Clean lighting reflectors, lenses, and other lighting surfaces.
- .11 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .12 Wax, seal, shampoo or prepare floor 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 roofs, gutters, downspouts and drainage systems. Clean areaways and sunken wells.
- .17 Sweep and wash clean paved areas.
- .18 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical and electrical equipment.
- .19 Remove snow and ice from access to building.
- .20 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

PART 2 **PRODUCTS (NOT APPLICABLE)****PART 3** **EXECUTION (NOT APPLICABLE)****END OF SECTION**

CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Text, schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:
 - .1 Diversion of Materials.
 - .2 Waste Audit (WA) - Schedule A.
 - .3 Waste Reduction Workplan (WRW) - Schedule B.
 - .4 Demolition Waste Audit (DWA) - Schedule C.
 - .5 Cost/Revenue Analysis Workplan (CRAW) - Schedule D.
 - .6 Materials Source Separation Program (MSSP).
 - .7 Canadian Governmental Responsibility for the Environment Resources - Schedule E.

1.2 DEFINITIONS

- .1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.
- .2 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .3 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .4 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .5 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.
- .6 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.
- .7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .8 Separate Condition: Refers to waste sorted into individual types.

CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

- .9 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.3 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by authorities having jurisdiction.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to recycling facility.

1.4 STORAGE, HANDLING AND PROTECTION

- .1 Unless specified otherwise, materials for removal become Contractor's property.
- .2 Protect, stockpile, store and catalogue salvaged items.
- .3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to approved local facility.
- .4 Protect structural components not removed for demolition from movement or damage.
- .5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Department having jurisdiction.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Separate and store materials produced during dismantling of structures in designated areas.
- .8 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.

CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

1.5 DISPOSAL OF WASTES

- .1 Do not bury OR burn rubbish or waste materials.
- .2 Do not dispose of any waste into waterways, storm, or sanitary sewers.
- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.6 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide security measures approved by Owner's Representative.

1.7 SCHEDULING

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

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION****3.1 APPLICATION**

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .2 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .3 Clean-up work area as work progresses.
- .4 Source separate materials to be reused/recycled into specified sort areas.

3.2 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Owner's Representative and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.

CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

- .2 On-site sale or distribution of salvaged materials to third parties is not permitted.

END OF SECTION

CLOSEOUT PROCEDURES

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 74 11 - Cleaning.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 79 00 – Demonstration and Training

1.2 FINAL INSPECTION AND DECLARATION PROCEDURES

- .1 Contractor's Inspection: The Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects; repair as required. Notify the Contract Administrator in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made. Request a Contract Administrator's Consultant's Inspection.
- .2 Contract Administrator's Inspection: Contract Administrator and the Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that the following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by Fire Commissioner, Utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Commissioning of building/mechanical and electrical systems: completed in accordance with section 01 79 00 – Demonstration and Training.
 - .7 Work is complete and ready for Final Inspection.
- .4 Final Inspection: When items noted above are completed, request final inspection of Work by the Contract Administrator(s) and the Contractor. If Work is deemed incomplete by the Contract Administrator, complete outstanding items and request a reinspection.
- .5 Declaration of Substantial Performance: When the Contract Administrator considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Certificate of Substantial Performance. Refer to General Conditions for specifics to application.

CLOSEOUT PROCEDURES

- .6 Commencement of Lien and Warranty Periods: The date of the Owners acceptance of the submitted declaration of Substantial Performance shall be the date for commencement for the warranty period and commencement of the lien period.
- .7 Declaration of Total Performance: When the Contract Administrator considers final deficiencies and defects have been corrected and it appears requirements of the Contract have been totally performed, make application for certificate of Total Performance. Refer to General Conditions for specifics to application. If Work is deemed incomplete by the Contract Administrator, complete the outstanding items and request a reinspection.

1.3 REINSPECTION

- .1 Should status of work require reinspection by Contract Administrator due to failure of work to comply with Contractor's claims for inspection, Owner will deduct amount of compensation for reinspection services from payment to Contractor.

1.4 OCCUPANCY

- .1 Owner reserves the right to occupy and operate portions of work whether partially or entirely completed, or whether completed on schedule or not.
- .2 Partial occupancy shall not imply acceptance of work in whole or in part nor shall it imply acknowledgement that the terms of Agreement are fulfilled.

1.5 SYSTEM DEMONSTRATION

- .1 Prior to Substantial Performance:
 - .1 Demonstrate operation of each system to Contract Administrator(s).
 - .2 Instruct personnel in operation, adjustment and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.

1.6 WARRANTIES

- .1 The contractor shall include a minimum one-year warranty on all products, materials and workmanship. Extended warranties shall be included for various items as defined in the individual specifications.

1.7 SUBMITTALS

- .1 Refer to Section 01 33 00 and Contract General Conditions for submission requirements at project completion.

1.8 FINAL CLEANING

- .1 Refer to Section 01 74 11 for cleaning requirements.

CLOSEOUT PROCEDURES

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

CLOSEOUT SUBMITTALS

Part 1 General**1.1 DEFINITIONS**

- .1 As-Built: a set of Contract Drawings marked up by the Contractor during construction, to record changes in the Work and to illustrate actual locations of hidden utilities or concealed elements.
- .2 Record Documents: a collection of construction documents, including Shop Drawings, Product Data sheets, operation and maintenance information, field test records, inspection certificates, manufacturer's certificates, as well as a revised set of the Contract Drawings, recording the actual placement, configuration and nature of the various Products used in the construction of a Project.
- .3 Electronic Record Documents: revised set of electronic Contract Drawings in the same electronic format as the original documents, recording the actual placement, configuration and nature of the various Products used in the construction of a Project.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.
- .3 Furnish evidence, if requested, for type, source and quality of products provided.
- .4 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .5 Pay costs of transportation.

1.3 OPERATION AND MAINTENANCE MANUALS

- .1 Submission:
 - .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
 - .2 Two weeks prior to anticipated Certificate of Completion, submit to the Consultant, electronic copy of operating and maintenance manuals.
 - .3 Copy will be returned with Consultant's comments.
 - .4 Revise content of documents as required prior to final submittal.
 - .5 Should comments be extensive, the Consultant may require the Initial Submission to be repeated prior to Certificate of Completion.
 - .6 Two weeks prior to final inspection of the Work, submit to the Consultant, revised electronic copy of operating and maintenance manuals.
 - .7 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.
- .2 Format:
 - .1 Organize data in the form of an instructional manual.

CLOSEOUT SUBMITTALS

- .2 Correlate data into related consistent groupings.
- .3 Identify with title 'Operations and Maintenance Manual'; list title of project and identify subject matter of contents.
- .4 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .5 Provide CAD files in AutoCad format and PDF.
- .3 Contents:
 - .1 Table of Contents: provide title of project and information below.
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems.
 - .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .3 Product Data: clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
 - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
 - .5 As required, supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.4 RECORD DOCUMENTS AND SAMPLES

- .1 Maintain at the site 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 record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Consultant.

1.5 RECORDING ACTUAL SITE CONDITIONS

- .1 Record as-built information on duplicate sets of white prints.

CLOSEOUT SUBMITTALS

- .2 Clearly mark both sets of drawings, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .2 Measured locations of internal utilities and appurtenances referenced to visible and accessible features of construction.
 - .3 Field changes of dimension and detail.
 - .4 Changes made by change orders.
 - .5 Details not on original Contract Drawings.
 - .6 References to related shop drawings and modifications.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .6 As part of the Work, submit to Consultant prior to Certificate of Completion, before occupancy, one set of marked up as-built drawings which reflect as-built information.
- .7 Electronic Record Documents:
 - Submit clear and concise redline markup drawings of as-built conditions to the consultant. The consultant will prepare the electronic as-built drawings based on contractor markups.
- .8 Final payment on the Contract will not be made until correct record documents are received.

1.6 FINAL SURVEY

- .1 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.

1.7 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics, and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

CLOSEOUT SUBMITTALS

- .1 Include regulation, control, stopping, shut-down, and emergency instructions.
- .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports.
- .15 Additional requirements: As specified in individual specification sections.

1.8 MATERIALS AND FINISHES

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

1.9 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue all items.
 - .1 Submit inventory listing to Consultant.

CLOSEOUT SUBMITTALS

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

1.1 DELIVERY, STORAGE AND HANDLING

- .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.

1.2 WARRANTIES AND BONDS

- .1 Separate each warranty or bond 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 by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Certificate of Completion is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

END OF SECTION

DEMONSTRATION AND TRAINING

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks before date of Certificate of Completion.
- .2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation.
 - .4 Ensure testing, adjusting, and balancing has been completed and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment indicated in the technical section.
- .6 Provide digital audio/visual recording of demonstration and training sessions.
 - .1 Organize into several short modules to permit incorporation of changes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide 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 three weeks prior to designated dates, for Owner and 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.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.
- .6 Provide copy of training videos for incorporation into operation and maintenance manuals.

DEMONSTRATION AND TRAINING

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Owner's personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

END OF SECTION

SELECTIVE SITE DEMOLITION

Part 1 General**1.1 SUMMARY**

- .1 Section includes descriptions for demolishing, salvaging, recycling and removing site work items identified for removal in whole or in part, and for backfilling trenches and excavations resulting from site demolition activities.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 16– Structure Demolition
- .2 Section 31 23 33.01– Excavating, Trenching and Backfilling

1.3 REFERENCE STANDARDS

- .1 The National Building Code of Canada, Part 8 – Safety Measures on Construction and Demolition Sites.
- .2 ASTM International (ASTM)
 - .1 ASTM F710-11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- .3 Ontario Regulation 102/94, Waste Audits and Waste Reduction Work Plans
- .4 Ontario Regulation 103/94, Environmental Protection Act.
- .5 Ontario Regulation 213/07 The Fire Code
- .6 Ontario Regulation 232-98 Landfilling Sites
- .7 Ontario Regulation 278/05 Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations
- .8 Ontario Regulation 347 Environmental Protection Act, General – Waste Management
- .9 Ontario Regulation 332/12 The Building Code
- .10 The Workplace Health and Safety Act, and Regulations for Construction Projects.
- .11 The Contractors Health and Safety Policy
- .12 Laws, rules, and regulations of other authorities having jurisdiction

1.4 DEFINITIONS

- .1 Selective Demolition: Sequencing demolition activities to allow separation and sorting of selected site materials.
- .2 Hazardous Substances: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or well being or environment if handled improperly.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate with Owner for the material ownership including the following:

SELECTIVE SITE DEMOLITION

- .1 Except for items or materials indicated to be salvaged, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- .2 Pre-Demolition Meetings.
 - .1 Convene meeting (2) two week before beginning work of this Contract Administration Section, with in accordance with Section 01 31 19- Project Meetings to:
 - .1 Verify project requirements.
 - .2 Verify existing site conditions adjacent to demolition work
 - .3 Coordinate with other construction sub trades
 - .4 Examine existing site conditions adjacent to demolition work, prior to start of Work
 - .5 Review with Owner the location for the salvaged material
 - .2 Hold project meetings every week.
 - .3 Ensure Site Supervisor and Contract Administrator attend.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Shop Drawings: Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada as follows:
 - .1 Submit for review and approval selective site demolition drawings, diagrams or details showing sequence of selective site demolition.
 - .2 Submit in accordance with Section 01 33 00- Submittal Procedures.
 - .2 Schedule of Selective Site Demolition Activities: Coordinate with Section 01 32 16 Construction Progress Schedule, and indicate the following:
 - .1 Detailed sequence of selective site demolition and removal work, with starting and ending dates for each activity
 - .2 Interruption of utility services
 - .3 Coordination for shutoff, capping, and continuation of utility services
 - .4 Locations of temporary partitions and means of egress
 - .3 Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:
 - .4 Proposed Dust Control, Noise Control Measures: Submit statement or drawing that indicates measures proposed for use, proposed locations, and proposed time frame for their operation.
 - .5 Inventory: Submit a list of items that have been removed and salvaged after selective site demolition is complete
 - .1 Pre demolition Photographs: Submit photographs 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 site demolition operations.

SELECTIVE SITE DEMOLITION

- .2 Informational Submittals: Provide the following submittals when requested by the Consultant:
 - .1 Qualification Data: Submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of Consultant and [Representative] [Consultant] , for work of similar complexity and extent.

1.7 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with applicable Provincial regulations.
- .2 Comply with hauling and disposal regulations of Authority Having Jurisdiction.

1.8 SITE CONDITIONS

- .1 Environmental protection:
 - .1 Ensure Work is done in accordance with Section 01 35 43- Environmental Procedures.
 - .2 Ensure Work does not adversely affect adjacent watercourses and groundwater or contribute to excess air and noise pollution.
 - .3 Fires and burning of waste or materials is not permitted on site.
 - .4 Burying of rubbish waste materials is not permitted.
 - .5 Disposal of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers, is not permitted.
 - .6 Ensure proper disposal procedures are maintained throughout the project.
- .2 Pumping of water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties, is not permitted.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.
- .4 Protect trees, plants and foliage on site and adjacent properties.
- .5 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .6 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.
- .7 Owner will occupy part of this building immediately adjacent to demolition area.
- .8 Conduct selective site demolition so Owner's operations will not be disrupted:
 - .1 Provide not less than 72 hours' notice to Owner of activities that will affect operations.
 - .2 Maintain access to existing walkways, exits, and other adjacent occupied or used facilities:
 - .1 Closing or obstructing walkways, exits, or other occupied or used facilities without written permission from (Authority Having Jurisdiction) is not permitted.

SELECTIVE SITE DEMOLITION

- .9 Contract Administrator assumes no responsibility for Selective Site elements being demolished:
 - .1 Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - .2 Before selective site demolition, remove, protect and store salvaged items as directed by Owner:
 - .1 Salvage items as identified by Contract Administrator.
 - .2 Deliver to Representative Owner as directed.

1.9 EXISTING CONDITIONS

- .1 Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work:
 - .1 Hazardous materials will be as defined in the Hazardous Materials Act.
 - .2 Hazardous materials will be removed by Owner before start of the Work.
- .2 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Contract Administrator. Hazardous materials will be removed by Owner under a separate contract or as a change to the Work.
- .3 If material resembling spray or trowel applied asbestos or other substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify Contract Administrator immediately. Proceed only after receipt of written instructions have been received from Contract Administrator.
- .4 Site elements that will be demolished are based on their condition, (at time of examination prior to tendering) .

Part 2 Products**2.1 EQUIPMENT**

- .1 Equipment and Heavy Machinery:
 - .1 On-road vehicles to: CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .2 Machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.
- .2 **SALVAGE**
 - .1 The existing Low-E ceiling and suspension structure shall be neatly salvaged and handed over to the owner.

Part 3 Execution**3.1 EXAMINATION**

- .1 Survey existing conditions and correlate with requirements indicated to determine extent of selective site demolition required.

SELECTIVE SITE DEMOLITION

- .2 Contract Administrator does not guaranty that existing conditions are the same as those indicated in Project Record Documents.
- .3 Inventory and record the condition of items being removed and salvaged.
- .4 When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Contract Administrator.
- .5 Engage a professional engineer to perform an engineering survey of condition of existing buildings to determine whether removing any site element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective site demolition operations.
- .6 Verify that hazardous materials have been remediated before proceeding with site demolition operations.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .2 Protection of in-place conditions:
 - .1 Work in accordance with Section 01 35 43- Environmental Procedures.
 - .2 Prevent movement, settlement or damage of adjacent structures and services.
 - .1 Provide bracing, shoring [and underpinning] as required.
 - .2 Repair damage caused by demolition as directed by Contract Administrator.
 - .3 Support affected site elements and, if safety of site element being demolished appears to be endangered, take preventative measures, stop Work and immediately notify Contract Administrator.
 - .4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- .3 Surface Preparation:
 - .1 Disconnect electrical and service lines within the site to be demolished.
 - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of selective site demolition.
 - .2 Disconnect and cap mechanical services.
 - .1 Natural gas supply lines: remove in accordance with gas company requirements.
 - .2 Sewer and water lines: remove in accordance with authority having jurisdiction.

SELECTIVE SITE DEMOLITION

- .3 Other underground services: remove and dispose of as directed by the Contract Administrator.

3.3 REMOVAL AND DEMOLITION OPERATIONS

- .1 Remove items as indicated.
- .2 Disruption of items designated to remain in place is not permitted.
- .3 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.
- .4 Disposal of Material:
 - .1 Dispose of materials not designated for salvage or reuse on site [at authorized facilities.
- .5 Backfill: Backfill in areas as indicated and in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

3.4 STOCKPILING

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.5 REMOVAL FROM SITE

- .1 Remove stockpiled material as directed by the Contract Administrator, when it interferes with operations of project.
- .2 Transport material designated for alternate disposal using approved haulers and in accordance with applicable regulations:

3.6 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 00- Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Remove debris, trim surfaces and leave work site clean, upon completion of Work

SELECTIVE SITE DEMOLITION

- .3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00- Cleaning.
- .3 Waste Management: separate waste materials for recycling.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

STRUCTURE DEMOLITION

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Methods and procedures for demolition of structures, parts of structures, basements and foundation walls and includes abandonment and removal of septic tanks and tanks containing petroleum products.

1.2 RELATED SECTIONS

- .1 Section 01 11 00 – Summary of Work
- .2 Section 01 35 29.06 - Health and Safety Requirements
- .3 Section 01 35 43 - Environmental Procedures
- .4 Section 01 52 00 – Construction Facilities
- .5 Section 01 56 00 - Temporary Barriers and Enclosures
- .6 Section 01 74 2100 – Construction/Demolition Waste Management and Disposal
- .7 Section 02 41 13 – Selective Site Demolition

1.3 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CSA S350, Code of Practice for Safety in Demolition of Structures

1.4 QUALITY ASSURANCE

- .1 Prior to start of Work arrange for site visit with Owner's Representative to examine existing site conditions adjacent to demolition work
- .2 Hold project meetings every month.
- .3 Ensure key personnel, site supervisor, project manager, subcontractor representatives, attend.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.6 EXISTING CONDITIONS

- .1 Should material resembling spray or trowel applied asbestos or any other designated substance be encountered in course of demolition, stop work, take

STRUCTURE DEMOLITION

preventative measures, and notify Owner's Representative immediately. Do not proceed until written instructions have been received (refer to Appendix C Asbestos report – none identified)

- .2 Structures to be demolished to be based on their condition on date that tender is accepted.
- .3 Salvage items as identified by Owner's Representative (Low E ceiling and supporting structure). Remove, protect and store salvaged items as directed by Owner's Representative. Deliver to Owner as directed.

1.7 DEMOLITION DRAWINGS

- .1 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .2 Submit drawings stamped and signed by qualified professional engineer licensed in Province of Ontario, Canada.

1.8 ENVIRONMENTAL PROTECTION

- .1 Ensure work is done in accordance with Section 01 35 43 – Environmental Procedures.
- .2 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades parts of existing building to remain.
- .3 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered cease operations and notify Owner's Representative.
- .4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- .5 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .6 Fires and burning of waste or materials is not permitted on site.
- .7 Do not bury waste or materials on site.
- .8 Do not dispose of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

STRUCTURE DEMOLITION

- .9 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- .10 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities' requirements.
- .11 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .12 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .13 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

1.9 SCHEDULING

- .1 Ensure project timelines are met without compromising specified minimum rates of material diversion. Notify Owner's Representative in writing of delays.

PART 2 PRODUCTS (NOT APPLICABLE)**PART 3 EXECUTION****3.1 PREPARATION**

- .1 Do work in accordance with 01 35 29 – Health and Safety Requirements.
- .2 Disconnect electrical, telephone service, and other utility lines entering buildings to be demolished. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .3 Disconnect and cap designated mechanical services.
 - .1 Sewer and water lines: remove to property line.
 - .2 Other underground services: remove and dispose of as directed by Owner's Representative.
- .4 Do not disrupt active or energized utilities designated to remain undisturbed.
- .5 Remove rodent and vermin as required by Owner's Representative.

3.2 SAFETY CODE

- .1 Do demolition work in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.
- .2 Blasting operations not permitted during demolition.

STRUCTURE DEMOLITION

3.3 DEMOLITION

- .1 Demolish foundation walls as indicated on project drawings.
- .2 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .3 At end of each day's work, leave Work in safe and stable condition. Protect interiors of parts not to be demolished from exterior elements at all times.
- .4 Demolish to minimize dusting. Keep materials wetted as directed by Owner's Representative.
- .5 Remove structural framing.
- .6 Contain all fibrous materials (e.g. Insulation) to minimize release of airborne fiber while being transported to waste disposal site or alternative disposal location.
- .7 Only dispose of material specified by selected alternative disposal option as directed by Owner's Representative.
- .8 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
- .9 Environmental:
 - .1 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimized danger at site or during disposal.
- .10 Prior to the start of any demolition work remove contaminated or hazardous materials as defined by authorities having jurisdiction, from site and dispose of at designated disposal facilities.
- .11 Use natural lighting to work by wherever possible. Shut off all lighting except those required for security purposes at the end of each day.

3.4 STOCKPILING

- .1 Stockpile materials in a location as directed by Owner's Representative.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Separate from general waste stream materials that may be disposed of in source separated Stockpiles. Stockpile materials in neat and orderly fashion in location and as directed by Owner's Representative for alternate disposal. Stockpile materials in accordance with applicable fire regulations.

STRUCTURE DEMOLITION

- .4 Supply separate, clearly-marked disposal bins for all categories of waste material. Do not remove bins from site until inspected and approved by Owner's Representative.
- .5 Provide collection areas for collection of miscellaneous metals in the area of demolition.

3.5 REMOVAL FROM SITE

- .1 Notify Owner's Representative in writing of any materials identified as not suitable for alternate disposal. Provide reasons prior to approval for disposal.
- .2 Dispose of materials as directed by Owner's Representative.
- .3 Remove stockpiled material as directed by Owner's Representative when it interferes with operations of project construction.
- .4 Remove stockpiles of like materials by an alternate disposal option once collection of materials is complete.
- .5 Transport material designated for alternate disposal in accordance with applicable regulations.
- .6 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.

3.6 REPORTING

- .1 Record off-site removal of debris and materials and provide following information regarding removed materials to Owner's Representative within two (2) working days.
 - .1 Time and date of Removal
 - .2 Description of Material
 - .3 Weight and Quantity of Materials.
 - .4 Breakdown of reuse, recycling and landfill quantities.
 - .5 End Demolition of Materials.

3.7 COORDINATION

- .1 Coordinate alternative disposal activities with Owner's Representative's on site waste diversion representative.

END OF SECTION

CONCRETE FORMING ACCESSORIES

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-place Concrete.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA) – Current Editions
 - .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121, Douglas Fir Plywood.
 - .4 CSA O151, Canadian Softwood Plywood.
 - .5 CAN/CSA-S269.1, Falsework and Formwork.
 - .6 CSA 0153, Poplar Plywood.
 - .7 CSA 0437, Standards for OSB and Waferboard.
 - .8 CSA 0188, Interior Mat Formed Wood Particleboard.
 - .9 CAN/CSA-0141, Softwood Lumber
- .2 National Lumber Grade Authority (NLGA): Standard Grading Rules for Canadian Lumber.
- .3 Ontario Provincial Standards Specification (OPSS): 919 Construction Specification for Formwork and Falsework – Current Edition.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittals.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, camber, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework and formwork drawings.
- .3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework. Indicate location of all construction joints in slabs and walls.

CONCRETE FORMING ACCESSORIES

- .5 Design, construct and dismantle falsework and formwork in accordance with the requirements of CSA A23.1, CSA S269.1 – Falsework for Construction Purposes, and CSA 269.3 – Concrete Formwork.
- .6 All temporary supports and shoring for formwork shall be designed by a Professional Engineer Registered in the Province of Ontario.
- .7 Each shop drawing submission shall bear stamp and signature of qualified professional engineer licensed in Province of Ontario.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Formwork materials:
 - .1 Plywood for exposed concrete to be new factory resin coated medium density overlaid Douglas Fir plywood, 19mm thick, base material with 7 ply Cofiform Grade finish. Coated side to be in contact with concrete. Plywood for concealed concrete may be re-used Douglas Fir Plywood.
 - .2 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CSA 0141, CSA 0437 or CSA-0153.
 - .3 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
 - .4 Form tie minimum working strength of 13kN.
 - .5 Snap ties shall release at 25mm from face of concrete without damaging concrete.
 - .6 Cone ties to be internal disconnecting type which snap 38mm from concrete surface.
 - .7 Form release agent: chemically active release agents containing components that react with free lime in concrete to provide water insoluble soaps, preventing set of film of concrete in contact with form (Formshield WB by Euclid Chemical or Noxcrete Form Coating).
 - .8 Plastic Anchor Bolt Sleeves: Dayton/Richmond D-1-S Anchor Bolt Sleeves. Size to suit anchor bolt diameter and embedment.
- .2 Form ties:
 - .1 Water Retaining Structures or Basements (N/A) – Use plastic cone type coil ties which break off or are removeable 38mm inside the concrete surface complete with neoprene washers in centre of tie to break surface continuity and prevent water seepage. Standard of acceptance: - National Concrete Accessories – 2 or 4 strut Waterseal Tyscru with Tycones.

CONCRETE FORMING ACCESSORIES

- .2 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
- .3 For Architectural concrete (other than above), use snap ties complete with plastic cones and light grey concrete plugs.
- .4 Unexposed concrete surfaces – snapties, coil ties or she-bolts to suit application. They are to be free of devices leaving holes larger than 25mm diameter.
- .3 Form liner:
 - .1 Plywood: medium density overlay Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151, T and G, 20mm thick, urea formaldehyde free.
 - .2 Waferboard to CAN3-0188, exterior grade, 20mm thick.
- .4 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, non-toxic, biodegradable.
- .5 Falsework materials: to CSA-S269.1.
- .6 Sealant: to Section 07 92 00 - Joint Sealants

PART 3 **EXECUTION****3.1** **FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 It is acceptable to leave timber formwork in place along north side of new wall adjacent to building (500mm void space) at the discretion of the contractor.
- .3 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
 - .1 Variation from plumb: plumbness of columns and walls shall be within 1:400 but not more than 15mm.
 - .2 Variation of cross-section of beams, columns, wall thickness, and slab thickness other than slab on grade shall be +/-8mm (0-300mm), +/-12mm (301-1000mm), and 20mm (>1000mm).
 - .3 Average slope of floors, beams and other horizontal units shall be within 1:400 but not more than 20mm for the total length of the structure.
 - .4 Variation of the linear building lines from established position in plan for all elements to be 6mm (0-6000mm) and +/- 12mm (>6000mm).

CONCRETE FORMING ACCESSORIES

- .4 Concrete exposed to view is considered as requiring architectural exposed finishes.
- .5 Camber all formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Positive means of adjustment (wedges or jacks) or shores and struts to be provided and all settlement taken up during concrete placing operations.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3, to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .9 Align form joints and make watertight. Keep form joints to minimum.
- .10 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .11 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .13 Construct forms for architectural concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .14 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .15 Provide temporary cleanout and inspection openings at the base of wall forms at maximum 5000mm o.c. Openings shall be located such that flushing water will drain from the form. Close temporary openings with tight fitting panels, flush with the inside form face prior to concrete placement. Joints to be neat and tight.
- .16 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Conform to CSA A23.1.
- .2 Leave formwork in place for the following minimum periods of time after placing:
 - .1 2 days for walls, piers and sides of slabs.

CONCRETE FORMING ACCESSORIES

- .3 Remove slab formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever is longer, and replace immediately with adequate re-shoring (maximum 3000 o.c each direction). Ensure the slab is not load until the concrete reaches its design strength.
- .4 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .5 Space reshoring in each principal direction in accordance with engineered design.
- .6 Re-use formwork and falsework subject to requirements of CSA-A23.1A23.2.

END OF SECTION

CONCRETE REINFORCING

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 American Concrete Institute (ACI) – Current Editions
 - .1 ACI SP-66, ACI Detailing Manual, 2004.
- .2 American Society for Testing and Materials International (ASTM) – Current Editions
 - .1 ASTM A82/A28M, Standard Specification for Steel Wire, Plain for Concrete Reinforcement.
 - .2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .4 ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .5 ASTM A1022/A1022M, Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement.
- .3 Canadian Standards Association (CSA) – Current Editions
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of test and Standard Practices for Concrete.
 - .2 CSA-A23.3, Design of Concrete Structures.
 - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel /Structural Quality Steel.
 - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC) – Current Edition
 - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

- .1 Submit product data in accordance with section 01 33 00 – Submittals.

CONCRETE REINFORCING

- .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Owner's Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada. ACI SP-66, ACI Detailing Manual, American Concrete Institute.
- .3 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Owner's Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .4 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only. Chair wire fabric in position indicated on drawings.
- .5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .6 Mechanical splices: subject to approval of Owner's Representative.
- .7 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI SP-66, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Owner's Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Owner's Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

CONCRETE REINFORCING

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Owner's Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
- .2 Upon request inform Owner's Representative of proposed source of material to be supplied.

PART 3 EXECUTION**3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Owner's Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Use only non-corrosible materials such as plastic or concrete block chairs to support wire mesh or rebar in slabs on grade. Lifting of mesh during concrete placement is not acceptable.
- .4 Prior to placing concrete, obtain Owner's Representative approval of reinforcing material and placement.
- .5 Ensure cover to reinforcement is maintained during concrete pour.

3.3 SPLICES

- .1 Reinforcing steel bars shall have Class "B" splices unless otherwise indicated.
- .2 Stagger splices a minimum of 1500 o.c.
- .3 Coordinate splices with pour sequencing and construction joint locations

CONCRETE REINFORCING

END OF SECTION

CAST IN PLACE CONCRETE

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 35 00 - Concrete Finishing.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM) – Current Editions
 - .1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C900 Test Method for Pullout Strength of Hardened Concrete.
 - .5 ASTM D1751, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .2 Canadian General Standards Board (CGSB) – Current Edition
 - .1 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA) – Current Editions
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN3-A266.4, Guidelines for the Use of Admixtures in concrete.
 - .3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .5 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittals.
- .2 Shop Drawings:
 - .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape location and details of reinforcing.

CAST IN PLACE CONCRETE

- .2 Submit drawings showing formwork and falsework design to CSA A23.1/A23.2.
- .3 At least 4 weeks prior to commencing work, inform Owner's Representative of proposed source of aggregates and provide access for sampling.
- .4 Submit testing results and reports for review by Owner's Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .5 Certificates:
 - .1 Minimum 4 weeks prior to starting concrete work submit to Owner's Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing materials.
 - .4 Grout.
 - .5 Admixtures.
 - .6 Aggregates.
 - .7 Water.
 - .8 Waterstops.
 - .9 Waterstop joints.
 - .10 Joint filler.
 - .11 Curing compounds
 - .2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2.
 - .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1/A23.2.
 - .4 Ready Mix Concrete Producer: Certified member in good standing with the local Ready Mix Concrete Association.
 - .5 Provide Certification that the plant, equipment, and materials to be used in concrete are adjusted to prevent alkali aggregate reactivity problems.

1.4 QUALITY ASSURANCE

- .1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01 45 00 - Quality Control for Owner's Representative approval for following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.

CAST IN PLACE CONCRETE

- .3 Cold weather concrete.
- .4 Curing.
- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Owner's Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Owner's Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.6 QUALIFICATIONS OF WORKER

- .1 At all times there shall be at least one person present during concrete placement who shall direct the work and who is familiar with the materials being placed and understands the best method for their placement.

1.7 CONCRETE TESTING

- .1 All concrete testing will be paid by the contractor through the testing and inspection allowance. Provide coordination with consultant/owner as required to schedule all required concrete testing.
- .2 Field control tests will be carried out in accordance with CSA-A23.1/A23.2 to ensure that concrete quality meets the minimum specified properties.
- .3 There will be no addition of water and/or chemical additives to the concrete without the approval of the consultant.

1.8 GEOTECH TESTING

- .1 Geotechnical consultant to verify all bearing surfaces prior to placement of structural fill, mudslabs, reinforcing or structural concrete. Geotech to verify all structural backfill.
- .2 If final bearing elevations require adjustment from those elevations noted on structural drawings, notify consultant in writing prior to proceeding with work.

CAST IN PLACE CONCRETE

1.9 COORDINATION

- .1 Coordinate location and supply of all embedded items such as sleeves, hangers, anchor bolts, bearing plates, etc. with other trades and install same. Supply embedded items which are not specified as being supplied by other trades.
- .2 Report any errors uncovered during the course of this work for Consultant's direction. Corrective measures to be the responsibility of the trade responsible for the error.
- .3 All temporary openings and permanent sleeves in structural concrete are required to be properly waterproofed after work is complete.
- .4 Confirm all exact equipment locations and penetration sizes and locations with other trades. Report any discrepancies to the consultant.

PART 2 PRODUCTS**2.1 DESIGN CRITERIA**

- .1 Alternative 1 – Performance: to CSA A23.1/A23.2.

2.2 PERFORMANCE CRITERIA

- .1 Ensure concrete supplier meets performance criteria of concrete and provide verification of compliance as indicated under Part 1.

2.3 MATERIALS

- .1 Portland cement: to CAN/CSA-A3001, Type GU – General Use.
- .2 Cementitious Hydraulic Slag: to CSA A3000.
- .3 Fly Ash is not accepted.
- .4 Water: to CAN/CSA-A23.1.
- .5 Aggregates: to CSA-A23.1/A23.2. The use of recycled concrete as aggregate is not permitted.
- .6 Admixtures: no chlorides
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixtures: to ASTM C494, Owner's Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

CAST IN PLACE CONCRETE

- .7 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .8 Curing/Sealing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1, Class B, water based acrylic, compatible with other concrete applied products. Sika Florseal WB 25 or approved equivalent.
- .9 Expanding Concrete Joint Waterstop (not applicable): Adeka MC-2010MN with Adeka Ultra Seal P-201.
- .10 Expanding Concrete Expansion Joint Waterstop (not applicable): Adeka KM-3030MN with Adeka Ultra Seal P-201
- .11 Tie Hole Grout: non-metallic, non-staining, non-toxic grout, CPD Fastcrete ultra or approved equal.
- .12 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board (minimum 13mm): to ASTM D1751.
- .13 Polyethylene film: minimum 0.25 mm thickness to ASTM C171.
- .14 Bonding adhesive: synthetic latex.
- .15 Weep hole tubes: plastic.
- .16 Control joint filler: semi-rigid filler.
 - .1 For sawcuts made with soft cut saw: two component epoxy.
 - .2 For conventional sawcuts in interior slab: two component epoxy urethane.
 - .3 For conventional sawcuts in exterior slabs: two or multi-component polyurethane based elastomeric.
- .17 Construction joint sealant: Sikaflex 2C-NS sealant with related Sikaflex 202 primer.
- .18 Grout for pipe penetrations, pipe puddle flanges and wall in-fills as indicated: Sika Grout 212.
- .19 Self compacting, cement based concrete repair: Sikacrete -08 SCC or approved equivalent.
- .20 Bonding agent and reinforcement protections: Sika Armatec 110 EpoCem or approved equivalent.
- .21 Cementitious repair mortar: Sika MonoTop-622 or approved equivalent.

CAST IN PLACE CONCRETE

- .22 Abrasion Resistant Coating: Sikagard E.W.L. Trowel Grade or approved equivalent.
- .23 Epoxy/Cement, Resurfacing and Pore-Filling Mortar: Sikagard 75 EpoCem.
- .24 Strip and Seal system for sealing difficult to seal or high movement joints: Sikadur Combiflex SG System or approved equivalent (not applicable).
- .25 Crack-Bridging and Anti-Carbonation, Protective and Decorative Coating: Sikagard-550W Elastic.
- .26 Epoxy Modified Cementitious Mortar: Tnemec Motarclad Series 218.
- .27 Modified Polyamine Epoxy: Perma-Glaze Series 435.

2.4 CONCRETE MIXES

- .1 Use ready-mix concrete proportioned in accordance with CSA A23.1, alternative 1 – Performance Method for Specifying Concrete.
- .2 Meet the performance criteria of concrete in hardened state as indicated on the structural drawings.
- .3 Pump mix designs shall not be modified from normal from normal concrete mix designs. Specifically fine aggregate contents shall not be increased or coarse aggregate contents reduced to accommodate pumping.
- .4 Admixtures apart from water reducing agents and air entrainers are not permitted unless approved in writing by Consultant. Calcium chloride shall not be added to concrete.
- .5 Construction joint grout shall be of the same proportions and materials as concrete but without coarse aggregate and with a 150mm slump.

2.5 ANCHORS

- .1 Mechanical expansion anchors shall be Hilti Kwik Bolt TZ. Adhesive anchors in concrete and solid filled masonry shall be Hilti HIT- HY 200 or Hilti HIT-RE 500 as specified. Adhesive anchors in hollow masonry shall be Hilti HIT-HY 270. Use Hilti HAS-E rods. Use stainless steel where noted.

PART 3 EXECUTION**3.1 PREPARATION**

- .1 Obtain Owner's Representative approval before placing concrete. Provide two (2) working days notice prior to placing of concrete.

CAST IN PLACE CONCRETE

- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Owner's Representative approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 Do not place load upon new concrete until authorized by Owner's Representative.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Sleeves and inserts.
 - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Owner's Representative.
 - .2 Where approved by Owner's Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Owner's Representative.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Owner's Representative before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings shown on drawings.

CAST IN PLACE CONCRETE

- .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor rods.
 - .1 Set anchor rods to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Owner's Representative, grout anchor rods in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be manufacturer's recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout.
 - .5 Locate anchor rods used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .5 Finishing
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Non-exposed Concrete Finish:
A "rough form finish" as defined by CSA A23.1/A23.2 for concrete surface not exposed to view in finished structures.
 - .3 Exposed Concrete Finish:
 - .1 A "smooth form finish" as defined by CSA A23.1/A23.2 for concrete surfaces exposed to view in finished structures. This includes all tank walls.
 - .2 Use cone type coil ties with setback plugs, chamfered corners and symmetrical joint arrangement for all exposed walls, beams and columns.
 - .4 Slab surfaces to be hard, smooth trowelled surfaces free from blemishes.
 - .5 As soon as forms are removed, the surfaces shall be thoroughly washed with clean water under pressure. All fins, projections and offsets smoothed off. Tie projections to be removed to a minimum of 25mm below surface.
- .6 Placing
 - .1 Place concrete in accordance with A23.1.
 - .2 Notify consultant for inspection a minimum of 48 hrs prior to all concrete pours. Do not place concrete until approval of consultant.
 - .3 Ensure the method of placement will permit continuous placement until completed.

CAST IN PLACE CONCRETE

- .4 Pump shall have the capacity and ability to pump without requiring concrete mix redesign. Pump shall be capable of transporting concrete at the discharge end with the specified air entrainment and the specified slump, while concrete supplied to the pump shall have a slump no more than 20mm greater than the specified slump.
- .5 Concrete will be rejected if not placed within 90min. since commencement of plant mixing.
- .6 Vibrate all concrete thoroughly. Use internal type vibrators wherever practicable. Keep a spare vibrator on site during all concrete placing operations. Take care not to over-vibrate, which would result in segregation or the formation of excess surface water. Take particular care to ensure the proper deposit of concrete in and around corners, joint inserts and at construction joints.
- .7 Limit free drop of concrete to 1500mm maximum in accordance with requirements of CSA A23.1-14, Clause 7.2.4 – Depositing.
- .8 Unless otherwise approved, concrete shall be placed in a single operation to the full thickness of slabs, beams, etc. and shall be placed in horizontal layers not exceeding 600mm in walls, columns and similar members. In walls the first batches in each lift shall be placed at each end of the segment and then placing shall progress towards the centre. Concrete shall be placed as rapidly as possible to ensure bonding of successive layers. No temporary joints shall be allowed to become “cold” before adjacent concrete is placed. The maximum allowable time between lifts shall be 45 minutes.
- .9 Place walls so that straight runs do not exceed 15m and vertical construction joints are no closer than 2m to a wall corner, wall intersection, a column or beam supported by the wall, or an opening in the wall greater than 600mm in width.
- .10 Allow a minimum of 4 days between placing new concrete against recently placed concrete in walls and slabs.
- .11 Protect previous work from concreting operations.
- .12 Deposit 100mm of wall and column grout evenly along horizontal construction joints in bottom of form through an elephant trunk immediately before placing wall or column concrete.
- .13 Wet cure using concrete curing blankets – Terrafix 240R non-woven geotextile (white). Minimum seven day wet cure for all slabs (ground and second) – three days for other concrete. Overlap adjacent edges 150 mm and tightly seal with sand on wood planks. Weigh sheets down to maintain close contact with concrete during the entire curing period. Maintain continuously wet during the curing period.
- .14 Finish concrete floor to meet requirements of CSA-A23.1/A23.2.
- .15 Concrete floor to have finish hardness equal or greater than Mohs hardness in accordance with CSA-A23.1/A23.2.
- .16 Provide swirl-trowelled finish for exterior walks, ramps, pads.
- .17 Provide float finish for interior floor slabs.

CAST IN PLACE CONCRETE

- .18 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .7 Waterstops (not applicable)
 - .1 Install waterstops to provide continuous water seal. Install waterstops in strict accordance with manufacturer's requirements.
- .8 Construction Joints
 - .1 At all construction joints in water retaining structures, install specified waterstops.
 - .2 For all other structures, install waterstops in construction joints below grade and where shown on drawings.
 - .3 At all construction joints, thoroughly clean and intentionally roughen the surface of set concrete to an amplitude of 5mm. No formed surface shall remain at joint locations. This shall be carried out by chiselling or by sandblasting to expose coarse aggregate.
 - .4 For all horizontal construction joints, clean the surface of all laitance and foreign matter. This shall be done with high pressure water blast (4000 psi) or small chippers. Place a 300mm thick layer of concrete and vibrate thoroughly into waterstop, joint surface and any irregularities of hardened surface before placing subsequent pours of concrete.
- .9 Joint fillers.
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Owner's Representative.
 - .2 When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form, isolation, construction and expansion joints as indicated. Install joint filler.
 - .4 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .10 Inserts
 - .1 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100x100 not indicated on the structural drawings must be approved by the Consultant.
 - .2 No sleeves, ducts, or other openings shall pass through joists, beams, lintels, or columns except where indicated on structural drawings.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain Consultants approval.

CAST IN PLACE CONCRETE

- .4 All openings greater than 100mm diameter must be sleeves cast in concrete walls.
- .5 Indicate all openings on rebar shop drawings illustrating size and location. Coordinate location and size with all disciplines. Report discrepancies to Consultant.
- .11 Curing
 - .1 Cure all concrete in accordance with the requirements of A23.1/A23.2.
 - .2 Protect new concrete from damage due to cold, heat, rain, drying winds or other conditions that can adversely affect the concrete quality.
 - .3 Curing methods and materials shall ensure concrete will be protected from drying out or undergoing wet/dry periods for the duration of the curing period. Concrete shall be wet cured for a period of 10 days, at a minimum temperature of 10oC while being maintained continuously wet.
- .12 Patching
 - .1 Neatly sawcut perpendicular to surface for a minimum depth of 25mm. Remove all defective concrete down to sound concrete to Consultant's satisfaction. Keep required area wet for 24 hours prior to patching. Dampen area +150mm all around just before patching. Remove standing water, area should be saturated surface dry. Follow the specified repair product manufacturers recommendations.
 - .2 Completely fill all cone tie holes with tie hole grout. Follow all manufacturer's directions. Use slurry bond coat of Fastcrete Ultra and additional liquid polymer. Substrate preparation directions and temperature limitations must be followed.
- .13 Exterior Slabs
 - .1 Broom finish all exterior slabs. Seal with 2 coats of acrylic sealer.
- .14 Equipment Bases, Inertia Slabs and Pits
 - .1 Confirm exact location and dimensions of equipment bases, slabs and pits with other trades. Report discrepancies to Consultant.
 - .2 Unless indicated otherwise, bases shall rest on the concrete floor slab. Scarify floor slab to make a good bond or key between the bases and floor slab.
 - .3 Refer to drawings for bases, slab and pit reinforcing.
 - .4 Chamfer exposed edges 20mm.
 - .5 Provide 25mm grout between equipment baseplates and concrete bases. Grout shall consist of non-shrink pre-mixed grout. Clean surface of concrete and wet prior to grouting. Do not remove levelling wedges until grout attains its final set. Fill voids left by removal of wedges with grout and finish exposed surface.

CAST IN PLACE CONCRETE

3.3 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Owner's Representative in accordance with CSA-A23.1/A23.2, and Section 01 45 00 - Quality Control.
- .2 Owner will pay for costs of tests for Testing Laboratory Services. Costs of retesting due to deficient work will be paid for by contractor, by credit change order.
- .3 Contractor is responsible for coordinating all testing and inspection with testing laboratory designated by the owner. Coordinate test types and frequency with the Owner and Owner's representative.
- .4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.1/A23.2.
- .5 Provide Certificate of Field Quality Inspection and Testing to Owner's Representative for inclusion in Commissioning Manual.
- .6 Inspection or testing will not augment or replace Contractor quality control nor relieve the Contractor of his contractual responsibility.

END OF SECTION

STRUCTURAL METAL STUD FRAMING

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A653/A653 M- Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A792/A792M- Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2 Canadian Standards Association (CSA)
 - .1 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .2 CSA W59, Welded Steel Construction (Metal Arc Welding) (Metric Version).
 - .3 CAN/CSA S136, North American Specification for the Design of Cold-Formed Steel Structural Members.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-Ready-Mixed Organic Zinc-Rich Coating.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 50M- Lightweight Steel Framing Binder.
 - .2 CSSBI S5, Guide Specification for Wind Bearing Steel Studs.
 - .3 CSSBI Fact Sheet #3, Care and Maintenance of Prefinished Sheet Steel Building Products.
 - .4 CSSBI Technical Bulletin Vol. 7, No. 2, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.

1.3 SUBMITTALS

- .1 Submit P. Eng Ontario stamped shop drawing of all steel studs. Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
- .2 Indicate locations, dimensions, openings and requirements of related work.

STRUCTURAL METAL STUD FRAMING

- .3 Indicate welds by welding symbols as defined in CSA W59.
- .4 Submit samples of framing components and fasteners to Owner's Representative.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
- .2 Handle and protect galvanized materials from damage to zinc coating.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Steel: to CSA S136, fabricated from ASTM A653/A653M, Grade 230 steel.
- .2 Zinc coated steel sheet: quality to A653M, with Z275 designation zinc coating.
- .3 Aluminum-zinc alloy coated steel sheet: to ASTM A792M, commercial quality, grade 37 with AZ180 coating, regular spangle surface, chemically treated for unpainted finish.
- .4 Welding materials: to CSAW59 and certified by Canadian Welding Bureau.
- .5 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected to minimum requirements of CSSBI, (minimum coating thickness of 0.008 mm of zinc), length to suit application, but not less than 5.0 mm longer than twice the thickness of steel.
- .6 Anchors: concrete expansion anchors or other suitable drilled type fasteners.
- .7 Bolts, nuts, washers: hot dipped galvanized to ASTM A123/A123M, 600 g/m² zinc coating.
- .8 Touch up primer to repair damaged or cut metallic coatings: zinc rich, to CAN/CGSB 1-GP-181.

2.2 STEEL STUD DESIGNATIONS

- .1 Colour code steel studs in accordance with CSSBI Technical Bulletin Vol. 7, No.2.

2.3 METAL FRAMING

- .1 Steel studs: to CSA S136, fabricated from zinc coated steel, depth as indicated. Minimum 20ga. Steel unless noted otherwise.

STRUCTURAL METAL STUD FRAMING

- .2 Stud tracks : fabricated from same material and finish as steel studs, depth to suit.
 - .1 Bottom track: single piece.
 - .2 Top track: single piece track **or** double track **or** slotted single top track. (double track or slotted single top track to accommodate deflection).
- .3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.22 mm minimum thickness.
- .4 Angle clips: fabricated from same material and finish as studs, 38 x 38mm x depth of steel stud, 1.22 mm minimum thickness.
- .5 Tension straps and accessories: as recommended by manufacturer.

2.4 SOURCE QUALITY CONTROL

- .1 Prior to commencement of work, submit:
 - .1 Two certified copies of mill reports covering material properties.

PART 3 EXECUTION**3.1 GENERAL**

- .1 Do welding in accordance with CSA W59.
- .2 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.
- .3 Do work in accordance with CSSBI S5.

3.2 ERECTION

- .1 Erect components to requirements of reviewed shop drawings.
- .2 Anchor tracks securely to structure at 800 mm oc maximum, unless lesser spacing prescribed on shop drawings.
- .3 Erect studs plumb, aligned and securely attached with two screws minimum, or welded in accordance with manufacturer's recommendations.
- .4 Seat studs into bottom tracks and top track. Gap between end of stud and web of track not to exceed 4.0 mm. Secure studs with two (2) screws minimum (in top and bottom tracks), or in accordance with manufacturer's recommendations.
- .5 Allow minimum deflection gap of 16.5 mm for double track **or** slotted single top track.

STRUCTURAL METAL STUD FRAMING

- .6 Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .7 Brace steel studs with horizontal internal bridging at 1200 mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.
- .8 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.
- .9 Touch up welds with coat of zinc rich primer.

3.3 ERECTION TOLERANCES

- .1 Plumb: not to exceed 1/500th of member length.
- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: not more than 3.0 mm from design spacing.
- .4 Gap between end of stud and track web: not more than 4.0 mm.

3.4 CUTOUTS

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

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

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

END OF SECTION

METAL FABRICATIONS

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittals.
- .2 Section 03 30 00 – Cast-in-place Concrete

1.2 REFERENCES

- .1 American Society for Testing and Materials, (ASTM) – Latest Edition
 - .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian Standards Association (CSA International) – Latest Editions
 - .1 CAN/CSA-S157/S157.1, Strength Design in Aluminum.
 - .2 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel.
 - .3 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .4 CSA S16, Design of Steel Structures.
 - .5 CAN/CSA-S16.1, Limit States Design of Steel Structures.
 - .6 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .7 CSA W59, Welded Steel Construction (Metal Arc Welding) (Imperial Version).
- .3 CISC/CPMA 2-75 a quick-drying Primer for Structural Steel unless otherwise specified (refer to plans and Division 9).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittals.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 – Submittals. Indicate VOC's:
 - .1 For finishes, coatings, primers and paints.
- .2 Shop Drawings
 - .1 Submit shop drawings in accordance with Section 01 33 00 – Submittals.

METAL FABRICATIONS

- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, accessories, weld symbols, grating and tread sizes and layouts etc.
- .3 All design shop drawings to be sealed by a professional engineer licensed in the province of Ontario.
- .3 Samples
 - .1 Submit samples in accordance with Section 01 33 00 – Submittals.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, Handling and Unloading: Deliver, store, handle and protect materials in accordance with Section 01 61 00 – Common Product Requirements.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 All fasteners to be stainless steel.
- .2 Welding materials: to CSA W59.
- .3 Bituminous paint to: CAN/CGSB-1.108.
- .4 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.

METAL FABRICATIONS

- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

PART 3 EXECUTION**3.1 ERECTION**

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to the Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16, or weld. Cut exposed bolts flush with nuts and grind to smooth even appearance before touching up with primer.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.
- .10 Isolate between any dissimilar materials (stainless steel, galvanized steel, zinc plated, aluminum etc.) using a rubber gasket (or approved non-conductive material).

END OF SECTION

ROUGH CARPENTRY

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 45 00 – Quality Control
- .2 Section 01 61 00 – Common Product Requirements
- .3 Section 01 74 11 – Cleaning
- .4 Section 07 52 00 – Modified Bituminous Membrane Roofing
- .5 Section 07 62 00 – Sheet Metal Flashing and Trim
- .6 Section 07 62 10 – Eavestroughs and Downspouts.
- .7 Section 07 92 00 – Joint Sealants

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
 - .3 ASTM C578, Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - .4 ASTM C1396/C1396M, Standard Specification for Gypsum Board.
 - .5 ASTM D5055, Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .3 CAN/CGSB-71.26, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .3 Canadian Standards Association (CSA)
 - .1 CSA A123.2, Asphalt Coated Roofing Sheets.
 - .2 CAN/CSA-A247, Insulating Fiberboard.
 - .3 CSA B111, Wire Nails, Spikes and Staples.

ROUGH CARPENTRY

- .4 CSA 0112.9, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .5 CSA O121, Douglas Fir Plywood.
- .6 CAN/CSA-O141, Softwood Lumber.
- .7 CSA O151, Canadian Softwood Plywood.
- .8 CAN/CSA-O325.0, Construction Sheathing.
- .4 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Stock Materials:
 - .1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick DFP or CSP grade plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate

1.4 QUALITY ASSURANCE

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.5 DELIVERY, STORAGE AND HANDLING

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

ROUGH CARPENTRY

PART 2 PRODUCTS

2.1 FRAMING AND LUMBER MATERIALS

- .1 Lumber: unless specified otherwise, softwood, No. 1 or No. 2 grade, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Framing and board lumber: in accordance with NBC.
- .3 Furring, blocking, nailing strips, grounds, rough bucks, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

- .1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .3 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .4 Cement Board Masonry Veneer Wall System (CBMV): to ASTM 1780, ASTM 3273, standard construction.

2.3 ACCESSORIES

- .1 Exterior wall sheathing paper: to CAN/CGSB-51.32 single ply, spunbonded olefin type coated impregnated as indicated.
- .2 Polyethylene film: to Section 07 26 00 – Vapour Retarders.
- .3 Sill Gasket Air seal: closed cell polyurethane or polyethylene.
- .4 Sealants: Section 07 92 00 – Joint Sealants.
- .5 General purpose adhesive: to CSA O112.9.
- .6 Nails, spikes and staples: to CSA B111.
- .7 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .8 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

ROUGH CARPENTRY

- .9 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.
- .10 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, type approved by Owner's Representative.

2.4 FASTENER FINISHES

- .1 Galvanizing: to ASTM A123/A123M, ASTM A653, use galvanized fasteners for exterior work, interior highly humid areas and fire-retardant treated lumber.

2.5 WOOD PRESERVATIVE

- .1 Surface-applied wood preservative: clear or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

PART 3 EXECUTION**3.1 PREPARATION**

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat all material as indicated as follows:
 - .1 Wood fascia, backing, curbs, nailers.
 - .2 Wood furring for sheeting/siding on outside surface of exterior masonry concrete walls.
 - .3 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.2 INSTALLATION

- .1 Comply with requirements of NBC latest edition, supplemented by following paragraphs.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install spanning members with "crown-edge" up.

ROUGH CARPENTRY

- .5 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .6 Install wall sheathing in accordance with manufacturer's printed instructions.
- .7 Install roof sheathing in accordance with requirements of NBC.
- .8 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.
- .9 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.
 - .1 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .10 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .11 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .12 Install sleepers as indicated.
- .13 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.3 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.
- .3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 SCHEDULES

- .1 Roof (N/A) / Parapet sheathing:
 - .1 Plywood, DFP or CSP sheathing grade (SHG) T&G edge, 16 mm thick, unless otherwise indicated.
- .2 Electrical equipment mounting boards:
 - .1 Plywood, DFP or CSP grade, (G1S) select square edge 19 mm thick, unless otherwise indicated.

ROUGH CARPENTRY

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

BLANKET INSULATION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Stone wool insulation blankets and semi-rigid stone wool insulation.
- .2 Related Requirements:
 - .1 Section 07 46 19 – Steel Siding
 - .2 Section 07 61 00 – Sheet Metal Roofing

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM C665-17, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - .2 ASTM C726-17, Standard Specification for Mineral Wool Roof Insulation Board.
 - .3 ASTM C1320-10(2016), Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
 - .4 ASTM E84-19b, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 Canadian Gas Association (CGA).
 - .1 CSA B149.1-15, with 2017 Ontario Amendments, Natural Gas and Propane Installation Code.
 - .2 CAN/CSA-B149.2-15, Propane Storage and Handling Code.
- .3 Underwriters Laboratories of Canada (ULC).
 - .1 CAN/ULC-S604:2016, Standard for Factory-Built Type A Chimneys.
 - .1 CAN/ULC-S702.1:2014-AMD1, Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification First Amendment to Third Edition.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals:
 - .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets.

Part 2 Products

2.1 INSULATION

- .1 Batt and blanket stone wool insulation: to ASTM C665, CAN/ULC-S702.1.
 - .1 Type: 1.
 - .2 Flame Spread: maximum 0, to ASTM E84.
 - .3 Smoke Development: maximum 0, to ASTM E84.
 - .4 Thickness: full depth of stud cavity, except as indicated.
-

BLANKET INSULATION

- .5 Sound and fire rated partitions: Rockwool AFB to thickness indicated.
- .2 Semi-rigid stone wool insulation: to ASTM C726, CAN/ULC-S702.1.
- .1 Roof insulation uncompressed blanket insulation to thickness indicated, compatible with specified roofing / wall system. Acceptable product: Multifix by Rockwool or approved comparable product.

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 INSULATION INSTALLATION

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .3 Do not compress insulation to fit into spaces.
- .4 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 CSA B149.1 and CAN/CSA B149.2 Type B and L vents.
- .5 Do not enclose insulation until it has been inspected and approved by Engineer.
- .6 Refer to wall assembly for locations of Rockwool within stud spacings.

3.3 CLEANING

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

END OF SECTION

STEEL SIDING

- Part 1 General
- 1.1 RELATED SECTIONS
- .1 Section 07 62 00 - Sheet Metal Flashing and Trim.
- 1.2 REFERENCES
- .1 American National Standards Institute (ANSI).
 .1 ANSI/ASME B18.6.4 Self-Tapping Thread Cutting Screws by available Material and Size.
- .2 American Society for Testing and Materials International, (ASTM).
 .1 ASTM A653/A653M - 20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 .2 ASTM D2832-92(2016), Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
- .3 SCAQMD Rule#1168 South Coast Air Quality Management District.
- .4 Underwriters Laboratories (UL).
 .1 UL 2761-2011, Sealants and Caulking Compounds, Edition 1.
- 1.3 SUBMITTALS
- .1 Product Data: Submit manufacturer's printed product literature, specifications and data sheet to Consultant for review and acceptance.
 .1 Submit two copies of WHMIS SDS - Safety Data Sheets. Indicate VOC's for caulking materials during application and curing.
- .2 Shop Drawings:
 .1 Submit shop drawings for review and acceptance.
 .2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, Z bars, insulation, and related work.
 .3 The VOC content of adhesives and sealants used in the interior of the building envelope must be less than the VOC content limits of SCAQMD Rule#1168.
 .1 Contractor to provide cut sheets, Material Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in litres) of each material used should also be provided.
- .3 Samples:
 .1 Submit samples to Consultant for review and acceptance.
 .2 Submit duplicate 300 x 300 mm samples of siding material of colour and profile specified.
- .4 Manufacturer's Instructions:
 .1 Submit manufacturer's installation instructions.
- 1.4 DESIGN CRITERIA
- .1 Design preformed metal panel wall to provide for thermal movement of component materials without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
- .2 Design wall system to accommodate, by means of expansion joints, any movement in
-

STEEL SIDING

wall and between wall and building structure, caused by structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

- .3 Design members to withstand dead load and wind loads as calculated in accordance with NBC 2005 and applicable municipal regulations, to maximum allowable deflection of 1/180 of span.
- .4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".

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 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

Part 2 Products

2.1 STEEL CLADDING AND COMPONENTS

- .1 **Exterior Vertical Cladding** – eShadowall Wall System by Butler or approved equivalent. Complete system eShadowall panel (24 ga.), thermal spacer blocks and fiberglass blanket insulation. Colour to later selection.

Interior Liner – Mod 36 Liner panel (24ga.) by Butler or approved equivalent. Colour to later selection.

All fasteners and trims to be specified and supplied by the cladding supplier. Supplier to provide trim detail around all wall openings, penetrations etc. Trim and fastener colour to match selected cladding colours.

2.2 PREFINISHED COATING

- .1 Prefinished factory applied coating:
 - .1 Weather XL – see 2.1 above for colours.

2.3 FASTENERS

- .1 ISO-Clips, 3 1/4" with three screw arrangement. Horizontal spacing to be 24 inches and vertical spacing to be 60 inches. Manufacturer to confirm final clip spacing based on local wind loads.

2.4 ACCESSORIES

STEEL SIDING

- .1 Insulation: Refer to Section 07 21 13 – Board Insulation.
- .2 Sealant: Polysulphide, one-part, non-sag to UL 2761, MC-2-40-B-4, colour to match siding.
- .3 The VOC content of adhesives and sealants used in the interior of the building envelope must be less than the VOC content limits of SCAQMD Rule#1168.
 - .1 Contractor to provide cut sheets, Material Safety Data Sheets, signed attestations or other official literature from manufacturers clearly identifying product emission rates. Documentation showing amount (in litres) of each material used should also be provided.

2.5 FABRICATION

- .1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window / door trim of same gauge material, colour and gloss as cladding, with fastener holes pre-punched. Supplied by cladding supplier.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install metal siding assembly in accordance with reviewed shop drawing and manufacturer's written instructions.
- .2 Install "Z" bar girts to structural wall supports, using self-tapping screws. Interlock and seal side and end joints.
- .3 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and door opening flashings as indicated.
- .4 Install insulation using adhesive to ensure continuous thermal barrier in conjunction with air/vapour barrier formed by liner sheet.
- .5 Install exterior panels to "Z" bars.
- .6 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .7 Attach components in manner not restricting thermal movement.
- .8 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

3.3 CLEANING

STEEL SIDING

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

END OF SECTION

SHEET METAL ROOFING

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittals.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 06 10 00 - Rough Carpentry.
- .4 Section 06 17 53 – Shop Fabricated Wood Trusses
- .5 Section 01 74 11 – Cleaning
- .6 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

- .1 Aluminum Association (AA).
 - .1 AA DAF-45, Designation System for Aluminum Finishes.
 - .2 AA ASM-35, Specifications for Aluminum Sheet Metal Work in Building Construction, Section 5.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
 - .3 ASTM D822, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-37.5, Cutback Asphalt Plastic Cement.
 - .2 CAN/CGSB-93.1, Sheet Aluminum Alloy, Prefinished, Residential.
- .4 Canadian Standards Association (CSA)
 - .1 CSA A123.3, Asphalt Saturated Organic Roofing Felt.
- .5 National Research Council Canada (NRC)/ Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC).
 - .1 CCMC, Registry of Product Evaluations.

SHEET METAL ROOFING

1.3 SUBMITTALS

- .1 Submit product data sheets for metal roofing, bitumen, roofing, felts, insulation, include:
 - .1 Product characteristics
 - .2 Performance criteria
 - .3 Limitations
- .2 Shop drawings to indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame.
- .3 Submit 300 x 300 mm samples of each sheet metal material.
- .4 Provide manufacturer's instructions to indicate special handling criteria, installation sequence and cleaning procedures.

1.4 WARRANTY

- .1 Provide a written guarantee, signed and issued in the name of the Owner, stating that the metal roofing systems will stay in place and remain watertight for a period of ten (10) years from the date of Substantial Completion of the work. The warranty will be a ten (10) years covering the total costs of repairing any defective materials and workmanship and associated damages.

1.5 DESIGN REQUIREMENTS

- .1 Design, fabricate and install metal roof system to the following requirements:
 - .1 Resist a minimum positive and negative wind pressure of 2 kPa.
 - .2 Maximum deflection 1/240 of clean span under live loads of wind, snow and ice.
 - .3 Calculate snow and ice loads for building area in accordance with National Building Code of Canada.
 - .4 Resist water penetration
 - .5 Allow for thermal movement
 - .6 Resist corrosion
 - .7 Resist loads imposed by the snow retention system.

PART 2 **PRODUCTS**

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: to ASTM A635 (G90), commercial quality, with Z275 coating, regular spangle surface, thickness as noted.

SHEET METAL ROOFING

2.2 PREFINISHED STEEL SHEET

- .1 VOC content for surface coatings and touch up coatings for prefinished metal sheet maximum 250g/L
- .2 Roof System: TLS 12 roof system with MR 24 roof profile, 24 gauge. Include painted steel liner as manufactured by Bulter or approved alternate. Colours to later selection. Include vapour retarder and 12" uncompressed blanket insulation to achieve R-40. Approved alternate must meet all requirements of Part 2 Products.
- .3 Accessories: Flashings, copings, closures and all other required trim: same material and colour as roof profile. Brake or bend to shape.
- .4 Assembly: 0.45mm prefinished white liner panel, support brackets, 75mm Z-purlins, semi-rigid insulation, and standing seam roof panels. Liner panel sidelaps and end laps to be sealed with flexible silicone sealant to prevent vapour transmission. Provide foam closures at liner panel ends to seal panel corrugations.
- .5 Insulation: refer to Section 07 21 16 – Blanket Insulation
- .6 Vapour Retarder: 0.15mm thickness, UV-stabilized, white polypropylene, laminated to 30-pound Kraft paper / metalized polyester and reinforced with glass fiber and polyester scrim, perm rating of 0.02. Seal all joints with sealant or tape capable of withstanding temperature of -20oC.
- .7 Snow Retention (Snow/Ice Guards): Heavy duty non-penetrating galvanized clamps compatible with the roofing system and standing seam profile, located at all doors indicated on plan, extend a minimum 900mm beyond door jambs each side. Acceptable product: S5 Snow Retention System by Sky Products Canada. The system shall not void the roof warranty. Manufacturer responsible to verify the guards and attachment method is capable of withstanding the vector snow/ice loading at the eave.
- .8 Surface coatings and touch up coatings manufactured or formulated without aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium and their compounds will be acceptable for use on this project.
- .9 Prefinished steel with factory applied polyvinylidene fluoride.
 - .1 Finish coating: silicone modified polyester (SMP) topcoat system.
 - .2 colour selected by Owner's Representative from manufacturer's standard range.
 - .3 Specular gloss: 30 units +/-5 to ASTM D523.
 - .4 Coating thickness: not less than 22 micrometres.

SHEET METAL ROOFING

- .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .1 Outdoor exposure period 2500 hours.
 - .2 Humidity resistance exposure period 5000 hours.
- .6 Profile as indicated on drawings

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5.
- .3 Underlay: dry sheathing to CAN/CGSB-51.32.
- .4 Slip sheet: reinforced sisal paper or a heavy felt kraft paper.
- .5 Sealant: as per Section 07 92 00 – Joint Sealants.
- .6 Rubber-asphalt sealing compound: to CAN/CGSB-37.29.
- .7 Cleats: of same material, and temper as sheet metal, minimum 50mm wide. Thickness same as sheet metal being secured.
- .8 Fasteners: concealed.
- .9 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .10 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.4 FABRICATION

- .1 Fabricate aluminium sheet metal in accordance with AA ASM-35.
- .2 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.
- .3 Hem exposed edges on underside 12 mm, mitre and seal.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.
- .6 Protect metals against oxidization by backpainting with isolation coating where indicated.

SHEET METAL ROOFING

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install roofing assembly in accordance with manufacturer's written instructions and reviewed shop drawings.
- .2 Use concealed fastenings except where approved by Owner's Representative before installation.
- .3 Provide underlay under sheet metal roofing. Secure in place and lap joints 100 mm minimum.
- .4 Apply slip sheet over asphalt felt underlay to prevent bonding between sheet metal and felt. Secure with minimum anchorage and lap joints 50 mm minimum in direction of waterflow.
- .5 Install sheet metal roof panels using cleats spaced at 610mm oc.
- .6 Secure cleats with two fasteners each and cover with cleat tabs.
- .7 Align transverse seams in adjacent panels.
- .8 Flash roof penetrations with material matching roof panels, and make watertight.
- .9 Form seams in direction of water-flow and make watertight.

END OF SECTION

SHEET METAL FLASHING AND TRIM

Part 1 General

1.1 REFERENCES

- .1 The Aluminum Association Inc. (AA).
 - .1 Aluminum Sheet Metal Work in Building Construction.
 - .2 AA DAF45, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials (ASTM International).
 - .1 ASTM A653/A653M-20, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-21a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .3 ASTM B32-20, Standard Specification for Solder Metal.
 - .4 ASTM B209/B209M-21, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .5 ASTM D1187/D1187M-97(2018), Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
- .3 Canadian Roofing Contractors Association (CRCA).
 - .1 CRCA Roofing Specifications Manual, latest edition.
- .4 Canadian Standards Association (CSA Group).
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .5 Sheet Metal and Air Conditioning Contractors' National Association Inc. (SMACNA).
 - .1 SMACNA Architectural Sheet Metal Manual – Seventh Edition.

1.2 SAMPLES

- .1 Submit shop drawings to Consultant for review and acceptance.
- .2 Submit duplicate 50 x 50 mm samples of each type of sheet metal material, colour, and finish.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 METAL MATERIALS

- .1 Zinc coated steel sheet: 0.76 mm thickness, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.
-

SHEET METAL FLASHING AND TRIM

- .2 Prefinished sheet steel: metallic coated by the hot-dip process and 2-Coat fluoropolymer to AAMA 621.
 - .1 Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - .2 Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - .3 Colours: Match adjacent steel siding colours. Refer to Section 07 46 19.
 - .3 Sheet aluminum: ASTM B209, Aluminum Association alloy AA1100, minimum 1.22 mm thickness except otherwise indicated and required by design requirements.
 - .1 Finishes:
 - .1 Clear anodic for exterior exposed aluminum surfaces: AAMA AA A41 anodized to AAMA 611 and AA DAF-45, AA-M12C22A41, Class I, minimum 18 microns thickness.
- 2.2 ACCESSORIES
- .1 Isolation coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
 - .2 Sealing compound: rubber asphalt type.
 - .3 Underlay for metal flashing: dry sheathing.
 - .4 Sealants: as specified in Section 07 92 00 - Joint Sealants.
 - .5 Cleats: Of same material, thickness, and temper as sheet metal flashing being secured, minimum 75 mm high.
 - .6 Fasteners: Of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for application.
 - .7 Washers: Of same material as sheet metal, 1 mm thick with rubber packings.
 - .8 Solder: Grade A to ASTM B32, approved brand of soldering flux for type of metal.
 - .9 Touch-up paint: as recommended by prefinished material manufacturer.
- 2.3 FABRICATION
- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details, SMACNA's "Architectural Sheet Metal Manual," and as indicated.
 - .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AA-Aluminum Sheet Metal Work in Building Construction
 - .3 Form pieces in 2 400 mm maximum lengths.
 - .1 Make allowance for expansion at joints.
 - .2 Underflash at joints.
 - .4 Hem exposed edges on underside 12 mm.
 - .1 Mitre and seal corners with sealant.
-

SHEET METAL FLASHING AND TRIM

- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Seams:
 - .1 Galvanized and Prefinished Steel: Fabricate non-moving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
 - .2 Aluminum: Fabricate non-moving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- .7 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

- .1 Form exposed flashings, drip edges, copings and fascias to profiles indicated from materials indicated:
 - .1 Prefinished steel sheet: minimum 0.61 mm thick, base metal thickness
 - .2 Sheet aluminum: minimum 1.22 mm metal thickness.
- .2 Form concealed flashings to profiles indicated of minimum 0.61 mm thick galvanized sheet steel.

2.5 PANS

- .1 Form pans to receive sealing compound from 0.61 mm thick galvanized steel sheet metal with minimum 200 mm upstand above roof drains and continuous flanges with no open corners.
 - .1 Solder joints.
 - .2 Make pans minimum 50 mm wider than member passing through roof membrane.

Part 3 Execution

3.1 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA FL series details, SMACNA's "Architectural Sheet Metal Manual," and as indicated.
 - .2 Use concealed fastenings except where approved before installation.
 - .3 Provide underlay under metal flashings.
 - .1 Secure in place and lap joints 100 mm.
 - .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
 - .1 Flash joints using S-lock forming tight fit over hook strips.
 - .5 Lock end joints and caulk with sealant.
 - .6 Metal protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
-

SHEET METAL FLASHING AND TRIM

- .1 Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
- .2 Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install course of underlayment and cover with slip sheet.
 - .1 Secure in place and lap joints 100 mm.
- .7 Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 - .1 Space movement joints at a maximum of 3 m with no joints allowed within of corner or intersection.
 - .2 Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 25 mm deep, filled with sealant concealed within joints.
- .8 Soldered Joints:
 - .1 Do not solder metallic-coated steel and aluminum sheet.
 - .2 Do not use torches for soldering.
 - .3 Clean surfaces to be soldered, removing oils and foreign matter.
 - .4 Pre-tin edges of sheets to be soldered to width of 38 mm, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - .5 Heat surfaces to receive solder and flow solder into joint.
 - .6 Fill joint completely.
 - .7 Completely remove flux and spatter from exposed surfaces.
- .9 Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.
 - .1 Interlock exterior and interior leg with continuous cleat anchored to substrate at 75 mm centers.
- .10 Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum 100 mm over base flashing.
 - .1 Install stainless-steel draw band and tighten.
- .11 Install pans, where shown around items projecting through roof membrane.
 - .1 Fill pans with sealing compound.

3.2 **CLEANING AND PROTECTION**

- .1 Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 - .2 Clean and neutralize flux materials.
 - .3 Clean off excess solder.
 - .4 Clean off excess sealants.
 - .5 Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
 - .6 On completion of installation, remove unused materials and clean finished surfaces.
-

SHEET METAL FLASHING AND TRIM

- .7

Maintain in a clean condition during construction.
- .8

Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.3 FLASHING SCHEDULE

Material	Location	Specification Section
Prefinished steel	All locations unless concealed	07 62 00
Galvanized steel	Roof penetrations, concealed flashings, and where indicated.	07 62 00

END OF SECTION

FIRE STOPPING

Part 1 General

1.1 RELATED SECTION

.1 Section 07 92 00 – Joint Sealants.

.2 Division 23 – Heating, Ventilating and Air Conditioning.

.3 Division 26 – Electrical.

1.2 REFERENCE STANDARDS

.1 American Society of Testing and Materials (ASTM International).

ASTM E2174-19, Standard Practice for On-site Inspection of Installed Firestops.

.1 ASTM E2393-10a (2015), Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.2 ASTM G21-15(2021)e1, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.3 ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus"

.2 Green Globes Canada.

.1 Green Globes for New Construction. Technical Manual 2015.

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

.1 Safety Data Sheets (SDS).

.4 National Research Council Canada (NRC).

.1 National Building Code of Canada 2015 (NBCC).

.2 NRCC-49677. June 2007. Best Practice Guide on Firestops and Fire Blocks and their Impact on Sound Transmission.

.5 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC-S101-14-EN, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC-S102:2018, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 CAN/ULC-S115:2018, Standard Method of Fire Tests of Firestop Systems.

.1 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN/ULC-S115:2018 under their designation of ULC-S115:2018 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.

.5 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

FIRE STOPPING

1.3 DEFINITIONS

- .1 Firestop Material: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between fire rated wall and floor assemblies.
- .2 Single Component Firestop System: Firestop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create firestop system.
- .3 Multiple Component Firestop System: Exact group of firestop materials that are identified within Listed Systems Design to create on site firestop system.
- .4 Membrane Penetration: Any penetration of a fire rated barrier that breaches one side but does not pass completely through to the other side, including recessed electrical devices.
- .5 System: The combination of specific materials and devices, including the penetrating items required to complete the Firestop, as tested by an independent third-party test facility.
- .6 Barrier / Assembly: A wall, floor, ceiling or roof assembly or other partition with a fire-smoke rating of 0,1, 2, 3 or up to 4 hours.
- .7 Fire Resistive Joint: Any joint or opening, whether static or dynamic, within or between adjacent sections of fire rated interior or exterior walls, floors, ceilings or roof decks.
- .8 Fireblocking: Building materials installed to resist the free passage of flame, smoke and noxious gases to other areas of the building through concealed spaces.
- .9 Intumescent: Materials that expand with that to seal around objects threatened by fire.
- .10 F-rating: The time a firestop, penetrating item, building, material, firestop material, can withstand direct flame without a burn through as tested to CAN/ULC-S115.
- .11 T-Rating: The amount of time a through-penetration firestop limits the temperature rise on the cold side-outside the test furnace as tested to CAN/ULC-S115.
- .12 Tightly Fitted; (ref: NBC Division B Part 3.1.9.1(1) and 9.10.9.6(1)): penetrating items that are cast in place in buildings of non-combustible construction or have 0 annular space in buildings of combustible construction.
 - .1 Words tightly fitted should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 SUBMITTALS

- .1 Provide submittals for review and acceptance.
 - .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit only the most current literature that has been updated by the manufacturer on a regular basis. Submit only literature that includes a date less than 24 months old.
 - .3 Submit manufacturer's printed product data sheets. Submit complete product data sheet for each individual component. Provide a comprehensive list and indicate the following properties for each component:
 - .1 Product name and product number.
 - .2 Product characteristics and performance criteria.
-

FIRE STOPPING

- .3 Physical size, finish and limitations.
 - .4 Technical data on out-gassing, off-gassing and age testing.
 - .5 Curing time.
 - .6 Chemical compatibility to other construction materials.
 - .7 Shelf life. Include expiry date.
 - .8 Life expectancy.
 - .9 Temperature range for installation.
 - .10 Humidity range for installation.
- .4 Submit copies of WHMIS SDS - Safety Data Sheets.
- .5 Submit Product Data in accordance with Green Globes Material Declaration form as contained in the GG Technical Manual.
- .3 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineering judgment to include both project name and Contractor's name who will install firestop system as described in drawing.
- .4 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
 - .3 Submit design system listings.
 - .1 Indicate proposed material, including technical data, reinforcement, anchorage, fastenings and method of installation. Construction details to accurately reflect actual job conditions.
 - .2 Provide CAN/ULC-S115 design system listings on each system for each application for each area as indicated.
 - .3 When more than one product is specified for the firestop design listing system or more than one backing/damming material is indicated, identify the item that will be used on this project.
- .5 Samples:
 - .1 Submit duplicate samples showing actual firestop material proposed for project in un-opened containers.
 - .2 Include all anchors / fasteners and damming material. Select samples from the same batches and production runs of products that will be used on-site. Identify each product indicating the shelf life and expiry date.
- .6 Quality assurance submittals:
 - .1 Test reports: In accordance with CAN/ULC-S101 for fire endurance and CAN/ ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied firestopping with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are non-toxic to building occupants.

FIRE STOPPING

- .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 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.5 RECORD DOCUMENTATION

- .1 Submit as-built records.
- .2 Maintain a daily log of all activities on site during construction. Provide a copy of all daily logs at completion of firestopping work.
- .3 Provide a copy of as-built drawings, project manual, schedules and firestop details.
- .4 Mark up the drawings, schedules and details weekly, showing all alterations, changes and confirmation of each design listing in relationship to the project schedules.
- .5 Provide completed firestopping schedules for floors, walls and ceilings.
- .6 Indicate all service penetrations or joints through each reference wall, floor and ceiling in the schedules. Record all information. Indicate all required descriptions for each column based on the actual on-site condition. Submit schedules to PMT at the end of the project for maintenance use.

1.6 OPERATION AND MAINTENANCE MATERIALS

- .1 Submit Operation and Maintenance products and records and incorporate the following materials:
 - .1 Safety Data Sheets (SDS).
 - .2 Product literature of each product used on this project.
 - .3 Approved design listings and Engineer Judgments.
 - .4 Matrix schedule indicating all design listings and Engineer Judgments and matching them to the penetration or joint type. Included in this schedule to be a quantity of each design listing / EJ on each floor.

1.7 ENGINEERING JUDGMENTS (EJ)

- .1 Where there are no specific tested design system listings available from the manufacturer for a firestop configuration, review systems from all other manufacturers to attempt to obtain a design system listing.
 - .2 Include in each EJ, a drawing of the proposed system, a description of the system, project name and room name including the room number that the EJ is located in. Include copies of all referenced design listings and signed and dated by the manufacturer's fire protection engineer. Once the EJ has been reviewed, submit the EJ to the Authority Having Jurisdiction for final approval.
 - .3 EJ to be issued only by firestop manufacturer's qualified technical personnel or in concert with the manufacturer, by a knowledgeable registered Professional Engineer, or fire protection engineer, or an independent testing agency that provides listing services for firestop systems.
 - .4 EJ to be based upon interpolations of previously tested firestop systems that are either sufficiently similar in nature or clearly bracket the conditions upon which the Engineering Judgment is to be given. Additional knowledge and technical interpretations based upon accepted engineering principles, fire science and fire testing guidelines (e.g. ASTM E2032) may also be used as further support data.
-

FIRE STOPPING

- .5 EJ to be based upon full knowledge of the elements of the construction to be protected and understanding of the probable behaviour of that construction and the recommended firestop system protecting it were they to be subjected to the appropriate firestop standard fire test method for the required fire rating duration.
- .6 EJ to be limited to the specific conditions and configurations upon which the Engineering Judgment was rendered and should be based upon reasonable performance expectations for the recommended firestop system under those conditions.
- .7 EJ to be accepted only for a single specific job and location and should not be transferred to any other job or location without thorough and appropriate review of all aspects of the next job or location's circumstances.

1.8 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacture's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
 - .2 Installer: Company specializing in firestopping installations approved by manufacturer with not less than 5 years documented experience.
 - .3 Procurement Responsibility: The procurement of through-penetration firestop systems and fire-resistive joint systems on this project to be from a single sole source firestop specialty manufacturer.
 - .4 The work is to be installed by a Contractor with at least one of the following qualifications:
 - .1 FM 4991 approved Contractor.
 - .2 ULC approved Contractor.
 - .3 Hilti accredited firestop specialty Contractor.
- .2 Pre-Installation Meetings: Convene pre-installation meeting one week before beginning work of this Section, with Owner, Consultant, and 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.
- .3 Site Meetings: As part of Manufacturer s Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Twice during progress of Work at 25 percent and 60 percent complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling, and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer s written instructions.
 - .2 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
-

FIRE STOPPING

- .2 Storage and Protection:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for recycling.

1.10 PROJECT CONDITIONS

- .1 Do not use materials that contain flammable solvents.
- .2 Scheduling:
 - .1 Schedule installation of firestopping materials after completion of penetrating item installation but before covering or concealing of openings.
 - .2 Schedule installation of preformed joint materials to be installed with the metal framing.
- .3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- .5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
 - .2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
 - .3 Provide a round fire-rated cable management device whenever cables penetrate fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device to consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve to be 305 mm. The fire-rated cable management device to contain integrated intumescent firestop wrap strip materials enough to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device to contain a smoke seal fabric membrane or intumescent firestop plugs enough to achieve the L-Rating requirements of the barrier type. Install device per the manufacturer's published installation instructions.
-

FIRE STOPPING

- .4 Penetrations in Fire Resistance Rated Walls: Provide firestopping with ratings determined in accordance with CAN/ULC-S115 as indicated below:

Fire Resistance Rating of Separation	Required ULC or cUL "F" Rating of Firestopping Assembly
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours

- .5 For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .6 Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with CAN/ULC-S115. For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .1 W-Rating: Class 1 rating in accordance with water leakage test per CAN/ULC-S115.
- .7 Provide a firestop system with an assembly rating as determined by CAN/ULC-S115 which is equal to the time rating of construction joint assembly.
- .8 Penetrations in smoke barriers: Provide firestopping with ratings determined in accordance with CAN/ULC-S115.
- .1 L-Rating: Not exceeding 5.0 cfm / square feet of penetration opening at both ambient and elevated temperatures.
- .9 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:
- .1 Basis of Design: Hilti (Canada) Corporation, Mississauga, Ontario.

2.3 MATERIALS

- .1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Accessories: Provide components for each firestopping and smoke seal systems that are needed to install fill materials. Use only components specified by firestopping material manufacturer and approved by the qualified testing agency. Accessories include, but are not limited to, the following items:
-

FIRE STOPPING

- .1 Permanent forming, damming, and backing material.
 - .2 Temporary forming material.
 - .3 Acceptable Hilti pre-formed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and cable bundles penetrating gypsum walls:
 - .1 Tub Box Kit (CP 681) for use with tub installations.
 - .2 Hilti Cast-In Place Firestop Device (CP 680-PX) for use with XFR pipe
 - .3 Hilti Cast-In Place Firestop Device (CP 680-M) for use with non-combustible penetrants.
 - .4 Speed Sleeve (CP 653) for use with cable penetrations.
 - .5 Firestop Drop-In Device (CFS-DID) for use with non-combustible and combustible penetrants.
 - .6 Hilti Cast-in Firestop sleeve (CFS-CID MD P) and (CFS-CID MD M) for use with combustible and non-combustible pipes through metal deck.
 - .7 Firestop Block (CFS-BL).
 - .4 Acceptable Hilti sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit, electrical metallic tubing (EMT), and sheet metal ducts:
 - .1 Intumescent Firestop Sealant (FS-ONE MAX).
 - .2 Fire Foam (CP 620)/CP 660.
 - .3 Flexible Firestop Sealant (CP 606).
 - .4 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .5 Acceptable Hilti sealants, sprays, or pre-formed materials for use with fire-rated construction joints and other gaps:
 - .1 Top Track Seal (CFS-TTS).
 - .2 Top Track Seal for Metal deck (CFS-TTS MD).
 - .3 Firestop Joint Spray (CFS-SP WB).
 - .4 Firestop Silicone Joint Spray (CFS-SP SIL).
 - .5 Flexible Firestop Sealant (CP 606).
 - .6 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .7 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .8 Bottom of Wall sealant (CP 605).
 - .6 Acceptable Hilti pre-formed mineral wool designed to fit flutes of metal profile deck; as a backer for spray material:
 - .1 Speed Plugs (CP 777).
 - .2 Speed Strips (CP 767).
 - .7 Acceptable Hilti non-curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles:
 - .1 Firestop Putty Stick (CP 618).
 - .2 Firestop Plug (CFS-PL).
 - .8 Acceptable Hilti Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa. pressure differentials, the following products are acceptable:
 - .1 Hilti Firestop Collar (CP 643N).
 - .2 Hilti Wrap Strips (CP 648E/648S).
 - .9 Acceptable Hilti wall opening protective materials for use with cUL / ULC listed metallic and specified non-metallic outlet boxes:
-

FIRE STOPPING

- .1 Firestop Putty Pad (CP 617).
 - .2 Firestop Box Insert.
 - .10 Acceptable Hilti sealants or caulking materials used for openings between structurally separate sections of wall and floors:
 - .1 Firestop Joint Spray (CFS-SP WB).
 - .2 Flexible Firestop Sealant (CP 606).
 - .3 Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .4 Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
 - .11 Acceptable Hilti product for single or cable bundles up to 25 mm diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies: CFS-D Firestop Cable Disk.
 - .12 Acceptable Hilti used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL).
 - .2 Hilti Composite Sheet (CFS-COS).
 - .3 Hilti Firestop Mortar (CP 637).
 - .4 Hilti Fire Foam (CP 620)/660.
 - .5 Hilti Firestop Board (CP 675T).
 - .13 Acceptable Hilti Pre-formed materials or Sealants for use as part of a perimeter fire barrier system between fire-resistance-rated floors and exterior wall assemblies, the following products are acceptable:
 - .1 Hilti Preformed Firestop System (CFS-EOS QuickSeal).
 - .2 Hilti Firestop Joint Spray (CFS-SP WB).
 - .3 Hilti Firestop Silicone Joint Spray (CFS-SP SIL).
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
 - .14 Acceptable Hilti product for joints and penetrations in non-rated fire separations:
 - .1 CP 506 Smoke and Acoustic sealant.
 - .2 CP 572 Smoke and Acoustic Spray.
 - .15 Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
 - .1 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .2 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .3 Hilti Flexible Firestop Sealant (CP 606)
 - .4 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - .16 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - .2 Hilti Fire Foam (CP 620)/660
 - .3 Hilti Flexible Firestop Sealant (CP 606)
 - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG)
 - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL)
 - .17 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL)
 - .2 Hilti Composite Sheet (CFS-COS)
-

FIRE STOPPING

- .3 Hilti Firestop Mortar (CP 637)
- .4 Hilti Fire Foam (CP 620)/660
- .5 Hilti Firestop Board (CP 675T)

- .18 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL)
 - .2 Hilti Firestop Board (CP 675T)

- .19 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are acceptable:
 - .1 Hilti Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
 - .2 Hilti Firestop Cable Collar (CFS-CC)
 - .3 Hilti Firestop Sleeve (CFS-SL SK)
 - .4 Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
 - .5 Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
 - .6 Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.

Part 3 Execution

3.1 MANUFACTURERS INSTRUCTIONS

- .1 Compliance: Comply with manufacturer s written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions and approved design system listings for each condition.
- .2 Verify that all joints, service penetrating elements and supporting devices / hangers have been properly installed as indicated on approved design listings. All temporary lines and markings have been removed to meet the approved design system listings for each condition has been identified.
- .3 Verify that the proposed firestopping system is composed of components that are compatible with each other, the substrates forming the openings, and the items, if any, penetrating the firestopping under conditions of application and service, as demonstrated by firestopping manufacturer based on testing and field experience.
- .4 Ensure no additional items have been installed through opening that does not appear on the approved design listing.
- .5 Ensure areas that are to be firestopped are accessible for proper installation and inspection.
- .6 Report in writing to the Consultant any defective surfaces or conditions affecting the firestop system installation, immediately and before commencing any installations.
- .7 Proceed only when defected surfaces or conditions have been corrected. Beginning of installation means acceptance of site conditions.

3.3 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
-

FIRE STOPPING

- .1 Ensure that substrates and surfaces are clean, dry and frost free.
 - .2 Prepare surfaces in contact with firestopping materials and smoke seals to manufacturer's instructions.
 - .3 Maintain insulation around pipes and ducts penetrating fire separation.
 - .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
 - .5 Do not proceed until unsatisfactory conditions have been corrected.
 - .6 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
- 3.4 COORDINATION
- .1 Coordinate construction of openings, penetrations and construction joints to ensure that the firestop systems are installed according to specified requirements.
 - .2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
 - .3 Coordinate firestopping with other trades so that obstructions are not placed in the way before the installation of the firestop systems.
 - .4 Do not cover up through-penetration firestop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.
- 3.5 INSTALLATION
- .1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory.
 - .2 Install firestopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
 - .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.
- 3.6 SEQUENCES OF OPERATION
- .1 Proceed with installation only when submittals have been reviewed by Consultant.
 - .2 Install floor firestopping before interior partition erections.
 - .3 Deck bonding: firestopping to precede spray applied fireproofing to ensure required bonding.
 - .4 Mechanical pipe insulation: certified firestop system component.
 - .1 Ensure pipe insulation installation precedes firestopping.
-

FIRE STOPPING

3.7 REPAIRS AND MODIFICATIONS

- .1 Identify damaged or re-entered seals requiring repair or modification.
- .2 Remove loose or damaged materials. Where penetrating items are to be added, remove enough material to insert new elements. Cause no damage to the balance of the seal.
- .3 Ensure that surfaces to be sealed are clean and dry. Install materials in accordance with specified installation requirements herein. Use only materials approved by manufacturer as suitable for repair of original seal. Do not mix different manufacturer's products.
- .4 Repair all damage resulting from firestop destructive testing.

3.8 FIELD QUALITY CONTROL

- .1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .2 Keep areas of work accessible until inspection by applicable Code authorities.
- .3 Inspection of through-penetration firestopping to be performed in accordance with ASTM E2174 and ASTM E2393.
- .4 Perform under this Section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- .5 Manufacturer's Field Services: The manufacturer's representative to be present during the first installation of every first firestop system. The manufacturer's technical representative to provide periodic walk-through. After every site visit the manufacturer's technical representative to submit site reports to indicate application reviewed, location and installer. Contractor to submit site reports by manufacturer to consultant within one week of each visit.

3.9 CLEANING

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.
- .2 Remove temporary dams after initial set of firestopping and smoke seal materials.

3.10 SCHEDULE

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and insulated metal panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separations.
 - .9 Rigid ducts: greater than 129 cm².

3.11 SCHEDULE OF COMMON FIRESTOPPING SYSTEMS

- .1 The following recognized and tested through penetrations firestopping systems are approved to be used on this project at various rated assemblies.
-

FIRE STOPPING

CONCRETE FLOORS – 1 HOUR FRR (F-RATING)		
ITEM	PENETRANT	SYSTEM / DESIGN NUMBER
1	SINGLE METAL PIPES OR CONDUIT	C-AJ-1226, F-A-1028, F-A-1017
2	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	F-A-2240, F-A-2025, CA-J-2078 , C-AJ-2035, CA-J-2022
3	SINGLE/CABLE BUNDLES	F-A-3007,C-AJ-3095,C-AJ-3180, C-AJ-3283
4	CABLE TRAY	C-AJ-4034, C-AJ-4071
5	SINGLE INSULATED PIPES	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5048
6	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-	C-AJ-7046, C-AJ-7051, C-AJ-7084
7	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	C-A-J-7145
8	MIXED PENETRANTS	C-AJ 8099, C-AJ-8056, C-AJ-8143

FIRE STOPPING

BLOCK MASONRY WALLS – 1 HOUR FRR (F-RATING)		
ITEM	PENETRANT	SYSTEM / DESIGN NUMBER
1	SINGLE METAL PIPES OR CONDUIT	C-AJ-1226, W-J-1067, W-J-1020
2	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	C-AJ-2109C-AJ-2078, W-J-2332, C-AJ-2024, C-AJ-2035, C-AJ-2022
3	SINGLE/CABLE BUNDLES	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167
4	CABLE TRAY	W-J-4027, C-AJ-4034, C-AJ-4071
5	SINGLE INSULATED PIPES	C-AJ-5090, C-AJ-5091, C-AJ 5061, W-J-5042
6	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022
7	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	W-J-7029, W-J-7124
8	MIXED PENETRANTS	C-AJ 8099, C-AJ 8056, W-J 8007, C-AJ 8143
GYPSUM BOARD WALLS – 1 HOUR FRR (F-RATING)		
ITEM	PENETRANT	SYSTEM / DESIGN NUMBER
1	METAL PIPES OR CONDUIT	W-L-1054, W-L-1058, W-L-1164, W-L-1506, W-L-1465
2	NON-METALLIC PIPE OR CONDUIT	W-L2028, W-L-2061, W-L-2020
3	SINGLE OR BUNDLED CABLES	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
4	CABLE TRAY	W-L-4011, W-L-4060, W-L-4081
5	INSULATED PIPES	W-L-5028, W-L-5029, W-L-5047
6	MECHANICAL DUCTWORK WITHOUT DAMPERS NON-INSULATED	W-L-7040, W-L-7042, W-L-7155

FIRE STOPPING

7	MECHANICAL DUCTWORK WITHOUT DAMPERS INSULATED	W-L-7059, W-L-7153, W-L-7156, W-L-7151
8	MIXED PENETRANTS	W-L-1095, W-L-8013

- .2 The following recognized and tested joint firestopping systems are approved to be used on this project at various rated assemblies.

JOINT FIRESTOPPING SYSTEMS – 1 HR FRR (F-RATING) NOT EXCEEDING 50 MM		
ITEM	LOCATION	SYSTEM / DESIGN NUMBER
1	CONCRETE (FLOOR TO FLOOR)	FF-D-1012, FF-D-1013
2	CONCRETE (EDGE OF FLOOR SLAB TO WALL)	FW-D-1011, FW-D-1012, FW-D-1013
3	CONCRETE OR BLOCK WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	Contact Manufacturer for details.
4	CONCRETE OR BLOCK WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	HW-D-0098
5	GYPSUM WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119
6	GYPSUM WALL TO CONCRETE FLOOR (BOTTOM-OF-WALL)	BW-S-0001, BW-S-0002
7	GYPSUM WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	HW-D-0045, HW-D-0154, HW-D-0292, HW-D-0295

FIRE STOPPING

JOINT FIRESTOPPING SYSTEMS – 1 HOUR FRR (F-RATING) GREATER THAN 50 MM BUT NOT EXCEEDING 152 MM.		
ITEM	LOCATION	SYSTEM / DESIGN NUMBER
1	CONCRETE (FLOOR TO FLOOR)	FF-D-1012, FF-D-1013
2	CONCRETE (EDGE OF FLOOR SLAB TO WALL)	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
3	CONCRETE OR BLOCK WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	Contact Manufacturer for details.
4	CONCRETE OR BLOCK WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	Contact Manufacturer for details.
5	GYPSUM WALL TO FLAT CONCRETE FLOOR (TOP-OF-WALL)	HW-D-1011, HW-D-1012, HW-1020
6	GYPSUM WALL TO CONCRETE FLOOR (BOTTOM-OF-WALL)	Contact Manufacturer for details.
7	GYPSUM WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	HWD-1011, HWD-1012, HW-1020

END OF SECTION

JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittals.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 74 11 – Cleaning.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C321, Standard Test Method for Bond Strength of Chemical-Resistant Mortars.
 - .2 ASTM C834, Standard Specification for Latex Sealants.
 - .3 ASTM C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
 - .4 ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications.
 - .5 ASTM C920, Standard Specification for Elastomeric Joint Sealants.
 - .6 ASTM C1330, Standard Specification for Cylindrical Sealant Backing for use with Cold Liquid Applied Sealants.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.21, Sealing and Bedding Compound Acoustical.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act (TDGA).

1.4 SUBMITTALS

- .1 Manufacturer's product to describe.

JOINT SEALANTS

- .1 Caulking compound.
- .2 Primers.
- .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .4 Installation instructions, surface preparation and product limitations.
- .2 Submit duplicate samples of each type of material and colour.
- .3 Cured samples of exposed sealants for each color where required to match adjacent material.
- .4 Manufacturers' instructions to include installation instructions for each product used.

1.5 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: company engaged in the manufacturing of products specified in this section with a minimum of ten (10) years documented experience.
- .2 Applicator Qualifications: Experienced installer equipped and trained for application of joint sealant required for this project with record of successful completion of projects of similar scope.
 - .1 Applicator to be approved by sealant manufacturer.
 - .2 Applicator to submit documentation of a minimum three (3) successfully completed projects of similar size, scope and complexity.

1.6 MOCK-UP

- .1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant. Mock-up may be part of finished work.
- .3 Allow two (2) working days for inspection of mock-up by Owner's Representative before proceeding with sealant work.
- .4 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .5 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.

1.7 FIELD ADHESION/COHESION TESTS

- .1 Test Frequency:

JOINT SEALANTS

- .1 Perform a field test each type of sealant and substrate combination, for all interior and exterior sealants associated with the building envelope.
- .2 Perform three (3) additional tests for each failed test.
- .2 Locate test joints as directed by Owner's Representative. Tests to be performed in the presence of the Owner's Representative and/or manufacturer's representative.
- .3 Notify Owner's Representative seven (7) days prior to dates tests are to be performed.
- .4 Test joint sealants by hand-pull methods #1 and # 2. Record test results in Field Adhesion/Cohesion Test Form.
 - .1 Test Method #1:
 - .1 Make a knife cut horizontally from one side of the joint to the other.
 - .2 Make two (2) vertical cuts (from the horizontal cut) approximately 75 mm long on each side of the joint.
 - .3 Pry out flap created from cuts.
 - .4 Firmly grasp flap and slowly pull at 90° from sealant plane.
 - .5 Pull flap until adhesive or cohesive failure occurs.
 - .1 Adhesive failure will be evidenced by the sealant pulling off clean from the substrate.
 - .2 Cohesion failure will be evidenced by the sealant ripping or failing within itself, leaving well-adhered sealant to the substrate.

(Cohesive failure is considered a positive result).
 - .2 Test Method # 2:
 - .1 Follow steps one (1) through four (4) of Test Method # 1.
 - .2 Mark a benchmark on the sealant 25 mm (1") from the plane of the installed sealant.
 - .3 Firmly grasp the flap and pull slowly, while holding a ruler parallel to the sealant flap. Note the position of the benchmark on the ruler.
 - .4 Refer to manufacturer's printed literature for each sealant tested for the required extension factor pass criteria; (i.e.: if the 25 mm (1") benchmark on the sealant can be pulled to 100 mm (4") and held with no failure of sealant, 400% elongation is achieved.)
 - .5 **If no failure occurs prior to the manufacturer's stated extension factor, the test is successful.** Extension factor should be three (3) times the movement capability of the sealant.
- .5 Inspect joints for:
 - .1 Complete fill,
 - .2 Absence of voids,
 - .3 Primer,

JOINT SEALANTS

- .4 Proper width/depth ratio, and
- .5 Back up material.
- .6 Repair sealants pulled in test area by applying new sealants following same procedures used to original seal joints.
- .7 Contractor shall repair test areas at no additional cost to the Owner.

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 and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.
- .3 Condition products to approximately 16 to 20 degrees C for use in accordance with manufacturer's recommendations.
- .4 Handle all products with appropriate precautions and care as stated on the Material Safety Data Sheet.

1.9 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°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.

PART 2 PRODUCTS**2.1 SEALANT MATERIALS**

- .1 Sealants and Caulking compounds must:

JOINT SEALANTS

- .1 Meet or exceed all applicable governmental and industrial safety and performance standards; and
- .2 Be manufactured and transported in such a manner that all steps for the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the Fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .2 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulphate.
- .3 Sealant and caulking compounds must not contain a total of volatile organic compound (VOC's) in excess of 100 grams per litre as calculated from records of the amounts of constituents used to make the product.
- .4 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.
- .5 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .6 When low toxicity caulks are not possible, confine usage to areas which off-gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.
- .7 Where sealants are qualified with primers use only these primers.
- .8 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Single component, low odor, moisture cure, medium modulus, low VOC sealant for use in sealing air/vapour barrier penetrations, to ASTM C920, Type S, Grade NS, Class 35.
 - .1 ASTM C719: $\pm 35\%$.
 - .2 Ultimate Elongation: 450 - 550%.
 - .3 Modulus, 100%: 275 - 345 kPa.
 - .4 Shore A Hardness: 25 ± 5 .
 - .5 Tensile Strength: 1034 – 1378 kPa.
 - .6 Maximum VOC: 5 g/L.

JOINT SEALANTS

- .2 Single component, medium modulus, high-performance, neutral-cure silicone sealant for general purpose exterior use, to ASTM C920, Type S, Grade NS, Class 35, Use NT, M, A and O.
 - .1 ASTM C719: $\pm 25\%$.
 - .2 Ultimate Elongation: 550%.
 - .3 Modulus, 50% extension: 380 kPa.
 - .4 Shore A Hardness: 25 ± 5 .
 - .5 Tensile Strength: 1240 kPa.
 - .6 Maximum VOC: 35 g/L.
 - .7 Colour to be selected from manufacturer's standard range.
- .3 Single component, low modulus, neutral-cure silicone sealant for general purpose masonry use, to ASTM C920, Type S, Grade NS, Class 50, Use T, NT, M, G, A and O.
 - .1 ASTM C719: $\pm 50\%$.
 - .2 Ultimate Elongation: 1600%.
 - .3 Modulus, 50% extension: 193 kPa.
 - .4 Shore A Hardness: 15.
 - .5 Tensile Strength: 690 kPa.
 - .6 Maximum VOC: 22 g/L.
 - .7 Colour to be selected from manufacturer's standard range.
- .4 Two-component, high modulus, neutral-cure flexible silicone rubber sealant for use with aluminum window and curtain wall fabrication, assembly and glazing installation, to ASTM C1184 and ASTM C920, Type M, Grade NS, Class 12 ½, Use NT.
 - .1 ASTM C719: $\pm 25\%$.
 - .2 Ultimate Elongation: 120%.
 - .3 Shore A Hardness: 30 - 40.
 - .4 Tensile Strength: 2000 kPa.
 - .5 Maximum VOC: < 18 g/L.
- .5 Single component, medium modulus, neutral-cure silicone sealant for general roofing applications, to ASTM C920, Type S, Grade NS, Class 50, Use NT, G, A and O.
 - .1 ASTM C719: $\pm 50\%$.
 - .2 Shore A Hardness: 35.
 - .3 Tensile Strength: 415 kPa.
 - .4 Maximum VOC: 28 g/L.
 - .5 Colour to be selected from manufacturer's standard range.

JOINT SEALANTS

- .6 Single component, chemical cure, silicone rubber sealant, for use with plumbing fixtures, showers, sinks, tubs, and junction of counter tops and adjacent wall finishes, to ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - .1 Shore A Hardness: 25.
 - .2 Tensile Strength: 2100 kPa.
 - .3 Maximum VOC: 36 g/L.
 - .4 Colour to be selected from manufacturer's standard range.
- .7 Single component, high-performance, elastomeric polyurethane sealant, paintable, for general purpose interior use, to ASTM C920, Type S, Grade NS, Class 35, Use NT, M, A, T, O and I.
 - .1 ASTM C719: 35%.
 - .2 Ultimate Elongation: 800%.
 - .3 Shore A Hardness: 25 - 30.
 - .4 Tensile Strength: 2400 kPa.
 - .5 Maximum VOC: 35 g/L.
 - .6 Colour to be selected from manufacturer's standard range.
- .8 Single component, non-skinning, non-hardening, synthetic rubber sealant for use in acoustical applications, to CAN/CGSB 19.21.
 - .1 Shrinkage: maximum 20%.
 - .2 Maximum VOC: 53 g/L.
 - .3 Sag: Maximum 4.0 mm.
- .9 Two-component, non-sag, tamper resistant, elastomeric polyurethane sealant, for use in interior joints, penetrations, doors, windows, perimeters of fixtures, where a flexible security sealant is required due to idle tampering or vandalism, to ASTM C920, type M, Grade NS, Class 12.5, Use T₁, M and O.
 - .1 Ultimate Elongation: 175 - 200%.
 - .2 Shore A Hardness: 40 - 45.
 - .3 Tensile Strength: 2000 to 2400 kPa.
 - .4 Maximum VOC: Activator - < 25 g/L, Base - < 100 g/L.
 - .5 Colour to be selected from manufacturer's standard range.

2.3 ACCESSORIES

- .1 Primer: Type as recommended by sealant manufacturer. Primer to be compatible with joint forming materials.
- .2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer and compatible with joint forming materials.
- .3 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

JOINT SEALANTS

- .1 Extruded closed cell foam backer rod.
- .2 Size: oversize 30 to 50 %.
- .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
- .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
- .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

PART 3 EXECUTION**3.1 PROTECTION**

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

3.2 SURFACE PREPARATION

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

3.3 PRIMING

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

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.

JOINT SEALANTS

- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

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

3.7 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.

END OF SECTION

METAL DOORS AND FRAMES

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittals.
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 61 00 – Common Product Requirements
- .4 Section 01 74 11 – Cleaning
- .5 Section 07 92 00 - Joint Sealants.
- .6 Section 08 71 00 - Door Hardware.
- .7 Section 09 91 13 - Exterior Painting.
- .8 Section 09 91 23 - Interior Painting.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A653/A653M, Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA)
 - .1 G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association, (CSDMA).
 - .1 CSDMA, Specifications for Commercial Steel Doors and Frames.
 - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)

METAL DOORS AND FRAMES

- .1 CAN4-S104M, Fire Tests of Door Assemblies.
- .2 CAN4-S105M, Fire Door Frames Meeting the Performance Required by CAN4-S104.
- .3 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .4 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings.
- .5 CAN/ULC-S704, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 DESIGN REQUIREMENTS

- .1 Design door assembly to withstand minimum 1,000,000 swing cycles in accordance with ANSI A151.1, with no failure of any design features of the door.
- .2 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .3 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
- .4 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 and NFPA 252 for ratings specified or indicated.
- .5 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 and NFPA 252 and listed by nationally recognized agency having factory inspection services and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.4 SUBMITTALS

- .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.
- .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing firerating and finishes.
- .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .4 Submit one 300 x 300 mm top corner sample of each type door.
- .5 Submit one 300 x 300 mm corner sample of each type of frame.
- .1 Show butt cutout, glazing stops.

METAL DOORS AND FRAMES

1.5 DELIVERY STORAGE AND HANDLING

- .1 Deliver, store, handle and protect doors and frames in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, handle and store doors and frames at the job site in such a manner as to prevent damage.
- .3 Store doors and frames under cover with doors stored in a vertical position on blocking, clear of floor and with blocking between doors to permit air circulation.

1.6 QUALITY ASSURANCE

- .1 Conform to requirements to ANSI A117.1
- .2 Company specializing in manufacturing products specified with a minimum of five (5) years documented experience.

1.7 WARRANTY

- .1 Provide a written warranty for work of this section from manufacturer for failure due to defective materials and from contractor for failure due to defective installation workmanship, for one (1) year respectively from the date of Substantial Completion.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: to ASTM A653/A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653/A653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 Stiffened: face sheets welded insulated core.
 - .1 Expanded polystyrene: CAN/ULC-S701, density 16 to 32 kg/m³.
 - .2 Polyurethane: to CAN/ULC-S704 rigid, modified polyisocyanurate, closed cell board. Density 32 kg/m³.
- .2 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250°C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

METAL DOORS AND FRAMES

- .3 Thermal Insulation material must:
 - .1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.
 - .2 Be manufactured using a process that uses chemical compounds with the minimum zone depletion potential (ODP) available.

2.3 ADHESIVES

- .1 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

2.5 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior top and bottom caps steel.
- .3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Door bottom seal: Section 08 71 00 – Door Hardware.
- .5 Metallic paste filler: to manufacturer's standard.
- .6 Fire labels: metal riveted.
- .7 Sealant: Section 07 92 00 – Joint Sealants.
- .8 Provide low expanding, single component polyurethane foam sealant installed at head and jamb perimeter of door frame for sealing to building air barrier, vapour retarder and door frame. Foam sealant width to be adequate to provide required air tightness and vapour diffusion control to building air barrier and vapour retarder foam interior. Refer to Section 07 21 20 – Low Expanding Foam Sealant.
- .9 Glazing: Section 08 80 50 – Glazing.
- .10 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable stainless steel glazing beads for dry glazing of snap-on type.
 - .2 Design exterior glazing stops to be tamperproof.

METAL DOORS AND FRAMES

- .11 Finish Painting: to Section 09 91 13 – Exterior Painting and Section 09 91 23 – Interior Painting.

2.6 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.2 mm welded, thermally broken type construction.
- .4 Interior frames: 1.2 mm welded type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, template hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .6 Protect mortised cutouts with steel guard boxes.
- .7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .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 Insulate exterior frame components with polyurethane insulation.

2.7 FRAME ANCHORAGE

- .1 Shim and anchor new doors in accordance with CAN/CSA A440.4.
- .2 Provide appropriate anchorage to floor and wall construction.
- .3 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .4 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .5 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.

2.8 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.

METAL DOORS AND FRAMES

- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .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 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.9 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: insulated, hollow steel construction. Interior doors: honeycomb hollow steel construction.
- .3 Fabricate doors with longitudinal edges locked seam. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E330.
- .5 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104 ASTM E152 NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

METAL DOORS AND FRAMES

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

2.10 HOLLOW STEEL CONSTRUCTION

- .1 Form each face sheet for exterior doors from 1.2 mm sheet steel.
- .2 Form each face sheet for interior doors from 1.2 sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with insulation as specified.
- .5 Fill voids between stiffeners of interior doors with honeycomb core.

2.11 THERMALLY BROKEN DOORS AND FRAMES

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinyl chloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

PART 3 EXECUTION**3.1 INSTALLATION GENERAL**

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

METAL DOORS AND FRAMES

- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and vapour retarder.

3.3 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latch side and head: 1.5 mm.
 - .3 Finished floor: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

3.4 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.
- .3 Refer to Division 09 for painting. Prime and paint interior and exterior of doors (match colour of siding (exterior) and masonry (interior)).

3.5 GLAZING

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

3.6 COMMISSIONING

- .1 Contractor to instruct maintenance personnel in operation and maintenance of doors and hardware.
- .2 Confirm operation and function for all doors and hardware.
- .3 Commissioning will be witnessed by Owner's Representative and Certificate will be signed by Contractor and Owner's Representative.

END OF SECTION

SECTIONAL METAL OVERHEAD DOORS

- Part 1 General
- 1.1 RELATED WORK SPECIFIED ELSEWHERE
- .1 Section 05 50 00 - Metal Fabrications.
- 1.2 REFERENCES
- .1 Canadian Standards Association (CSA Group).
- .1 CSA G164-2018, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .2 American Society for Testing and Materials (ASTM International).
- .1 ASTM A653/A653M-18, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM A1008/A1008M-18, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- 1.3 DESIGN CRITERIA
- .1 Design door assembly to withstand minimum 50,000 cycles per annum.
- 1.4 SHOP DRAWINGS
- .1 Submit shop drawings to Consultant for review and acceptance.
- .2 Indicate materials, operating mechanisms, required clearances.
- 1.5 WARRANTY AND MAINTENANCE DATA
- .1 In addition to General Conditions Warranty of contract (1 yr.), provide manufacturers limited door and operator systems warranty for 10 years against cracking, splitting, or deterioration of steel skin due to rust. Provide maintenance and operation data for overhead door hardware for incorporation into maintenance manual.
- Part 2 Products
- 2.1 MATERIALS
- .1 Galvanized sheet steel: commercial quality to ASTM A653/A653M with Z275 zinc coating.
- .2 Primer: compatible for galvanized steel surfaces.
- .3 Insulation: 35 mm thick polyurethane core.
- .4 Cable: multi-strand galvanized steel aircraft cable.
-

SECTIONAL METAL OVERHEAD DOORS

2.2 DOOR

.1 Type 1: Fabricate minimum 35 mm thick flush panel doors of 0.31 mm roll formed sheet steel sections. Sheet shall be zinc-coated with a minimum of G90 galvanizing and steel surface to be smooth. Door assembly to provide minimum R15 thermal resistance, size as indicated on the Drawings (site verify existing door sizes). Provide steel door ends with hot-dipped galvanized steel, full height with end caps (minimum 16 ga.). Provide doors with shop applied baked enamel finish, colour to later selection. Model Wayne Dalton TS 150 Sectional Steel door by Cornwall Door Systems or approved alternate.

.2 Glazing: None

2.3 OPERATORS (2 LOCATIONS - D10 and D011)

.1 Equip door operation by: Genie GCL-H Standard Duty Commercial Hoist Operator c/w built-in chain host for manual operation in the event of power failure or approved alternate.

.2 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval with CSA enclosure type CEMA 1. Provide transformer and control wiring as required for complete installation.

.3 Power supply: Site verify existing. Provide electric motor ½ HP.

.4 Controller units with integral motor reversing starter, 3 heater elements for overload protection, including 3 pushbuttons and control relays as applicable.

.5 Operation: surface mounted, with “OPEN-STOP-CLOSE” designations on pushbuttons.

.6 Safety switches: combination roll rubber with limit switches for full length of bottom rail of bottom section of door, to reverse door to open position when coming in contact with object on closing cycle.

.7 Door speed: Minimum 152 mm per second.

.8 Mounting brackets: galvanized steel, size, and gauge to suit conditions.

.9 Provide manual chain fall and lock with D012.

2.3 HARDWARE

.1 Track: Provide 76mm tracks as recommended by manufacturer to suit loading required and clearances available – Standard lift hardware, galvanized steel track with torsion spring lifting and all required ancillary hardware items.

.2 Rollers: full floating hardened steel, ball bearing, size to suit track.

.3 Roller brackets: adjustable, min. 2.48 mm galvanized steel.

.4 Accessories:

.1 5mm thick formed sheet 1 524 mm high track guards.

.2 Pusher springs.

.3 Flat bar door latch with night latch operated from inside.

.4 Glazing-Sealed double-glazed windows, size as shown on drawings, to manufacturer's standard detail.

.5 Double contact bulb type extruded neoprene weatherstrip for door sill section, full

SECTIONAL METAL OVERHEAD DOORS

- width.
- .6 Extruded aluminum and arctic grade vinyl weatherstrip for jambs and head, to manufacturers standard.
- .5 Finish ferrous hardware items with minimum zinc coating of G90 to CSA G164.
- .6 Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
- .7 Spring Counterbalance: Sized to weight of the door, with helically wound, oil tempered torsion spring mounted on a steel shaft; aircraft cable sized with a minimum 5 to 1 safety factor design for 50,000 cycles.

Part 3 Execution

3.1 INSTALLATION

- .1 Install door and hardware.
- .2 Touch-up with primer where galvanized finish damaged during fabrications with finish paint where enamel finish is scratched.
- .3 Lubricate springs and adjust door operating components to ensure smooth opening and closing of door.
- .4 Support door components from building structural members only.
- .5 Test for proper operation and adjust as necessary to provide proper operation without binding or distortion. Adjust hardware and operating assemblies for smooth noiseless operation.

END OF SECTION

DOOR HARDWARE

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittals.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 08 11 00 - Metal Doors & Frames.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2, Bored and Preassembled Locks and Latches.
 - .3 ANSI/BHMA A156.4, Door Controls - Closers.
 - .4 ANSI/BHMA A156.5, Cylinders and Input Devices for Locks.
 - .5 ANSI/BHMA A156.12, Interconnected Locks and Latches.
 - .6 ANSI/BHMA A156.13, Mortise Locks and Latches Series 1000.
 - .7 ANSI/BHMA A156.18, Materials and Finishes.
 - .8 ANSI/BHMA A156.21, Thresholds.
 - .9 ANSI/BHMA A156.22, Door Gasketing and Edge Seal Systems.
 - .10 ANSI/BHMA A156.26, Continuous Hinges.
 - .11 ANSI/BHMA A156.28, Keying Systems.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA)
 - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
 - .2 CSDFMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
- .2 Samples:

DOOR HARDWARE

- .1 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
- .2 After approval samples will be returned for incorporation in the Work.
- .3 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Closeout Submittals
 - .1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Supply two sets of wrenches for door closers.

1.5 WARRANTY

- .1 Provide a written manufacturer's warranty for work of this Section for failure due to defective materials for ten (10) years, dated from substantial completion certificate.
- .2 Provide a written Contractor's warranty for work of this Section for failure due to defective installation workmanship for one (1) year, dated from submittal completion certificate.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
 - .2 Only products certified in accordance with ANSI/BHMA standards are acceptable. Items that are equal in design, function and quality will be accepted upon approval of the Owner's Representative.
 - .3 Only recognized contract hardware distributors will be considered for the work of this section. The distributor shall have on staff a qualified Architectural Hardware

DOOR HARDWARE

Consultant recognized by the Door and Hardware Institute or a person with equivalent qualifications to assist installers and direct detailing, processing and delivery of material, and certify installation acceptance.

- .4 Upon completion of finish hardware installation, hardware supplier shall inspect work and shall certify in writing that all items and their installation are in accordance with requirements of Contract Documents and are functioning properly.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Store finishing hardware in locked, clean and dry area.
- .3 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

1.8 MAINTENANCE SERVICE

- .1 Provide maintenance service for one year during warranty period to maintain all barrier free entrance automatic operators as follows:
- .1 Qualified service personal approved by manufacturer of operators.
- .2 Site inspection every three months will all necessary adjustment made during this visit. Separate warranty service calls, if required, will only qualify as an inspection if time of call is close to the three month intervals.
- .3 Make detailed reports of each visit and copy to Owner and Engineer.
- .4 Cost of this service will be included as part of this Section and is not covered by any allowance amount.

PART 2 PRODUCTS**2.1 MANUFACTURERS**

- .1 The following manufacturers are accepted subject to compliance with requirements of the Contract Documents. Acceptance of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Accepted Alternative:</u>
Hinges	Stanley	Hager, Ives, McKinney
Continuous Hinges	Hager (Roton)	Select, McKinney
Manual Flush Bolts	Gallery	Hager, Ives
Automatic Flush Bolts	Ives	Hager, Rockwood
Locksets & Cylinders	Schlage	None
Exit Devices	Von Duprin	None
Closers	LCN 1460 / 4040	None

DOOR HARDWARE

Protection Plates	Gallery	SMH, CBH
Overhead Stops	Glynn Johnson	None
Door Stops	Gallery	Ives, CBH
Coordinator	Ives	None
Key Cabinet	Telkee	or approved alternate
Threshold & Gasketing	KN Crowder	Pemko

2.2 DOOR HARDWARE**.1 Locks and latches:**

- .1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2, 4000 bored lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
- .2 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, designed for function and keyed as stated in Hardware Schedule.
- .3 Lever handles : design as indicated in hardware groups.
- .4 Roses: round.
- .5 Normal strikes: box type, lip projection not beyond jamb.
- .6 Cylinders: key into keying system as directed.
- .7 All corresponding cylinders to be removable.
- .8 Finished as indicated in Hardware Groups.

.2 Butts and hinges:

- .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .2 Interior hinges of steel, unless otherwise indicated.
- .3 Continuous hinges shall be heavy duty as indicated, full height, complete with installation aids and fasteners to suit door and frame conditions. Hinge to have access to electrical items without removing hinge.
- .4 Quantity, size and width of hinges in accordance with manufacturer's recommendations and ASNI/BHMA 156.1.

.3 Exit Devices shall:

- .1 Tested and approved by BHMA for ANSI 156.3, Grade 1
- .2 Provide a deadlocking latchbolt.
- .3 Non-fire rated exit devices shall have cylinder dogging.
- .4 Touchpad shall be "T" style
- .5 Exposed components shall be of architectural metals and finishes.
- .6 Lever design shall match lockset lever design
- .7 Provide strikes as required by application.
- .8 Fire exit devices to be listed for UL10C
- .9 UL listed for Accident Hazard

DOOR HARDWARE

- .10 Approved Products:
 - .1 Von Duprin 35/98; See hardware schedule
- .4 Door Closers and Accessories:
 - .1 Door controls (closers): to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4. Table A1.
 - .2 Closers of narrow, slim line design complete with backcheck, rack and pinion hydraulic action.
 - .3 Closers equipped with full cover, as noted in Hardware Groups, complete with secure and concealed mounting screws
 - .4 Adapter plates for added reinforcing shall be added to any opening if required to suit field conditions or door design.
 - .5 Closers shall include all necessary arm brackets, cushion arm supports and blade stop spacers to suit door swing, frame reveals or stop conditions.
 - .6 Closers capable of field adjustments of at least fifteen (15) percent.
 - .7 Finish as indicated in Hardware Groups.
- .5 Auxiliary locks and associated products: to ANSI/BHMA A156.5, designated by letter E and numeral identifiers listed in Hardware Schedule.
 - .1 Key into keying system as noted.
- .6 Architectural door trim: to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule.
 - .1 Door protection plates: 1.27 mm thick stainless steel, finished to BMHA 630.
 - .2 Push plates: 1.27 mm thick stainless steel finished to BMHA 630.
 - .3 Push/Pull units: type stainless steel finished to BMHA 630.
 - .4 Fastened with through bolts or concealed bolts depending on application.
 - .5 Where pull has back plate, fasteners will be countersunk and bevelled with no sharp edges.
 - .6 Where bolts cannot be concealed under the push plate they shall have a grommet washer finished to match other hardware.
- .7 Auxiliary hardware: to ANSI/BHMA A156.16, designated by letter L and numeral identifiers listed in Hardware Schedule.
 - .1 Combination stop and holder, floor mounted: finished to BMHA 626.
 - .2 Surface bolt lever extension flush bolt: finish to BMHA 626.
- .8 Door bottom seal: heavy duty, door seal of extruded aluminum frame and hollow closed cell neoprene weather seal, surface mounted with drip cap closed ends, clear anodized finish.
- .9 Thresholds:

DOOR HARDWARE

- .1 To ANSI/BHMA A156.21 extruded aluminum mill finish, serrated surface, with lip and vinyl door seal insert, thermally broken.
- .2 Thresholds of aluminum material. Provide 50 mm longer than opening to allow fitting on site.
- .3 When mullion is used, increase length of threshold to fit around mullion.
- .4 Fasteners of countersink type suitable to properly install to floor/sill conditions. Supply complete with screw anchors.
- .10 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.
- .11 Astragal: overlapping, extruded aluminum frame with vinyl insert, finished to match doors.

2.3 KEY CABINET (N/A)

- .1 Provide one wall mounted steel key cabinet with capacity for 1.5 times the number of keys with an indexed key control system to ANSI/BHMA A156.5.

2.4 FASTENINGS

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

2.5 KEYING

- .1 Doors, padlocks and cabinet locks to be master keyed as directed. Prepare detailed keying schedule in conjunction with Owner's Representative and owner.
- .2 Provide keys in triplicate for every lock in this Contract.
- .3 Provide 4 master keys for each MK or GMK group. Allow for six (4) levels of sub master keying.
- .4 Stamp keying code numbers on keys and cylinders.

DOOR HARDWARE

- .5 Provide construction cores.
- .6 Provide all permanent cores and keys to Owner's Representative.
- .7 Supply fifty (10) blanks for each sub master group used.

2.6 FINISHES

- .1 Following finishes are indicated in hardware groups.

BHMA	CAN MATERIAL	FINISH
626	C26D Brass/Bronze	Satin Chrome
628	C28 Aluminum	Satin Alum, Anodized
630	C32D Stainless Steel	Satin Stainless Steel
652	C26D Steel	Plated Satin Chrome
689	Al All	Painted Aluminum
	Alum Aluminum	Mill Finish
	TMDFF (to match door and frame finish).	

2.7 ABBREVIATIONS

ALD	Aluminum Door and Frame
ATMS STMS	Arm/strike To Template with Machine Screws
ASB	Arm Complete with Sex Bolts
BC	Back Check
C to C, C/L	Centerline to Centerline
Cyl	Cylinder (of a lock)
CMK	Construction Master Key
Deg.	Degree (of opening)
DEL	Delayed Action
FBB or BB	Ball bearing hinge

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.
- .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.

DOOR HARDWARE

3.2 INSTALLATION

- .1 Install door hardware in accordance with manufacturer's instructions, using special tools and jigs. Fit accurately and apply securely. Ensure that hardware is installed correctly.
- .2 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .3 No operating hardware shall be installed at a height of more than 1200 above the finished floor (NBC 3.4.6.16).
- .4 Installation to be done by a qualified tradesman. Technical assistance provide by door hardware supplier where required.
- .5 Closers shall be installed according to manufacturer's templates and installation instructions. Unless required otherwise, installation shall be on pull side of door. Outswing doors shall be on push side using top jamb or parallel arm installation.
- .6 Where closer or arm is installed on door, sex bolts will be used, finished to match other hardware.
- .7 Install key control cabinet.
- .8 Use only manufacturer's supplied fasteners. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .9 Remove construction cores and locks when directed by Owner's Representative; install permanent cores and check operation of locks.
- .10 Wiring Diagrams:
 - .1 Provide any special information, voltage requirements and wiring diagrams to other trades requiring such information.

3.3 EXAMINATION

- .1 Visit site prior to start of installation of hardware.
- .2 Visit will include examination of openings, site conditions and materials for conditions that prevent proper application of finish hardware.
- .3 Report to General Contractor, in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Commencement of installation will imply acceptance pf prepared work by others.

3.4 FIELD QUALITY CONTROL

- .1 Hardware contractor to have a qualified AHC representative from the manufacturer/supplier on site at Substantial Completion Inspection and at

DOOR HARDWARE

commissioning of the finished hardware. Cost of the visits to be included in contract.

- .2 Provide an inspection report 6 (six) months after Substantial Completion, completed by a qualified Architectural Hardware Consultant, to note any deficiencies. The inspection should include checking each lock against the key schedule to make sure the correct locks and cylinders are on the proper doors.
- .3 Fire Rated Door Assemblies On-Site Inspection:
 - .1 Upon completion of the installation, inspect each fire rated door assembly to confirm proper operation of its closing device, confirming it meets the criteria of NFPA 80.
 - .2 Provide a written report to the Owner's Representative listing each fire rated door assembly for the project including:
 - .1 Each door number,
 - .2 An itemized list of hardware set components for each door opening, and
 - .3 Each door location in the facility.

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.
- .4 Where hardware is found defective, repair or replace or correct as desired by inspection reports.

3.6 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 PROTECTION

- .1 All hardware shall be protected against damage from paint, plaster or other defacing materials. Whenever possible manufacturers protective covering when

DOOR HARDWARE

applied, shall not be removed until final project cleaning takes place. Material not protected by manufacture shall be covered or removed from door during painting or any other adjustments that can cause damage to hardware.

3.8 HARDWARE GROUPS

- .1 Provide hardware as specified in the previous articles in sets according to the following groups: *(insert hardware groups)*.

3.9 DEMONSTRATION

- .1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
 - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
 - .3 Lock key cabinet and turn over key to Owner's Representative.
- .2 Designated Staff Briefing:
 - .1 Brief designated 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.

3.10 COMMISSIONING

- .1 Site inspection or visit at Substantial Completion and training follow up and inspection at commissioning as directed by Owner's Representative.
- .2 Provide 10 month warranty service.

END OF SECTION

EXTERIOR PAINTING

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittals.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 78 00 – Closeout Submittals.
- .5 Section 08 11 00 – Metal Doors and Frames.

1.2 REFERENCES

- .1 Environmental Protection Agency (EPA)
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
- .2 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual
- .3 Society for Protective Coatings (SSPC).
 - .1 SSPC Painting Manual, Systems and Specifications Manual.
- .4 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeyperson shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyperson in accordance with trade regulations.
- .3 Conform to latest MPI requirements for exterior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Products" listing and shall be from a single manufacturer for each system used.

EXTERIOR PAINTING

- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Owner's Representative.
- .7 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
 - .2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

- .1 Provide paint products meeting MPI "Environmentally Friendly" E2 or E3 ratings based on VOC (EPA Method 24) content levels.

1.5 SCHEDULING OF WORK

- .1 Submit work schedule for various stages of painting to Owner's Representative for approval. Submit schedule minimum of two (2) working days in advance of proposed operations.
- .2 Obtain written authorization from Owner's Representative for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.6 SUBMITTALS

- .1 Submit product data and manufacturer's installation/application instructions for paints and coating products to be used.
- .2 Submit WHMIS - MSDS - Material Safety Data Sheets.
- .3 Upon completion, submit records of products used, records to be included in Operation and Maintenance Manuals. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 Manufacturer's Material Safety Data Sheets (MSDS).
 - .5 MPI Environmentally Friendly classification system rating.

EXTERIOR PAINTING

- .4 Submit manufacturer's application instructions for each product specified.
- .5 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating, with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
 - .2 13 mm birch plywood for finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
- .6 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
- .7 Submit full range of available colours where colour availability is restricted.

1.7 QUALITY CONTROL

- .1 Provide mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 When requested by the Owner's Representative or Paint Inspection Agency, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 EXTRA MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Submit 1 - 4 litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.
- .3 Deliver to Owner's Representative and store where directed.

1.9 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in original containers, sealed, with labels intact.
- .3 Labels shall clearly indicate:

EXTERIOR PAINTING

- .1 Manufacturer's name and address.
- .2 Type of paint or coating.
- .3 Compliance with applicable standard.
- .4 Colour number in accordance with established colour schedule.
- .4 Remove damaged, opened and rejected materials from site.
- .5 Provide and maintain dry, temperature controlled, secure storage.
- .6 Observe manufacturer's recommendations for storage and handling.
- .7 Store materials and supplies away from heat generating devices.
- .8 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.
- .9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
- .11 Remove paint materials from storage only in quantities required for same day use.
- .12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .13 Fire Safety Requirements:
 - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.
- .14 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

1.10 SITE REQUIREMENTS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.

EXTERIOR PAINTING

- .2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
- .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
- .4 Provide temporary ventilating and heating equipment where permanent facilities are not available.
- .5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by Owner's Representative and, applied product manufacturer, perform no painting work when:
 - .1 ambient air and substrate temperatures are below 10°C.
 - .2 substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 the relative humidity is above 85% or when dew point is less than 3°C variance between air/surface temperature.
 - .5 rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .2 Perform no painting work when maximum moisture content of substrate exceeds:
 - .1 12% for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
 - .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
 - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
 - .4 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.
 - .5 Do not apply paint when:

EXTERIOR PAINTING

- .1 Temperature is expected to drop below 10°C before paint has thoroughly cured.
- .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
- .3 Surface to be painted is wet, damp or frosted.
- .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
- .7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
- .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.
- .9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of the Owner's Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.11 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 29 Health and Safety requirements and Section 0 35 43 Environmental Protection.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Unused paint, coating materials must be disposed of at official hazardous material collections site as approved by Owner's Representative.
- .6 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal.
- .7 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .9 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

EXTERIOR PAINTING

- .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
- .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
- .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
- .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
- .10 Empty paint cans are to be dry prior to disposal or recycling (where available).

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Existing Exterior Steel:
Primer: Macropoxy 646, fast cure epoxy, min of 8 (wet) mils, by Sherwin Williams.
Top Coat: Acrolon 218 HS, acrylic polyurethane, min of 6 (wet) mils, by Sherwin Williams.
Before prime and paint, prepare all exposed steel as per paint manufacturer's written instructions. Prepare structural steel by creating a profile of a minimum of 2 mils and no more than 3 mils before primer is applied. Steel to be free of rust scale and contaminations.
- .2 Paint materials listed in the latest edition of the MPI Approved Products List (APL) are acceptable for use on this project.
- .3 Paint materials for each coating formula to be products of a single manufacturer.
- .4 Low odour products: whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour. Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.
- .5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be water-based, water soluble, water clean-up.
 - .2 be non-flammable
 - .3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

EXTERIOR PAINTING

- .6 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .8 Water-borne surface coatings must have a flash point of 61.0°C or greater.
- .9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .10 Water-borne paints and stains, and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

- .1 Owner's Representative will provide Colour Schedule after Contract award.
- .2 Selection of colours will be from manufacturer's full range of colours.
- .3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Owner's Representative written permission.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

EXTERIOR PAINTING

- .4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Owner's Representative.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

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

Gloss Level /Category	Units @ 60E/	Units @ 85°
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 – gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein.

2.5 EXTERIOR PAINTING SYSTEMS

- .1 The following paint formulas requires a three coat finish as indicated in the MPI Architectural Painting Specifications Manual.
- .2 Asphalt Surfaces: zone/traffic marking for drive and parking areas, etc.
 - .1 EXT 2.1B Alkyd zone/traffic marking finish.
- .3 Concrete Vertical Surfaces: (including horizontal soffits)
 - .1 EXT 3.1A – Latex G4 finish
- .4 Concrete Horizontal Surfaces: decks
 - .1 EXT 3.2D - Alkyd floor enamel G4 finish.
- .5 Clay Masonry Units: (pressed and extruded brick)
 - .1 EXT 4.1A - Latex G4 finish.
- .6 Concrete Masonry Units: smooth and split face block and brick
 - .1 EXT 4.2A - Latex G4 finish.
- .7 Structural Steel and Metal Fabrications:
 - .1 EXT 5.1J - Pigmented polyurethane finish (over high build epoxy).
- .8 Galvanized Metal: not chromate passivated

EXTERIOR PAINTING

- .1 EXT 5.3D - Pigmented polyurethane finish for use in high contact/high traffic areas.

PART 3 EXECUTION**3.1 GENERAL**

- .1 Perform preparation and operations for exterior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply all paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Owner's Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Owner's Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Concrete: 12%.
 - .2 Clay and Concrete Block/Brick: 12%.
 - .3 Wood: 15%.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Owner's Representative.
- .2 Cover or mask windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.
- .3 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .4 Protect factory finished products and equipment.

EXTERIOR PAINTING

- .5 Protect passing pedestrians, building occupants and general public in and about the building.
- .6 Remove electrical cover plates, light fixtures, surface hardware on doors, and all other surface mounted fittings, equipment and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.
- .7 Cover or move exterior furniture and portable equipment around building as necessary to carry out painting operations. Replace as painting operations progress.
- .8 As painting operations progress, place "WET PAINT" signs in areas of work to approval of Owner's Representative.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare exterior surfaces in accordance with MPI Painting Specification Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
- .2 Prevent contamination of cleaned surfaces before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

EXTERIOR PAINTING

- .5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes or blowing with clean dry compressed air.
- .6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
- .7 Do not apply paint until prepared surfaces have been accepted by Owner's Representative.

3.5 APPLICATION

- .1 Method of application to be as approved by Owner's Representative. Apply paint by brush roller, air sprayer, airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray Application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
 - .4 Brush out immediately runs and sags.
 - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Owner's Representative.

EXTERIOR PAINTING

- .5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Paint fire protection piping red.
- .4 Do not paint over nameplates.
- .5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.7 FIELD QUALITY CONTROL

- .1 Field inspection of exterior painting operations to be carried out by Owner's Representative.
- .2 Advise Owner's Representative when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with Owner's Representative and provide access to areas of work.

END OF SECTION

INTERIOR PAINTING

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittals.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 61 00 - Common Product Requirements.
- .4 Section 01 78 00 - Closeout Submittals.
- .5 Section 08 11 00 – Metal Doors & Frames.

1.2 REFERENCES

- .1 Environmental Protection Agency (EPA)
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
- .2 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual.
- .3 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, Volume Two, Systems and Specifications Manual.
- .4 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

- .1 Provide paint products meeting MPI "Environmentally Friendly" E2 or E3 ratings based on VOC (EPA Method 24) content levels.

INTERIOR PAINTING

- .2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 or E3 rating.

1.5 SCHEDULING

- .1 Submit work schedule for various stages of painting to Owner's Representative for approval. Submit schedule minimum of two (2) working days in advance of proposed operations.
- .2 Obtain written authorization from Owner's Representative for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.6 SUBMITTALS

- .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be
- .2 Submit product data for the use and application of paint thinner.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets. Indicate VOCs during application and curing.
- .4 Upon completion, submit records of products used, records to be included in Operating and Maintenance Manuals. List products in relation to finish system and include the following:
 - .1 Product name, type and use
 - .2 Manufacturer's product number
 - .3 Colour numbers
 - .4 MPI Environmentally Friendly Classification System Rating
 - .5 Manufacturer's Material Safety Data Sheets (MSDS)
- .5 Submit full range colour sample chips to indicate where colour availability is restricted.
- .6 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
 - .1 3 mm steel plate for finishes over metal surfaces.
 - .2 13 mm birch plywood for finishes over wood surfaces.
 - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
 - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

INTERIOR PAINTING

- .7 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.7 QUALITY CONTROL

- .1 Provide mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 When requested by Owner's Representative, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 EXTRA MATERIALS

- .1 Submit maintenance materials from same product run as products installed in accordance with Section 01 78 00 - Closeout Submittals. Package products with protective covering and identify with descriptive labels.
- .2 Submit one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.
- .3 Deliver to Owner's Representative and store where directed.
- .4 Provide certificate signed by staff that extra materials have been received in order.

1.9 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in original containers, sealed, with labels intact.
- .3 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .4 Remove damaged, opened and rejected materials from site.
- .5 Provide and maintain dry, temperature controlled, secure storage.
- .6 Observe manufacturer's recommendations for storage and handling.

INTERIOR PAINTING

- .7 Store materials and supplies away from heat generating devices.
- .8 Store materials and equipment in a well ventilated area with temperature range 7° C to 30° C.
- .9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Owner's Representative. After completion of operations, return areas to clean condition to approval of Consultant.
- .11 Remove paint materials from storage only in quantities required for same day use.
- .12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .13 Fire Safety Requirements:
 - .1 Provide minimum one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Unused paint, coating materials must be disposed of at official hazardous material collections site as approved by Owner's Representative.
- .6 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal.
- .7 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

INTERIOR PAINTING

- .8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .9 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).

1.11 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .4 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10°C.
 - .2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is above 60% or when the dew point is less than 3°C variance between the air/surface temperature.
 - .2 Perform no painting work when the maximum moisture content of the substrate exceeds:

INTERIOR PAINTING

- .1 12% for concrete and masonry (clay and concrete brick/block).
- .2 15% for wood.
- .3 12% for plaster and gypsum board.
- .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Additional Interior Application Requirements:
 - .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner's Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 PRODUCTS**2.1 MATERIALS (see attached data sheets from Sherwin-Williams)**

- .1 Steel/Ferrous Metal:

Primer: Sherwin-Williams B66W01310 – Pro Industrial Pro Cryl Primer. Location-Bare metal primer/rusted areas primer

Finish: Sherwin Williams B66W01151 – Pro Industrial DTM Acrylic Semi-Gloss Extra White. Location – Metal Surfaces.
- .2 Concrete and Block:

Primer: Sherwin-Williams LX02W0050 – Loxon Concrete / Masonry Primer. Location-Bare Masonry.

Finish: Sherwin Williams B66W01151 – PI Multi Surface Acrylic. Location – Concrete and Masonry Surfaces.
- .3 Paint materials for paint systems shall be products of a single manufacturer.

INTERIOR PAINTING

- .4 Low odor products. Whenever possible, select products exhibiting low odor characteristics. If two products are otherwise equivalent, select the product with the lowest odor. Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.
- .5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be water-based, water soluble, water clean-up.
 - .2 be non-flammable.
 - .3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .6 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .8 Water-borne surface coatings must have a flash point of 61.0°C or greater.
- .9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .10 Water-borne paints and stains, and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.
- .11 Refer to coating schedule with drawing package and division 03 specifications for specific coating products and locations.

2.2 COLOURS

- .1 Owner's Representative will provide Colour Schedule after contract award.
- .2 Selection of colours will be from manufacturers full range of colours.

INTERIOR PAINTING

- .3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

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

2.4 GLOSS/SHEEN RATINGS

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

Gloss Level Category	Units @ 60E	Units @ 85E
G1 - matte finish	max. 5	max. 10
G2 - velvet finish	max. 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein.

2.5 INTERIOR PAINTING SYSTEMS

- .1 The following paint formulas requires a three coat finish as indicated in the MPI Architectural Painting Specifications Manual.
- .2 Concrete Vertical Surfaces: including horizontal soffits
 - .1 Refer to room finished schedule.

INTERIOR PAINTING

- .3 Concrete Horizontal Surfaces: floors
 - .1 Refer to section 09 67 26 – Quartz Flooring
- .4 Concrete Masonry Units: smooth and split face block and brick.
 - .1 INT 4.2A Latex G5 finish.
- .5 Structural Steel and Metal Fabrications: columns, beams, joists, etc.
 - .1 INT 5.1E Alkyd G5 finish.
- .6 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.
 - .1 INT 5.3A Latex G5 finish.
- .7 Dimension Lumber: columns, beams, exposed joists, underside of decking, etc.
 - .1 INT 6.2D Latex G5 finish (over latex primer).
- .8 Dressed Lumber: including doors, door and window frames casings, mouldings, etc.
 - .1 INT 6.3T Latex G5 finish (over latex primer).
- .9 Wood Paneling and Casework: partitions, panels, shelving, millwork, etc.
 - .1 INT 6.4C Semi-transparent stain finish.
- .10 Plaster and gypsum board: gypsum wallboard:
 - .1 INT 9.2B - High performance architectural latex G4 finish.
 - .1 Typical Walls: G3 finish.
 - .2 Typical Ceilings: G2 finish.
 - .3 Wet and Service Areas: G5 finish.
 - .2 INT 9.2N – Epoxy high build, G3-4 finish.
 - .1 Shower Room
- .11 Painting of interior game line layouts with colours as noted on approved game line layout drawing on interior resilient (gymnasium) flooring to be by others in accordance with MPI Architectural Painting Specification.

PART 3 **EXECUTION****3.1** **MANUFACTURER'S INSTRUCTIONS**

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

INTERIOR PAINTING

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply all paint materials in accordance with paint manufacturer's written application instructions.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Owner's Representative.
- .2 Cover or mask floors, windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.
- .3 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .4 Protect factory finished products and equipment.
- .5 Protect passing pedestrians, building occupants and general public in and about the building.
- .6 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, bath accessories and other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.
- .7 As painting operations progress place "WET PAINT" signs in occupied areas to approval of Owner's Representative.

3.4 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Owner's Representative all damage, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Owner's Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Plaster and wallboard: 12%

INTERIOR PAINTING

- .2 Masonry/Concrete: 12%
- .3 Concrete Block/Brick: 12%
- .4 Wood: 15%

3.5 CLEANING AND PREPARATION

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
- .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .3 Sand existing surfaces with intact, smooth, high gloss coatings to provide adequate adhesion for new finishes.
- .4 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air, or vacuum cleaning.

INTERIOR PAINTING

- .7 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
- .8 Do not apply paint until prepared surfaces have been accepted by Owner's Representative.

3.6 APPLICATION

- .1 Method of application to be as approved by Owner's Representative. Apply paint by brush, roller, air sprayer, airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.
 - .4 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Owner's Representative.
- .5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

INTERIOR PAINTING

- .7 Sand and dust between coats to remove visible defects.
- .8 Finish tops of cupboards, cabinets and projecting ledges, both above and below sight lines as specified for surrounding surfaces.
- .9 Finish closets and alcoves as specified for adjoining rooms.
- .10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 In finished areas: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 In boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 In other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .9 Paint all fire protection piping red.
- .10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .11 Do not paint interior transformers and substation equipment.

3.8 FIRE SEPARATIONS (N/A)

- .1 Contractor to stencil on both sides of fire rated partitions the fire rating for that assembly (i.e.: **1 HR FIRE SEPARATION**).

INTERIOR PAINTING

- .2 Stenciled fire ratings to be minimum 100 mm high **RED** letters, minimum 150 mm above finished ceilings, and minimum 2400 mm o.c. along partition.

3.9 FIELD QUALITY CONTROL

- .1 Field inspection of interior painting operations to be carried out by Owner's Representative.
- .2 Advise Owner's Representative when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with Owner's Representative and provide access to all areas of the work.
- .4 Standard of Acceptance:
 - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

END OF SECTION



SHERWIN-WILLIAMS®

Product Submittal

Project Information

Presented By:

Alexander Daze

SALES- Sales Representative PC New
Residential

alexander.j.daze@sherwin.com

SHERWIN-WILLIAMS
1760 WOODWARD DR
OTTAWA, ON K2C0P8
(613) 226-7098

October 31, 2025

Interior Finishes

Steel/Ferrous Metal

Primer: B66W01310 - Pro Industrial Pro Cryl Primer

- Location: Bare Metal Primer/ Rusted Areas Primer

Notes: Apply primer to all bare metal areas. Ensure the metal is sanded, cleaned and degreased prior to applying primer. Primer also to be used in any areas where early rust is detected. Ensure the affected areas are sanded and clean prior to applying primer. See attached data sheets for further specifications.

Finish: B66W01151 - Pro Industrial DTM Acrylic Semi-Gloss Extra White

- Location: Metal Surfaces

Notes: Paint for metal surfaces, can be used over previously painted surfaces as well as areas primed with

Pro-cryl. For previously painted areas ensure areas are all sanded and cleaned. Apply test patch to ensure adhesion. See data sheets for further specifications.

Block (Cinder and Concrete)

Primer: LX02W0050 - Loxon Concrete/Masonry Primer

- Location: Bare Masonry/ Cinder Blocks

Notes: Primer to be used on any bare areas of block/ concrete walls. Ensure surface is clean and dry prior to applying primer. See attached data sheets for further specifications.

Finish: B66W01551 - PI Multi Surface Acrylic

- Location: Concrete Walls/ Concrete Bleachers

Notes: To be used on properly prepared block walls as well as concrete of bleacher area. All bare areas must be addressed with loxon primer. Coating can be used over previously painted areas. Ensure all previously painted areas are sanded and cleaned prior to applying coating. See attached data sheets for further specifications.



SHERWIN-WILLIAMS®

Reference Pages

Data Pages

Pro Industrial™ Pro-Cryl®

Universal Primer

B66-1300 Series


**SHERWIN
WILLIAMS.**

CHARACTERISTICS

Pro Industrial Pro-Cryl® Universal Primer is an advanced technology, self-cross-linking acrylic primer. It is rust inhibitive and was designed for both construction and maintenance applications. It can be used as a primer under water-based or solvent-based high-performance topcoats.

Features:

- Rust inhibitive, corrosion resistant
- Single component
- Early moisture resistant
- Fast dry
- Lower temperature application 35°F
- Interior and exterior use
- Suitable for use in USDA inspected facilities

For use on properly prepared:

Steel, Galvanized & Aluminum, Wood

Finish: Low Sheen

Color: Off White, Medium Grey, and Red Oxide

Recommended Spreading Rate per coat:

Wet mils: 5.0-10.0
 Dry mils: 1.9-3.8
 Coverage: 160-320 sq. ft. per gallon
 Theoretical Coverage: 609 sq. ft. per gallon @ 1 mil dry

Approximate spreading rates are calculated on volume solids and do not include any application loss.

Note: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 6.0 mils wet, @ 50% RH:

Drying and recoat times are temperature, humidity, and film thickness dependent.

	@40°F	@77°F	@120°F
To touch	2 hours	40 minutes	20 minutes
Tack free	8 hours	2 hours	1 hour
To recoat	16 hours	4 hours	2 hours

Tinting: DO NOT TINT

Extra White B66W01310

(may vary by color)

V.O.C. (less exempt solvents):

less than 50 grams per litre; 0.42 lbs. per gallon
 As per 40 CFR 59.406

Volume Solids: 38 ±2%

Weight Solids: 50 ±2%

Weight per Gallon: 10.09 lbs

Flash Point: N/A

Shelf Life: 36 months, unopened

COMPLIANCE

As of 2/14/2024, Complies with:

OTC	Yes
OTC Phase II	Yes
S.C.A.Q.M.D.	Yes
CARB	Yes
CARB SCM 2007	Yes
CARB SCM 2020	Yes
Canada	Yes
LEED® v4 & v4.1 Emissions	Yes
LEED® v4 & v4.1 V.O.C.	Yes
EPD-NSF® Certified	Yes
MIR-Manufacturer Inventory	Yes
MPI®	Yes

APPLICATION

Temperature:
 minimum 35°F / 1.6°C
 maximum 120°F / 48.8°C
 air, surface and material
 At least 5°F above dew point

Relative humidity: 85% maximum
 The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer: Water

Airless Spray:
 Pressure 2000 p.s.i.
 Hose 1/4 inch I.D.
 Tip .015-.019 inch
 Filter 60 mesh

Conventional Spray:
 Gun Binks 95
 Fluid Nozzle 66
 Air Nozzle 63 PB
 Atomization Pressure 60 p.s.i.
 Fluid Pressure 25 p.s.i.

Reduction: As needed up to 5% by volume

Brush: Nylon-polyester

Roller Cover: 3/8 inch woven
 If specific application equipment is listed above, equivalent equipment may be substituted.

Apply paint at the recommended film thickness and spreading rate as indicated. Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

Stripe coat crevices, welds, and sharp angles to prevent early failure in these areas. For best results on rusty surfaces, always apply first coat by brush.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

No painting should be done immediately after a rain or during foggy weather.

For optimal performance, this primer should be topcoated.

For exterior exposure, this primer should be topcoated within 14 days. If 14 days is exceeded remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Finish with appropriate topcoat.

SPECIFICATIONS

Acceptable Water Based topcoats:

1-2 coats Pro Industrial Acrylic Coating or Pro Industrial Acrylic Dryfall
 Pro Industrial DTM Acrylic
 Pro Industrial Multi-Surface Acrylic
 Pro Industrial Pre-Catalyzed Epoxy
 Pro Industrial Pre-Catalyzed Urethane
 Pro Industrial Water Based Acrolon 100
 Pro Industrial Water Based Alkyd Urethane
 Pro Industrial Water Based Catalyzed Epoxy
 Sherwin-Williams Architectural Coatings

Acceptable Solvent Based topcoats:

Pro Industrial High Performance Epoxy
 Pro Industrial Industrial Enamels
 Tile Clad HS Epoxy

The finishes listed above are representative of the product's use. Other finishes may be appropriate.

Pro Industrial™ Pro-Cryl® Universal Primer

SURFACE PREPARATION

WARNING! If you scrape, sand or remove old paint, you may release lead dust. LEAD IS TOXIC. EXPOSURE TO LEAD DUST CAN CAUSE SERIOUS ILLNESS, SUCH AS BRAIN DAMAGE, ESPECIALLY IN CHILDREN. PREGNANT WOMEN SHOULD ALSO AVOID EXPOSURE. Wear a NIOSH-approved respirator to control lead exposure. Clean up carefully with a HEPA vacuum and a wet mop. Before you start, find out how to protect yourself and your family by contacting the National Lead Information Hotline at 1-800-424-LEAD or log on to www.epa.gov/lead.

Do not use hydrocarbon solvents for cleaning.

Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Glossy surfaces should be sanded dull. Stains from water, smoke, ink, pencil, grease, etc. should be sealed with the appropriate primer-sealer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Iron & Steel - Minimum surface preparation is Hand Tool Cleaning per SSPC-SP2. Remove all oil and grease from the surface per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6. Prime the area the same day as cleaned. Self priming.

Aluminum - Remove all oil, grease, dirt, oxide and other foreign material per SSPC-SP1. Self priming.

Galvanizing - Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1. When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP16 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned. Self priming.

Previously Painted Surfaces - If in sound condition, clean the surface of all foreign material. Smooth, hard or glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, additional abrasion of the surface and/or removal of the previous coating may be necessary. Retest surface for adhesion. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Wood - Surface must be clean, dry and sound. Prime with recommended primer. No painting should be done immediately after a rain or during foggy weather. Knots and pitch streaks must be scraped, sanded and spot primed before full coat of primer is applied. All nail holes or small openings must be properly caulked.

SURFACE PREPARATION

Mildew-

Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.

Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts clean water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach-water solution.

PERFORMANCE

System Tested: (unless otherwise indicated)

Substrate: Steel

Surface Preparation: SSPC-SP10

Finish: 1 coat Pro Industrial Pro-Cryl Off White
1 coat Pro Industrial Acrylic Coating

Adhesion:

Method: ASTM D4541

Result: 500 p.s.i.

Corrosion Weathering:

Method: ASTM D5894, 10 cycles, 3360 hours

Result: Passes

Direct Impact Resistance:

Method: ASTM D2794

Result: greater than 140 inch lb.

Dry Heat Resistance:

Method: ASTM D2485

Result: 200°F

Flexibility:

Method: ASTM D522, 180° bend,

1/2 inch mandrel

Result: Passes

Moisture Condensation Resistance:

Method: ASTM D4585, 100°F, 1250 hours

Result: Passes

Pencil Hardness:

Method: ASTM D3363

Result: B

Salt Fog Resistance:

Method: ASTM B117, 1250 hours

Result: Passes

Provides performance comparable to products formulated in lieu of federal specification: AA50557 and Paint Specification: SSPC-Paint 23.

SAFETY PRECAUTIONS

Before using, carefully read **CAUTIONS** on label.

Refer to the Safety Data Sheets (SDS) before use.

FOR PROFESSIONAL USE ONLY.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

CLEANUP INFORMATION

Clean spills, spatters, hands and tools immediately after use with soap and warm clean water. After cleaning, flush spray equipment with compliant cleanup solvent to prevent rusting of the equipment. Follow manufacturer's safety recommendations when using solvents.

HOTW	2/14/2024	B66W01310	10	39
HOTW	2/14/2024	B66A01320	08	38
HOTW	2/14/2024	B66N01310	08	39
FRC				

Pro Industrial™ DTM

Acrylic Semi-Gloss

B66-1150 Series


**SHERWIN
WILLIAMS.**

CHARACTERISTICS

Pro Industrial DTM Acrylic coating is an interior-exterior, water based, corrosion resistant acrylic coating for light to moderate industrial use. Designed for new construction or maintenance use and can be used directly over prepared substrates.

- Chemical Resistant
- Corrosion Resistant
- Fast dry
- Flash rust-early rust resistance
- Suitable for use in USDA inspected facilities

Finish: Semi-Gloss 38-48 @ 60°

Color: Most Colors

Recommended Spreading Rate per coat:

Wet mils:	6.0-10.0
Dry mils:	2.4-4.0
Coverage:	160-267 sq. ft. per gallon
Theoretical Coverage:	641 sq. ft. per gallon
	@ 1 mil dry

Approximate spreading rates are calculated on volume solids and do not include any application loss.

Note: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 6.0 mils wet, @ 50% RH:

Drying and recoat times are temperature, humidity, and film thickness dependent.

	@50°F	@77°F	@110°F
To touch	1 hour	20 minutes	10 minutes
Tack free	2 hours	45 minutes	30 minutes
To recoats	2 hours	1 hour	1 hour

Tinting with CCE only:

Base	oz. per gallon	Strength
Extra White	0-6	SherColor
Deep Base	6-12	SherColor
Ultradeep Base	10-12	SherColor
Real Red	0-12	SherColor
Vivid Yellow	0-14	SherColor

Extra White B66W01151

(may vary by color)

V.O.C. (less exempt solvents):

less than 50 grams per litre; 0.42 lbs. per gallon

As per 40 CFR 59.406

Volume Solids:	40 ±2%
Weight Solids:	51 ±2%
Weight per Gallon:	10.20 lbs
Flash Point:	N/A
Vehicle Type:	Acrylic
Shelf Life:	36 months, unopened

COMPLIANCE

As of 10/18/2022, Complies with:

OTC	Yes
OTC Phase II	Yes
S.C.A.Q.M.D.	Yes
CARB	Yes
CARB SCM 2007	Yes
CARB SCM 2020	Yes
Canada	Yes
LEED® v4 & v4.1 Emissions	Yes
LEED® v4 & v4.1 V.O.C.	Yes
EPD-NSF® Certified	Yes
MIR-Manufacturer Inventory	No
MPI®	Yes

APPLICATION

Temperature:	
minimum	50°F / 10°C
maximum	110°F / 43°C
	air, surface and material
	At least 5°F above dew point

Relative humidity: 85% maximum
The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer: Water

Airless Spray:

Pressure	1500 p.s.i.
Hose	¼ inch I.D.
Tip	.017-.021 inch
Filter	60 mesh

Conventional Spray:

Gun	Binks 95
Fluid Nozzle	66
Air Nozzle	63 PB
Atomization Pressure	50 p.s.i.
Fluid Pressure	10-20 p.s.i.

Reduction: Not Recommended

Brush: Nylon-polyester

Roller Cover: 1/4-3/8 inch woven

If specific application equipment is listed above, equivalent equipment may be substituted.

Due to this product's fast dry performance, brushing should be limited to small areas where a wet edge can be maintained.

Apply paint at the recommended film thickness and spreading rate as indicated. Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Overspray landing on hot surfaces may adhere to these surfaces. Immediately remove overspray from hot surfaces before adhesion occurs.

SPECIFICATIONS

Steel*

2 coats Pro Industrial DTM Acrylic

Steel:

1 coat Pro Industrial Pro-Cryl Primer or Pro Industrial DTM Primer/Finish or Kem Bond HS Metal Primer or Zinc Clad Primer
1-2 coats Pro Industrial DTM Acrylic

Aluminum:

1-2 coats Pro Industrial DTM Acrylic

Aluminum (Water Based Primer):

1 coat Pro Industrial Pro-Cryl Primer
1-2 coats Pro Industrial DTM Acrylic

Concrete Block (CMU):

1 coat Pro Industrial Heavy Duty Block Filler or Loxon Acrylic Block Surfer
2 coats Pro Industrial DTM Acrylic

Concrete-Masonry:

1 coat Loxon Concrete & Masonry Primer or 1 coat Loxon Conditioner
2 coats Pro Industrial DTM Acrylic

Drywall:

1 coat ProMar 200 Zero V.O.C. Primer
1-2 coats Pro Industrial DTM Acrylic

Galvanizing:

2 coats Pro Industrial DTM Acrylic

Pre-Finished Siding: (Baked-on finishes)

1 coat Bond-Plex Waterbased Acrylic or DTM Bonding Primer
1-2 coats Pro Industrial DTM Acrylic

Wood, exterior:

1 coat Exterior Wood Primer
1-2 coats Pro Industrial DTM Acrylic

Wood, interior:

1 coat Premium Wall & Wood Primer
1-2 coats Pro Industrial DTM Acrylic

*Application of coating on unprimed steel may cause pinpoint rusting. Safety Colors, Deep Base, and Ultradeep colors require a prime coat for maximum durability, adhesion, and corrosion protection.

Zinc Primers – Refer to the zinc technical data sheet application procedures and performance tips prior to topcoating.

Pro Industrial™ DTM

Acrylic Semi-Gloss

SURFACE PREPARATION

WARNING! If you scrape, sand or remove old paint, you may release lead dust. LEAD IS TOXIC. EXPOSURE TO LEAD DUST CAN CAUSE SERIOUS ILLNESS, SUCH AS BRAIN DAMAGE, ESPECIALLY IN CHILDREN. PREGNANT WOMEN SHOULD ALSO AVOID EXPOSURE. Wear a NIOSH-approved respirator to control lead exposure. Clean up carefully with a HEPA vacuum and a wet mop. Before you start, find out how to protect yourself and your family by contacting the National Lead Information Hotline at 1-800-424-LEAD or log on to www.epa.gov/lead.

Do not use hydrocarbon solvents for cleaning.

Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Glossy surfaces should be sanded dull. Stains from water, smoke, ink, pencil, grease, etc. should be sealed with the appropriate primer-sealer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Iron & Steel - Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6. Primer recommended for best performance.

Aluminum - Remove all oil, grease, dirt, oxide, and other foreign material per SSPC-SP1.

Galvanizing - Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1. When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP16 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2. Prime the area the same day as cleaned.

Concrete Block - Surface should be thoroughly clean and dry. Air, material, and surface temperatures must be at least 55°F (13°C) before filling. Use Pro Industrial Heavy Duty Block Filler or Loxon Acrylic Block Surfer. The filler must be thoroughly dry before topcoating.

Masonry - All masonry must be free of dirt, oil, grease, loose paint, mortar, masonry dust, etc. Clean per SSPC-SP13/Nace 6/ICRI No. 310.2R, CSP 1-3. Poured, troweled, or tilt-up concrete, plaster, mortar, etc. must be thoroughly cured at least 30 days at 75°F. Form release compounds and curing membranes must be removed by brush blasting. Brick must be allowed to weather for one year prior to surface preparation and painting. Prime the area the same day as cleaned. Weathered masonry and soft or porous cement board must be brush blasted or power tool cleaned to remove loosely adhering contamination and to get to a hard, firm surface. Apply one coat Loxon Conditioner, following label recommendations.

Wood - Surface must be clean, dry, and sound. Prime with recommended primer. No painting should be done immediately after a rain or during foggy weather. Knots and pitch streaks must be scraped, sanded and spot primed before full coat of primer is applied. All nail holes or small openings must be properly caulked. Sand to remove any loose or deteriorated surface wood and to obtain a proper surface profile.

SURFACE PREPARATION

Previously Painted Surface - If in sound condition, clean the surface of all foreign material. Smooth, hard or glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, additional abrasion of the surface and/or removal of the previous coating may be necessary. Retest surface for adhesion. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Mildew - Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.

Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts clean water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach-water solution.

PERFORMANCE

System Tested: (unless otherwise indicated)

Substrate: Steel

Surface Preparation SSPC-SP10

Finish: 2 coats Pro Industrial DTM Acrylic
B66W01151, 3.0 D.F.T per coat

Adhesion:

Method: ASTM D4541
Result: 1436 p.s.i.

Corrosion Weathering*:

Method: ASTM D5894, 7 cycles
Result: Rating 10 per ASTM D714 for blistering
Rating 8.5 per ASTM D1654 for corrosion

Direct Impact Resistance:

Method: ASTM D2794
Result: greater than 176 inch pound

Dry Heat Resistance:

Method: ASTM D2485
Result: 300°F

Flexibility:

Method: ASTM D522, 1/8 inch mandrel
Result: Pass

Humidity Resistance*:

Method: ASTM D4585, 2186 hours
Result: Rating 10 per ASTM D714 for blistering
Rating 10 per ASTM D1654 for corrosion

Pencil Hardness:

Method: ASTM D3363
Result: 2H

*over Pro Industrial Pro-Cryl Primer.

No painting should be done immediately after a rain or during foggy weather.
Do not paint on wet surfaces.
Check adhesion by applying a test strip to determine the readiness for painting.

Provides performance comparable to products formulated in lieu of federal specification: AA50570, and Paint Specification: SSPC-Paint 24.

SAFETY PRECAUTIONS

Before using, carefully read **CAUTIONS** on label.

Refer to the Safety Data Sheets (SDS) before use.

FOR PROFESSIONAL USE ONLY.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

CLEANUP INFORMATION

Clean spills, spatters, hands and tools immediately after use with soap and warm clean water. After cleaning, flush spray equipment with compliant cleanup solvent to prevent rusting of the equipment. Follow manufacturer's safety recommendations when using solvents.

HOTW 10/18/2022 B66W01151 22 35
FRC, SP

Loxon®**Concrete and Masonry Primer-Sealer**

US LX02W0050, Canada LX02WQ050 White

**SHERWIN
WILLIAMS®****CHARACTERISTICS**

Loxon Concrete & Masonry Primer-Sealer is an acrylic coating specifically engineered for interior and exterior, above grade, masonry surfaces requiring a high-performance primer. It is highly alkali and efflorescence resistant and can be applied to a surface with a pH of 6 to 13.

Loxon Concrete and Masonry Primer-Sealer: Seals and adheres to concrete, brick, stucco and plaster.

Conditions porous masonry surfaces.

Use on above grade masonry surfaces for a long-lasting finish.

Apply to masonry and concrete surfaces that are at least 7 days old.

Prevents harm to subsequent coatings by alkalies in the substrate.

For use on these surfaces:

Concrete, Concrete Block, Brick, Stucco, EIFS
Fiber Cement Siding, Plaster, Mortar, Exterior
Wall Cladding, Tilt-Up/Pre-Cast Concrete

Finish: 0-10 units @ 85°
Color: White

Coverage:
Wet mils: 5.3-8.0
Dry mils: 2.1-3.2
Coverage: 200-320 sq. ft. per gallon
Coverage on porous & rough stucco 80 square feet per gallon.

Coverage (thin-mil primer application to new construction tilt-up/precast concrete):

Wet mils: 2.7-4.0
Dry mils: 1.1-1.6
Coverage: 400-600 sq. ft. per gallon

Drying Schedule 77°F @ 50% RH:

To touch 4 hours
To recoat 24 hours

Air and surface temperatures must not drop below 40°F for 48 hours after application.

Drying and recoat times are temperature, humidity, and film thickness dependent.

Tinting with CCE only:

For best topcoat color development, use the recommended "P"-shade primer. If desired, up to 4 oz. per gallon of ColorCast Ecotones can be used to approximate the topcoat color. Check color before use.

Extra White LX02W0050**V.O.C. (less exempt solvents):**

less than 50 grams per litre; 0.42 lbs. per gallon
As per 40 CFR 59.406

Volume Solids: 40 ±2%
Weight Solids: 55 ±2%
Weight per Gallon: 10.92 lbs
Flash Point: N.A.
Vehicle Type: Acrylic
Shelf Life: 36 months, unopened

COMPLIANCE

As of 07/19/2023, Complies with:

OTC	Yes
OTC Phase II	Yes
S.C.A.Q.M.D.	Yes
CARB	Yes
CARB SCM 2007	Yes
CARB SCM 2020	Yes
Canada	Yes
LEED® v4 & v4.1 Emissions	Yes
LEED® v4 & v4.1 V.O.C.	Yes
EPD-NSF® Certified	Yes
MIR-Product Lens Certified	Yes
MPI®	Yes

APPLICATION**Temperature:**

minimum 40°F

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer: No reduction necessary

Airless Spray:
Pressure 2000-2700 p.s.i.
Tip .19 inch

Brush: nylon-polyester

Roller Cover: ½ to 1½ inch nap synthetic cover

Spray and back roll on porous & rough stucco to achieve required film build and a pin-hole free surface.

For porous block, a coat of Loxon Acrylic Block Surfer is required to achieve a pinhole free surface.

Apply at temperatures above 40°F. When the air temperature is at 40°F, substrates may be colder; prior to painting, check to be sure the air, surface, and material temperature are above 40°F and at least 5°F above the dew point. Avoid using if rain or snow is expected within 4-6 hours.

Do not apply at air or surface temperatures below 40°F or when air or surface temperatures may drop below 40°F within 48 hours.

For best performance results, avoid painting in direct sun or painting substrates with elevated surface temperatures.

Do not reduce.

May be applied to damp but not to wet surfaces.

APPLICATION TIPS

Apply paint at the recommended film thickness and spreading rate as indicated on the page. Application of coating below minimum recommended spreading rate may adversely affect the coating systems performance.

When spot priming on some surfaces, a non-uniform appearance of the final coat may result, due to differences in holdout between primed and unprimed areas. To avoid this, prime the entire surface rather than spot priming.

For optimal performance, this primer-sealer must be topcoated with a latex, alkyd-oil, water-based epoxy, or solvent based epoxy coating on architectural applications.

For exterior use, this primer-sealer must be topcoated within 14 days to prevent degradation due to weathering.

RECOMMENDED SYSTEMS**Concrete, Masonry, Cement:**

1 coat Loxon Concrete & Masonry Primer
2 coats Appropriate Topcoat

Stucco, Fiber Cement Siding, EIFS:

1 coat Loxon Concrete & Masonry Primer
2 coats Appropriate Topcoat

Recommended Architectural Topcoats:

A-100 Exterior Latex
Duration Exterior & Duration Home Interior
Emerald Exterior & Interior
Loxon Masonry Coatings
SuperPaint Exterior & Interior
ProClassic Interior
ProMar Interior

Recommended Industrial Topcoats:

Industrial Enamels
Pro Industrial Series
Water Based Catalyzed Epoxy

Industrial finishes have been tested for architectural applications only. Loxon Concrete and Masonry Primer has not been tested in environments subject to chemical attack. Any recommendations for use in such areas must follow a thorough evaluation of the effects of the environment on the Loxon Concrete and Masonry Primer and topcoat system.

Loxon®

Concrete and Masonry Primer-Sealer

SURFACE PREPARATION

WARNING! If you scrape, sand or remove old paint, you may release lead dust. LEAD IS TOXIC. EXPOSURE TO LEAD DUST CAN CAUSE SERIOUS ILLNESS, SUCH AS BRAIN DAMAGE, ESPECIALLY IN CHILDREN. PREGNANT WOMEN SHOULD ALSO AVOID EXPOSURE. Wear a NIOSH-approved respirator to control lead exposure. Clean up carefully with a HEPA vacuum and a wet mop. Before you start, find out how to protect yourself and your family by contacting: US - National Lead Information Hotline at 1-800-424-LEAD or log on to www.epa.gov/lead; Canada - your local health authority.

Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Glossy surfaces should be sanded dull. Stains from water, smoke, ink, pencil, grease, etc. should be sealed with the appropriate primer-sealer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Masonry, Concrete, Stucco:

All new surfaces must cure for at least 7 days. Remove all form release and curing agents. Pressure clean to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, peeling and defective coatings, chalks, etc. Allow the surface to dry before proceeding. Repair cracks, voids, and other holes with an appropriate patching compound or sealant.

Concrete and mortar must be cured at least 7 days at 75°F. Moisture content must be 15% or lower. On tilt-up and poured-in-place concrete, commercial detergents and sandblasting may be necessary to remove sealers, release compounds, and to provide an anchor pattern. Fill bugholes, air pockets and other voids with an acrylic elastomeric patch or sealant.

Caulking:

Fill gaps between walls, ceilings, crown moldings, and other trim with the appropriate caulk after priming the surface

SURFACE PREPARATION

Mildew:

Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.

Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts clean water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach-water solution.

PHYSICAL PROPERTIES

Do not paint on wet surfaces.

LX02W0050

Water Vapor Permeance (US):

Method: ASTM D1653 (grains/(hr ft² in Hg)

Result: 25.79 perms

Flexibility:

Method: ASTM D522

Result: method B, 180° bend, 1/8 inch mandrel
Pass

Alkali Resistance:

Method: ASTM D1308

Result: Pass

Mildew Resistance:

Method: ASTM D3273/D3274

Result: Pass

Efflorescence:

Method: ASTM D7072-04

Result: Pass (None)

Wind-Driven Rain Test:

Method: ASTM D6904-03

Result: Pass

SAFETY PRECAUTIONS

For interior or exterior use.

Protect from freezing.

Do not apply at temperatures below 40°F. Air and surface temperatures must not drop below 40°F for 48 hours after application.

Before using, carefully read **CAUTIONS** on label.

ZINC Use only with adequate ventilation. To avoid overexposure, open windows and doors or use other means to ensure fresh air entry during application and drying. If you experience eye watering, headaches, or dizziness, increase fresh air, or wear respiratory protection (NIOSH approved) or leave the area. Avoid contact with eyes and skin. Wash hands after using. Keep container closed when not in use. Do not transfer contents to other containers for storage. **FIRST AID:** In case of eye contact, flush thoroughly with large amounts of water. Get medical attention if irritation persists. If swallowed, call Poison Control Center, hospital emergency room, or physician immediately. **WARNING:** This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. **DO NOT TAKE INTERNALLY. KEEP OUT OF THE REACH OF CHILDREN.**

HOTW 07/19/2023 LX02W0050 50 46
FRC, SP

CLEANUP INFORMATION

Clean spills, spatters, hands and tools immediately after use with soap and warm clean water. After cleaning, flush spray equipment with compliant cleanup solvent to prevent rusting of the equipment. Follow manufacturer's safety recommendations when using solvents.

Pro Industrial™**Multi-Surface Acrylic Semi-Gloss**

B66–1550 Series

**SHERWIN
WILLIAMS.****CHARACTERISTICS**

Pro Industrial Multi-Surface Acrylic is a waterborne acrylic for interior and exterior use on marginally prepared metal or masonry surfaces. Features multiple sheens, fast dry, easy application and dry fall properties.

Features:

- Self-priming directly to multiple surfaces
- Excellent one-coat hide and stain blocking
- Abrasion resistant
- Optimized for spray application
- Good exterior color and gloss retention
- Dries fast and dry falls in 10-15 feet
- Suitable for use in USDA inspected facilities

For use on properly prepared:

Steel, Galvanized & Aluminum, Concrete and Masonry

Finish: 35-45 units @ 60°
Color: Most Colors

**Recommended Spreading Rate per coat:
B66W00671 (may vary by base)**

Wet mils: 3.75-6.0
Dry mils: 1.4-2.2
Coverage: 269-424 sq. ft. per gallon
Theoretical Coverage: 593 sq. ft. per gallon
@ 1 mil dry

Approximate spreading rates are calculated on volume solids and do not include any application loss.

Note: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 5.0 mils wet, @ 50% RH:

Drying and recoat times are temperature, humidity, and film thickness dependent. Dryfall characteristics will be affected at temperatures below 77°F (25°C) or above 50% RH.

	@40°F	@77°F	@100°F
To touch	1 hour	30 minutes	15 minutes
To handle	2 hours	1 hour	30 minutes
To recoat	4 hours	2 hours	1 hour
To dryfall	10-15 ft.	10 ft.	10 ft.

Tinting with CCE only:

Base	oz. per gallon	Strength
Extra White	0-6	SherColor
Ultradeep Base	10-14	SherColor

Extra White B66W01551

(may vary by color)

V.O.C. (less exempt solvents):

less than 50 grams per litre; 0.42 lbs. per gallon
As per 40 CFR 59.406

Volume Solids: 37 ±2%
Weight Solids: 50 ±2%
Weight per Gallon: 10.25 lbs
Flash Point: N/A
Vehicle Type: Acrylic
Shelf Life: 24 months, unopened

COMPLIANCE

As of 03/06/2025, Complies with:

OTC	Yes
OTC Phase II	Yes
S.C.A.Q.M.D.	Yes
CARB	Yes
CARB SCM 2007	Yes
CARB SCM 2020	Yes
Canada	Yes
LEED® v4 & v4.1 Emissions	Yes
LEED® v4 & v4.1 V.O.C.	Yes
EPD-NSF® Certified	Yes
MIR-Manufacturer Inventory	No
MPI®	#226

APPLICATION

Temperature:
minimum 40°F / 4.4°C
maximum 100°F / 37.7°C

air, surface and material

At least 5°F above dew point

Relative humidity: 85% maximum

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer: Water**Airless Spray:**

Pressure 2000 p.s.i.
Hose ¼ inch I.D.
Tip .013-.017 inch
Filter 60 mesh

Conventional Spray:

Gun Binks 95
Fluid Nozzle 63 C
Air Nozzle 63 FB
Atomization Pressure 60 p.s.i.
Fluid Pressure 50 p.s.i.
Reduction Not recommended

Brush: Nylon-polyester**Roller Cover:** 1/4 inch woven

If specific application equipment is listed above, equivalent equipment may be substituted.

Apply paint at the recommended film thickness and spreading rate as indicated. Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Overspray landing on hot surfaces may adhere to these surfaces. Immediately remove overspray from hot surfaces before adhesion occurs.

No painting should be done immediately after a rain or during foggy weather.

Do not paint on wet surfaces.

Check adhesion by applying a test strip to determine the readiness for painting.

SPECIFICATIONS**Steel***

2 coats Pro Industrial Multi-Surface Acrylic

Steel:

1 coat Pro Industrial Pro-Cryl Primer
or Pro Industrial DTM Primer/Finish
or Pro Industrial Kem Bond HS
or Zinc Clad Primer
1-2 coats Pro Industrial Multi-Surface Acrylic

Aluminum:

1-2 coats Pro Industrial Multi-Surface Acrylic

Aluminum (Water Based Primer):

1 coat Pro Industrial Pro-Cryl Primer
1-2 coats Pro Industrial Multi-Surface Acrylic

Concrete Block (CMU):

1 coat Pro Industrial Heavy Duty Block Filler
or Loxon Acrylic Block Surfer
1-2 coats Pro Industrial Multi-Surface Acrylic

Concrete-Masonry:

1 coat Loxon Concrete & Masonry Primer (if needed)
or 1 coat Loxon Conditioner (if needed)
2 coats Pro Industrial Multi-Surface Acrylic

Drywall:

1 coat ProMar 200 Zero V.O.C. Primer
1-2 coats Pro Industrial Multi-Surface Acrylic

Galvanizing:

2 coats Pro Industrial Multi-Surface Acrylic

Pre-Finished Siding: (Baked-on finishes)

1 coat Pro Industrial Bond-Plex Waterbased Acrylic
or Pro Industrial DTM Bonding Primer
1-2 coats Pro Industrial Multi-Surface Acrylic

Wood, exterior:

1 coat Exterior Wood Primer
1-2 coats Pro Industrial Multi-Surface Acrylic

Wood, interior:

1 coat Premium Wall & Wood Primer
1-2 coats Pro Industrial Multi-Surface Acrylic

*Primer recommended for best performance.

Pro Industrial™

Multi-Surface Acrylic Semi-Gloss

SURFACE PREPARATION

WARNING! If you scrape, sand or remove old paint, you may release lead dust. LEAD IS TOXIC. EXPOSURE TO LEAD DUST CAN CAUSE SERIOUS ILLNESS, SUCH AS BRAIN DAMAGE, ESPECIALLY IN CHILDREN. PREGNANT WOMEN SHOULD ALSO AVOID EXPOSURE. Wear a NIOSH-approved respirator to control lead exposure. Clean up carefully with a HEPA vacuum and a wet mop. Before you start, find out how to protect yourself and your family by contacting the National Lead Information Hotline at 1-800-424-LEAD or log on to www.epa.gov/lead.

Do not use hydrocarbon solvents for cleaning.

Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Existing peeled or checked paint should be scraped and sanded to a sound surface. Glossy surfaces should be sanded dull. Stains from water, smoke, ink, pencil, grease, etc. should be sealed with the appropriate primer-sealer. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Iron & Steel - Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6. Primer recommended for best performance.

Aluminum - Remove all oil, grease, dirt, oxide, and other foreign material per SSPC-SP1.

Galvanizing - Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1. When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP16 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2. Prime the area the same day as cleaned.

Concrete Block - Surface should be thoroughly clean and dry. Air, material, and surface temperatures must be at least 55°F (13°C) before filling. Use Pro Industrial Heavy Duty Block Filler or Loxon Acrylic Block Surfer. The filler must be thoroughly dry before topcoating.

Masonry - All masonry must be free of dirt, oil, grease, loose paint, mortar, masonry dust, etc. Clean per SSPC-SP13/Nace 6/ ICRI No. 310.2R, CSP 1-3. Poured, troweled, or tilt-up concrete, plaster, mortar, etc. must be thoroughly cured at least 30 days at 75°F. Form release compounds and curing membranes must be removed by brush blasting. Brick must be allowed to weather for one year prior to surface preparation and painting. Prime the area the same day as cleaned. Weathered masonry and soft or porous cement board must be brush blasted or power tool cleaned to remove loosely adhering contamination and to get to a hard, firm surface. Apply one coat Loxon Conditioner, following label recommendations.

Wood - Surface must be clean, dry, and sound. Prime with recommended primer. No painting should be done immediately after a rain or during foggy weather. Knots and pitch streaks must be scraped, sanded and spot primed before full coat of primer is applied. All nail holes or small openings must be properly caulked. Sand to remove any loose or deteriorated surface wood and to obtain a proper surface profile.

SURFACE PREPARATION

Previously Painted Surface - If in sound condition, clean the surface of all foreign material. Smooth, hard or glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, additional abrasion of the surface and/or removal of the previous coating may be necessary. Retest surface for adhesion. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above. Recognize that any surface preparation short of total removal of the old coating may compromise the service length of the system.

Mildew - Prior to attempting to remove mildew, it is always recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions may be advised.

Mildew may be removed before painting by washing with a solution of 1 part liquid bleach and 3 parts clean water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry before painting. Wear protective eyewear, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach-water solution.

PERFORMANCE

System Tested: (unless otherwise indicated)

Substrate: Steel

Surface Preparation SSPC-SP10

Finish: 2 coats Pro Industrial Multi-Purpose Acrylic B66W01551, 2.5 D.F.T.

Adhesion:

Method: ASTM D4541
Result: 1385 p.s.i.

Abrasion Resistance:

Method: ASTM D4060, CS17 wheel,
1000 cycles, 1000 mg load
Result: 52.7 mg loss

Corrosion Weathering*:

Method: ASTM D5894, 5 cycles
Result: Rating 10 per ASTM D714 for blistering
Rating 8 per ASTM D1654 for corrosion

Direct Impact Resistance:

Method: ASTM D2794
Result: 30 inch pound

Dry Heat Resistance:

Method: ASTM D2485
Result: 300°F

Flexibility:

Method: ASTM D522, 1/8 inch mandrel
Result: Pass

Pencil Hardness:

Method: ASTM D3363
Result: 4H

Water Vapor Permeance (US):

Method: ASTM D1653
Result: 24.77 grains/(hr ft² in Hg)

*over Pro Industrial Pro-Cryl Primer.

SAFETY PRECAUTIONS

Before using, carefully read **CAUTIONS** on label.

Refer to the Safety Data Sheets (SDS) before use.

FOR PROFESSIONAL USE ONLY.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

CLEANUP INFORMATION

Clean spills, spatters, hands and tools immediately after use with soap and warm clean water. After cleaning, flush spray equipment with compliant cleanup solvent to prevent rusting of the equipment. Follow manufacturer's safety recommendations when using solvents.

HOTW 3/06/2025 B66W01551 13 45
FRC

SCOREBOARD AND ASSOCIATED EQUIPMENT

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Division 26 – Electrical

1.2 SCOPE OF WORK

- .1 Fabricate, supply and install a complete scoreboard, control center, shot clocks and other accessories for a complete functional installation and as described herein.
- .2 Supply and install a digital signage system for room assignments and scheduling display as described herein.
- .3 Coordinate with Division 26 contractor for conduit routing and power receptacle placement.
- .4 Contractor to provide all means to perform installation including rental of appropriate aerial lifts.
- .5 Provide all equipment, personnel, & resources necessary to facilitate system engineering, installation, testing, documentation, end-user training, and after-sales service/support.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittals. Ensure submission includes the following:
 - .1 Product data for scoreboards, controls, and accessories. Include descriptions of control functions.
 - .2 Shop drawings showing locations, face layout, dimensions, construction, electrical wiring diagrams, interface with structural supports, and method of anchorage.
 - .3 Finish Samples
 - .4 Copy of guarantee
 - .5 Manufacturer's installation instructions

SCOREBOARD AND ASSOCIATED EQUIPMENT

PART 2 **PRODUCTS**

2.1 **GENERAL PRODUCT SPECIFICATIONS**

- .1 All components shall meet local building codes and will be CSA and/or ULC approved with said marking clearly visible. The Contractor will be responsible at no cost to Owner for replacing all components found not to be CSA or UL-C approved or the Contractor will be responsible for obtaining the CSA or UL-C approvals at no extra cost to the Owner.
- .2 Scoreboard, controllers, timers, and digital signage system shall be supplied by one manufacturer – OES Scoreboards Trevor Trotman – 647-408-9321; www.oes-scoreboards.com; dplant@oes-inc.com
- .3 Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01 25 00 - Substitution Procedures.

2.2 **MATERIALS**

- .1 Enclosures: enclosures shall be made out of 5052-H32 aluminum with 1.6 mm thick front and back faces and 2.3 mm thick top, bottom and sides.
- .2 Finish: Tiger Powder Coat all sides, front and back of scoreboard. Color to later selection.
- .3 Fasteners, screws, and other exposed hardware: Corrosion resistant coating or stainless steel.
- .4 Digit covering: Poly-carbonate.
- .5 Digits: Seven segment digit control per digit display. Conformal Coating: acrylic coating for moisture resistant use in outdoor and some indoor application with high humidity like hockey areas.
- .6 PCB: Digit boards shall be FR4 fire rated fiber glass with 1 OZ copper boards. All digit and indicator boards shall use a black silk screen and solder mask on the face of the board to help hide the board from view.
- .7 LEDs: The score board shall use LEDs for digits, dots, arrows, team names and possession indicators. The LEDs shall be equipment with the ColorCast Pro feature to allow for variation in digit color choices, customization of colours, and to allow the LEDs to flash at user selected events.
- .8 LED indoor: Indoor LEDs will be SMT with a viewing angle of 120°. LEDs to have a rated life/viewing angle of 100,000 hours/120°.
- .9 Viewing Distance: Digits shall have a clear viewing distance of approximately 15.24m for every 25mm of digit size.
- .10 Digit Control boards: Control boards shall be conformal coated.

SCOREBOARD AND ASSOCIATED EQUIPMENT

- .11 Communication: Scoreboard and controller be connected using Belden 9502 or equivalent shielded twisted paired wiring in a daisy chain configuration from the communication source as shown on contract drawings. Connector used for connection of communication shall be a 4-pin XLR type connectors. The scoreboard and controller shall use standard RS-485 differential current driven communications. All wiring required for a complete and operational system shall be supplied as part of this package.
- .12 Scoreboard Horn: Horn shall produce 100dBa at 3.5m, shall have an electrical input of 120 VAC, 60 Hz at 0.18 Amps and shall be 100mm in width, 100mm in height, and 67.5mm in depth. The horn is made with a stainless steel diaphragm.

2.3 SCOREBOARD

- .1 Type: indoor, electronic Hockey Scoreboard with LED Digits for time (88:88), scores (88), period (8), player (88) and penalty (8:88).
- .2 Size: 5,486mm (W) x 1,168mm (H) x 100mm (D)
- .3 Approximate Weight: 113 kg
- .4 Digit Size:
 - .1 355mm high – “TIME”, “HOME”, & “GUEST”
 - .2 254mm high – “PERIOD”, “PLAYER PENALTY” (Player Number and Penalty Time)
- .5 White on black captions:
 - .1 150mm high – “HOME”, “GUESTS”
 - .2 100mm high – “PLAYER”, “PENALTY”
 - .3 75mm high – “1”, “2”, “PERIOD”
- .6 Power Requirement: 110 VAC, 60 Hz, 5A
- .7 Communication input: RS485 (XLR 4 M & F)
- .8 Connectors: 1 x CN137C (XLR4F) and 1 x CN137D (XLR4M)
- .9 Standard of Acceptance:

OES Model M6018CICV – 18' Hockey Scoreboard

RFD-XB24 – Wireless Radio Kit

ISC Edge – Touchscreen Console Controller

ISC Edge Carry Case

SCOREBOARD AND ASSOCIATED EQUIPMENT

2' High Ad Panel

2.4 CONTROL CENTRE

- .1 Type: Wired, microprocessor based operator's control center designed to operate different models of scoreboard and accessories by interchange of keyboard overlay and changing user accessible software settings.
- .2 Console: One piece Diecast aluminum case – 318 mm x 210 mm x 100 mm.
- .3 Features:
 - .1 Microprocessor and quartz crystal based, providing timing accuracy.
 - .2 4X8 key and 3X4 keyboards with separate dedicated run, stop and horn keys.
 - .3 Interchangeable Keyboard overlays for 4X8 keyboard used for different sports.
 - .4 Battery backed memory Game data saved on power off position.
 - .5 130 mm Full graphic backlit display capable of displaying 6 line of information.
 - .6 RS485 2-wire communication port for game data.
 - .7 USB communication port for diagnostics and upgrades.
 - .8 Communication port for multi-controller setups.
 - .9 Two configurable remote input ports.
 - .10 7.6 m control cable with connectors.
 - .11 Timer features: Time of day display, multiple time out timers with warning, interval horn, upcount auto stop with horn, and 1/10th second display during last minute.
 - .12 9 level Dimmer control for scoreboard.
- .4 Power requirements: 120 volts, 20 watts, 50/60 Hz, 1 amp fuse.
- .5 Weight: 2 kg
- .6 Carrying Case: Carrying case for control center, cable, and 1 x ISCREM remotes
 - .1 Dimensions: 432 mm x 300 mm x 163mm
 - .2 Construction: Black polyethylene with foam padded interior, mechanical latches, and hinges.
- .7 Remote Switches: Remote control switches with one toggle and one bush button for operation of the time clock.
- .8 Standard of Acceptance: OES ISC Edge – Touchscreen Console Controller with ISC Edge Carry Case

SCOREBOARD AND ASSOCIATED EQUIPMENT

2.5 SHOT CLOCKS (NOT APPLICABLE)

- .1 Supply one (1) set of shot clocks as described as follows:
 - .1 Dimensions: 500mm x 356mm x 152mm
 - .2 Approximate Weight: 6.8 kg
 - .3 Electrical: 110Vac, 60 Hz, 1 A
 - .4 Communication Input: RS485
 - .5 Enclosure: Black Aluminum with mounting tabs and horn included in each enclosure.
 - .6 Vinyl Colour: White
 - .7 Digits: Shot Clock (88) in 250mm Red
 - .8 Standard of Acceptance: OES SHOTS10IRL

2.6 TIME OF DAY CLOCKS

- .1 Supply one time of day clock as described as follows:
 - .1 Dimensions: 250mm high digits
 - .2 Approximate Weight: 4.54 kg
 - .3 Enclosure: Black aluminum with mounting tabs
 - .4 LED Digits: 4" White LED digits and Colon for time (88:88) covered with shatter resistant Lexan
 - .5 Electrical: 110Vac, 60Hz, 0.25A
 - .6 Communication Input: RS485
 - .7 Standard of Acceptance: OES 10" Digit Time of Day Clock

2.7 DIGITAL SIGNAGE SYSTEM (NOT APPLICABLE)

- .1 Supply and Install a digital signage system capable of displaying room assignments or event information on various television displays.
- .2 System shall be capable of displaying RSS feeds, local weather features, videos streaming, scrolling message banner or schedules and shall be accessible from a remote location.
- .3 System shall include all hardware required to display information onto seven displays as shown on construction drawings.
- .4 System to include content & scheduling software, one (1) HDMI over IP transmitter, seven (7) HDMI over IP receiver, computer, and Windows OS license.
- .5 Standard of Acceptance: OES VENRUNPRO, one (1) XF10F HDMI over IP transmitter and seven (7) XF810G HDMI over IP receiver.
- .6 System to be supplied with installation and 2 hrs. of onsite training of the system.

SCOREBOARD AND ASSOCIATED EQUIPMENT

PART 3 EXECUTION**3.1 INSTALLATION GENERAL**

- .1 Follow manufacturers' instructions for installing, operating, configuring, and programming their equipment. Do not perform modifications to equipment that would void its warranty.
- .2 Install and terminate all cables and interconnect all equipment and components in accordance with approved drawings.
- .3 All video, and control system signal cables shall be free from kinks, sharp bends, tears, stress, etc. that could degrade their performance.
- .4 System components and related wiring shall be located to minimize electromagnetic and electrostatic hum, spurious oscillation, wiring length, and shall provide proper ventilation, safety, and convenience for the operator.
- .5 Lifting of ground on any AC plug is not acceptable.

3.2 TESTING

- .1 Upon system completion, Contractor shall test the entire system to ensure the system is fully operational. This systems testing shall be completed prior to commissioning with the Consultant.
- .2 The system shall perform, as a minimum, as specified within these specifications. It is the Contractor's responsibility to correct all system problems and deficiencies.
- .3 Each video source shall be tested to each video display. Ensure that video display picture quality is at acceptable standards and is free any distortion including hum bars.
- .4 Test and troubleshoot all aspects of the Control System operations.
- .5 Perform any necessary programming or configuration of the system to ensure a fully operational package.

3.3 TRAINING

- .1 The Contractor to provide a qualified representative for a minimum two-hour training session to the Owner at the Owner's location. The exact date of the session shall be coordinated with Owner's schedule and availability.

SCOREBOARD AND ASSOCIATED EQUIPMENT

END OF SECTION

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL**1.1 RELATED REQUIREMENTS**

- .1 Section 07 62 00 - Sheet Metal Flashing and Trim
- .2 Section 07 84 00 - Firestopping
- .3 Section 09 01 90.63 - Interior Repainting
- .4 Section 09 91 00.08 - Painting for Minor Works
- .5 Section 09 91 23 - Interior Painting
- .6 Section 23 08 00 - Commissioning of HVAC
- .7 Section 26 05 00 - Common Work Results for Electrical
- .8 Section 26 08 00 - Commissioning of Electrical Systems

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - .1 ANSI/ASHRAE 62.1, Ventilation and Acceptable Indoor Air Quality.
 - .2 ANSI/ASHRAE 183 Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Coordinate with Section 07 62 00 - Sheet Metal Flashing and Trim for installation of flashing at HVAC systems penetrating building envelope.
 - .2 Coordinate with Section 07 84 00 - Firestopping for through penetration firestopping or smoke seal systems.
 - .3 Coordinate with Section 26 05 00 - Common Work Results for Electrical for electrical connections for mechanical equipment.
- .2 Pre-installation meetings: Conduct a site meeting in accordance with Section 01 31 19 - Project Meetings and attended by the contractor administrator and appropriate Subcontractors to:
 - .1 Verify project requirements.
 - .2 Review delivery, storage, and handling requirements. .3 Review installation and substrate conditions.
 - .3 Coordinate with other Subcontractors.

COMMON WORK RESULTS FOR HVAC

- .4 Review manufacturer's instructions and warranty requirements.

1.4 ACTIONS AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittals.
- .2 Shop Drawings:
 - .1 Submit shop drawings.
 - .2 Indicate on drawings:
 - 1. Show location of each component, dimensioned plans and elevations, large scale details, mounting arrangements, operating and maintenance clearances, and attachment details.
 - 2. Show locations and sizes of framing, blocking, or backing required for wall mounting, including concealed items specified in other sections.
 - .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance codes.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Operation and Maintenance Data:
 - .1 Include, in the operation and maintenance manual, manufacturer's operating and maintenance instructions and recommended cleaning materials and methods.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

COMMON WORK RESULTS FOR HVAC

- .4 Operation instruction for systems and components.
- .5 Description of actions to be taken in the event of equipment failure.
- .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.
 - .2 Make changes as required and re-submit as directed by Consultant.
- .6 Additional Data:
 - .1 Prepare and insert into operation and maintenance manual additional data when the need for it becomes apparent during specified demonstrations and instructions.
- .7 Site Records:
 - .1 Mark changes as work progresses and changes occur.
 - .2 Transfer information to as-built drawings, revising to show work as actually installed.
 - .3 Make available for reference purposes and inspection.
- .8 As-built drawings:

COMMON WORK RESULTS FOR HVAC

- .4 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
- .5 Identify each drawing in lower right-hand corner in letters at least 13 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .6 Submit to Contract Administrator for approval and make corrections as directed.
- .7 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .8 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installers and maintenance personnel: Trained and authorized by respective equipment manufacturers

1.7 DELIVERY, STORAGE, AND HANDLING

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

COMMON WORK RESULTS FOR HVAC

PART 2 PRODUCTS**2.1 PERFORMANCE/DESIGN CRITERIA**

- .1 System sizing guidelines:
 - .1 ASHRAE 183.
- .2 Ventilation design and performance:
 - .1 Comply with CAN/CSA-F326 or ANSI/ASHRAE 62.1.
- .3 Ensure all connected HVAC system components, including controls, are fully compatible and integrable.
- .4 Design and install system with consideration to access to main components for repairs, replacements, and alterations throughout the service life of the building.
- .5 Ensure plumbing penetrations for the purpose of running HVAC ductwork and piping do not compromise structural integrity.
- .6 Provide CSA or ULC certified heating and cooling appliances.

PART 3 EXECUTION**3.1 PAINTING, REPAIRS AND RESTORATION**

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

3.2 SYSTEM STARTUP

- .1 Perform in accordance with:
 - .1 Section 01 91 13 - General Commissioning Requirements.
 - .2 Section 23 08 00 - Commissioning of HVAC.
 - .3 Section 26 08 00 - Commissioning of Electrical Systems.

3.3 SYSTEM CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning and:
 - .1 Clean interiors and exteriors of all systems.
- .2 Waste management:
 - .1 Manage waste in accordance with Section 01 74 19 - Waste Management and Disposal

COMMON WORK RESULTS FOR HVAC

3.4 DEMONSTRATION

- .1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, and as-built drawings as part of instruction materials.

3.5 SITE CLEANING

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

3.6 PROTECTION

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

END OF SECTION

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL**1.1 SUMMARY**

- .1 Section Includes:
 - .1 Electrical motors, drives and guards for mechanical equipment and systems.
 - .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

1.2 REFERENCES

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 National Electrical Manufacturers Association (NEMA).
 - .1 ANSI/NEMA MG 1, Motors and Generators
 - .2 NEMA MG 11, Energy Management Guide for Selection and Use of Single-Phase Motors

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's product literature, specifications and datasheet, including product characteristics, performance criteria, wiring characteristics and limitations.
 - .2 Submit a complete list of HVAC motors and identify their locations before beginning installation of motors.
 - .3 Instructions: Submit manufacturer's installation instructions.
- .3 Shop Drawings:
 - .1 Submit drawings, stamped and signed by a professional engineer, indicating work of other Subcontractors, and identify areas that might have congestion or conflicts.
 - .2 When requested, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Submit maintenance data for motors, drives, and guards and incorporate into operation and maintenance manual.
- .3 Submit field test reports.

1.5 MAINTENANCE MATERIALS SUBMITTALS

- .1 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals, unless otherwise indicated in other Division 23 Sections.

1.6 QUALITY ASSURANCE

- .1 Where multiple motors are required for the same application, provide the same manufacturer's motor model for all identical conditions.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Perform packing, shipping, handling and unloading in accordance with Section 01 61 00 – Common Product Requirements.
 - .2 Protect motors from dust and corrosion.
- .2 Waste Management and Disposal:
 - .1 Perform Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 PRODUCTS**2.1 GENERAL**

- .1 Motors to be premium efficiency, in accordance with local hydro company standards and the requirements of ANSIASHRAE/IES 90.1.

2.2 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 1/2 HP: NEMA MG11, speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

- .3 Motors 1/2 HP and larger: NEMA MG1, Class B, 1.15 service factor, squirrel cage induction, premium efficiency, speed as indicated, continuous duty, enclosure as indicated, ball bearing, maximum temperature rise 40° C, 3 phase, 575 V, unless otherwise indicated, for inverted duty for variable frequency drives.
- .4 Motors located in electrically classified areas to be explosion-proof and have appropriate rating for use in designated area.

2.3 TEMPORARY MOTORS

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Contract Administrator for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.
- .3 For motors under 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave to be determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 – Closeout Submittals.

2.5 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives:
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
- .3 Provide means to permit lubrication and use of test instruments with guards in place.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
 - .2 Securely fasten in place.
 - .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

PART 3 **EXECUTION****3.1** **MANUFACTURER'S INSTRUCTIONS**

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

3.2 **INSTALLATION**

- .1 Fasten securely in place.
- .2 Locate motors with adequate access space to allow safe and unimpeded maintenance services.
- .3 Install with minimum interference with other equipment and services.
- .4 Install belt guards to allow movement of motors for adjusting belt tension.
- .5 Fasten motors and equipment securely in place.
- .6 Replace temporary motors with specified motors.

3.3 **CLEANING**

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

END OF SECTION

VIBRATION AND SEISMIC CONTROLS FOR HVAC

GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Vibration isolation materials and components, seismic control measures and their installation.

1.2 REFERENCE STANDARDS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 National Fire Protection Association (NFPA).
- .3 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Shop drawings: Submit drawings.
 - .2 Provide separate shop drawings for each isolated system complete with performance and product data.
 - .3 Provide detailed drawings of seismic control measures for equipment and piping.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:

VIBRATION AND SEISMIC CONTROLS FOR HVAC

- .1 Do construction occupational health and safety in accordance with Section 01 35 30 – Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling, and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 – Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Waste Management and Disposal: separate waste materials for reuse and recycling.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Size and shape of bases, type and performance of vibration isolation as indicated.

2.2 SEISMIC CONTROL MEASURES

- .1 General:
 - .1 Following systems and/or equipment to remain operational during and after earthquakes:
 - .1 Heating System.
 - .2 Seismic control systems to work in every direction.
 - .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .4 Drilled or power-driven anchors and fasteners are not permitted.
 - .5 No equipment, equipment supports or mounts to fail before failure to structure.
 - .6 Supports of cast iron or threaded pipe not permitted.
 - .7 Seismic control measures not to interfere with integrity of firestopping.

VIBRATION AND SEISMIC CONTROLS FOR HVAC

- .2 Static Equipment:
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Suspended equipment:
 - .1 Use one or more of following methods depending upon site conditions or as indicated:
 - .1 Cable restraint system.
 - .3 Seismic restraints:
 - .1 Cushioning action gentle and steady.
 - .2 Never reach metal-like stiffness.
- .3 Vibration Isolation Equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation system. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
 - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.
 - .3 As indicated.
- .4 Bracing methods:
 - .1 Approved by consultant.
 - .2 Structural angle or channels.
 - .3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cable connections to reduce shock loads.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

VIBRATION AND SEISMIC CONTROLS FOR HVAC

3.2 INSTALLATION

- .1 Seismic control measures to meet requirements of NBC, OBC and local governing codes, as applicable.
- .2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .3 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 CLEANING

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

END OF SECTION

TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL**1.1 SUMMARY**

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

1.2 REFERENCE STANDARDS

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - .1 ANSI/ASHRAE Standard 111, Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems
- .2 Associated Air Balance Council (AABC):
 - .1 ANSI/AABC National Standards for Total System Balance
- .3 National Environmental Balancing Bureau (NEBB):
 - .1 NEBB Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
 - .1 SMACNA 1780 - HVAC Systems - Testing, Adjusting and Balancing

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
 - .1 Test and balance each system independently and where interlocked with other systems, in unison with those systems.
- .2 Scheduling:
 - .1 Schedule time required for work of this Section (including repairs, and re-testing) into Project schedules to ensure completion before scheduled completion date.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit proposed methodology and procedures for performing work of this Section.
- .2 Before starting work of this Section, submit names and documented qualifications of personnel to perform work of this Section.

TESTING, ADJUSTING AND BALANCING

- .3 Submit list of instruments and include serial numbers and calibration certificates.
- .4 Preliminary Report: Submit for checking and approval by consultant before submission of formal report. Include:
 - .1 Details of instruments used
 - .2 Details of procedures employed
 - .3 Calculations procedures
 - .4 Summaries
- .5 Testing and Balancing Report:
 - .1 Format in accordance with ANSI/AABC National Standards for Total System Balance, ANSI/ ASHRAE 111, NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems or SMACNA 1780 and show results in SI units.
 - .2 Include:
 - .1 Project record drawings
 - .2 System schematics
 - .3 Submit electronic copies of the report to consultant, in English, complete with index tabs.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements: Test and balance systems regulated by codes to the satisfaction of the authority having jurisdiction.
- .2 Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience, certified by AABC or NEBB.
- .3 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

PART 2 PRODUCTS**2.1 NOT USED****PART 3 EXECUTION****3.1 PREPARATION**

- .1 During construction, coordinate location and installation of measurement and balancing devices, equipment, accessories, measurement ports, and fittings.
- .2 Calibrate instruments in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

TESTING, ADJUSTING AND BALANCING

- .3 Calibrate instruments within three (3) months of work. Submit certificate of calibration.
- .4 Notify Consultant seven (7) days before start of work.

3.2 VERIFICATION OF CONDITIONS

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

3.3 SYSTEM START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified in equipment Sections.

TESTING, ADJUSTING AND BALANCING

3.4 ADJUSTING

- .1 Operate systems as required to perform the work and as required by consultant for verification of reports.
- .2 Test to verify proper and safe operation, to determine actual point of performance, and to evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .3 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .4 Balance systems and equipment to regulate flow rates to match load requirements over full specified operating ranges.
- .5 Equipment Noise: Measure vibration and noise from equipment as scheduled.

3.5 AIR SYSTEMS

- .1 Test and balance air systems to ANSI/AABC National Standards for Total System Balance, ANSI/ASHRAE 111, NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, or SMACNA 1780.
- .2 Take measurements as appropriate for application, including but not limited to air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, and vibration.
- .3 Document locations of equipment measurements in report, including:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
 - .3 Main ducts, main branch, sub-branch, and terminals (grille, register or diffuser).
 - .4 Smoke Management Systems: Test for proper operation of all smoke and fire dampers, detectors, sensors, installed as component parts of air systems specified in Division 23.

3.6 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 Laboratory HVAC systems: plus 10%, minus 0%.
 - .2 Other HVAC systems: plus or minus 5%.
 - .3 Hydronic systems: plus or minus 10 %.
 - .4 Accuracy: plus or minus 2% of actual values.

TESTING, ADJUSTING AND BALANCING

3.7 SITE QUALITY CONTROL

- .1 Reported results are subject to verification by Consultant. Verify number and location of results as directed by Consultant.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Repeat work as required until results fall within specified performance values.

3.8 CLOSEOUT ACTIVITIES

- .1 After work is completed to satisfaction of Consultant replace drive guards, close access doors, lock devices in set positions, and ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

3.9 MAINTENANCE

- .1 Measure WBT (or %RH), noise criteria NC levels, air flow patterns, DBT, air velocity, in occupied zones of following areas:
 - .1 Ice Rink.
 - .2 Bleachers.
 - .3 Dehumidifier area.
 - .4 Lobby
- .2 Participate in systems checks twice during Warranty Period:
 - .1 Approximately three (3) months after acceptance and
 - .2 Within one (1) month of termination of Warranty Period.

END OF SECTION

COMMISSIONING OF HVAC

PART 1 GENERAL**1.1 SUMMARY****.1 Section Includes:**

- .1 This section specifies the Contractor's responsibilities related to commissioning (Cx) of heating, ventilation and air-conditioning (HVAC) systems and their contribution to the overall Cx work specified in Division 01.
- .2 Construction Team: Contractor is responsible for performing tests and verification activities specified in Division 23 and submitting reports to Departmental Representative.

1.2 RELATED SECTIONS

- .1 Section 23 05 93 – Testing, Adjusting and Balancing for HVAC

1.3 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - .1 ASHRAE Guideline 1.2, Technical Requirements for the Commissioning Process for Existing HVAC&R Systems and Assemblies
- .2 CSA Group (CSA):
 - .1 CSA Z320, Building commissioning
 - .2 CSA Z5000, Building commissioning for energy using systems

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 HVAC Cx Schedule:
 - .1 Submit proposed schedule before start of Cx conferences indicating key activities critical to the Cx process including:
 - .1 Inspection of HVAC systems.
 - .2 Testing, flushing, and cleaning of HVAC piping and ductwork.
 - .3 Testing, adjusting, and balancing (TAB) activities in coordination with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
 - .4 Cx phases: Static verification, start-up, FPT, systems orientation, O&M manuals submissions, training sessions.
 - .5 Integrated testing activities.
 - .6 Review activities to be completed by other participants: Departmental Representative.
 - .2 Review the proposed schedule through the course of the Work and notify the Departmental Representative of modifications required.

COMMISSIONING OF HVAC

- .3 Cx Forms: Contractor to review and complete forms for documenting static verification and start-up activities in accordance with Section 01 91 13 – General Commissioning Requirements
- .4 Testing Equipment: Submit a list of proposed testing equipment for performing HVAC Cx activities and related tests in accordance with [Section 01 91 13 – General Commissioning Requirements].
- .5 Site Quality Control Submittals: Submit manufacturers' written certificates and reports demonstrating compliance of Work, as specified in Division 23.
- .6 Training Program: Submit proposed training program and materials in accordance with Section 01 91 13 – General Commissioning Requirements.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit O&M data and as-built information in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Site Modifications: Record changes to installations, system configuration or controls that were made during the Cx process to meet the required performance of HVAC equipment and systems.

1.6 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Construction Team – Cx Representative:
 - .1 To be acceptable to Department Representative with the following qualifications:
 - .1 Technical personnel with a minimum of 5 years of documented experience in construction, testing, and Cx of HVAC systems.
 - .2 Site supervisor or project manager within the construction team, with direct responsibilities for supervising the execution of work specified in Division 23.

PART 2 PRODUCTS**2.1 NOT USED****PART 3 EXECUTION****3.1 EQUIPMENT**

- .1 Furnish special tools or equipment required for:
 - .1 Verifying or adjusting equipment/system components.

COMMISSIONING OF HVAC

- .2 Accessing equipment, enclosures, or control cabinets.
- .3 Interfacing with equipment controls or system integrated diagnostics.
- .2 Furnish instruments and equipment required to perform testing and validate performance of HVAC systems through the Cx process or as specified in Division 23.

3.2 STATIC VERIFICATION

- .1 Perform static verification of components, equipment, and systems in accordance with Section 01 91 13 – General Commissioning Requirements and complete the approved Cx Forms in coordination with performing the following activities:
 - .1 Verify installation and connection of equipment, sub-systems, and systems.
 - .2 Confirm proper location of valves, sensors, dampers and control components in accordance with design and O&M requirements.
 - .3 Confirm accessibility to HVAC equipment and components for inspection and O&M activities.
 - .4 Conduct hydrostatic pressure testing of HVAC piping and report results.
 - .5 Conduct pressure testing and leakage tests of HVAC ductwork and report results.
 - .6 Record equipment and systems information including manufacturer, model number, serial number, and rated capacities.
 - .7 Confirm completion of labelling and identification of piping, valves, dampers, ductwork, equipment, and control components.
 - .8 Confirm completion and documentation of equipment prestart-up tests, including manufacturer's factory tests.
 - .9 Confirm adequate protection of HVAC systems during construction.
 - .10 Confirm that thermal insulation of HVAC systems and equipment is completed in accordance with design requirements.
 - .11 Confirm seismic and vibration controls for HVAC equipment/systems are installed in accordance with design details and manufacturer's recommendations.
- .2 Site Quality Control: Commissioning authority (CxA) to conduct random verification on-site to validate the accuracy of static verification reporting. Contractor to assist the CxA on site to review selected samples of performance representing up to 30% of the overall installation.

3.3 START-UP

- .1 Perform start-up of equipment and systems in accordance with [Section 01 91 13.13 – Commissioning Plan] [Section 01 91 13 – General Commissioning Requirements] and complete the approved Cx Forms in coordination with performing the following activities:

COMMISSIONING OF HVAC

- .1 Flushing and cleaning of HVAC piping.
- .2 Cleaning of HVAC ductwork.
- .3 Contractor start-up of equipment.
- .4 Electrical start-up of equipment including site electrical tests and verification of overloads and motor rotation.
- .5 Confirm equipment electrical wiring diagrams are provided within the unit's electrical or controls enclosure.
- .6 Start-up of chemical water treatment systems.
- .7 Visual and mechanical inspections following equipment start-up.
- .8 Verify proper staging control of multi-stage equipment and modulation of equipment supplied with variable control.
- .9 Verify operation of safety controls and interlocks.
- .10 Complete inspections required by the AHJ.
- .11 Setup and adjustment of system and expansion tank pressures on hydronic networks.
- .12 Setup and adjustment of glycol feed systems.
- .13 Verify temperature performance of hydronic and ventilation systems.
- .14 Verify refrigerant charges.
- .2 Site Quality Control: Departmental Representative and the AHJ, if required, will witness start-up activities for selected equipment. Notify the Departmental Representative and the AHJ of start-up activities in accordance with Section 01 91 13 – General Commissioning Requirements.

3.4 FUNCTIONAL PERFORMANCE TESTING FPT

- .1 Perform FPT on HVAC equipment and systems in accordance with Section 01 91 13 – General Commissioning Requirements, ASHRAE Guideline 1.2 and as directed by the Departmental Representative.
- .2 Operate equipment as directed by Departmental Representative to demonstrate and validate that equipment, sub-systems, and systems function and perform in accordance with design requirements.
- .3 FPT activities include:
 - .1 Verify proper operation of HVAC systems and equipment in the following modes of operation:
 - .1 Systems operation on normal power.
 - .2 Systems operation on emergency power.
 - .3 Normal operation – no alarm conditions.
 - .4 Systems operation in alarm condition.
 - .5 Manual operation mode.
 - .6 Automatic operation mode.

COMMISSIONING OF HVAC

- .2 Verify operation of safety cut-outs, alarms, and interlocks.
- .3 Confirm alarms are generated and transmitted effectively to the intended notification system (for example, pilot light, control panel, building automation system (BAS), or remote surveillance system).
- .4 Confirm capacities of heating and cooling systems at design conditions: first at near winter design conditions and then under near summer design conditions.
- .5 Optimize operation of systems involved in energy control strategies such as peak shaving and load shifting.
- .6 Verify that the proper schedules were configured for each HVAC equipment and system and confirm that they are disabled or set back when not required.
- .7 Confirm that airflow quantities in ventilation systems meet design and special requirements, specifically with regards to indoor air quality, building/space pressurization and energy optimization.
- .8 Verify TAB results [in coordination with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC].
- .9 Verify operation of HVAC equipment running on dual energy sources and optimize controls responsible for switching energy sources.
- .10 Confirm that simultaneous heating and cooling is not occurring at an equipment or system level.
- .11 Optimize operating sequences, control parameters, and setpoints for HVAC systems with an emphasis on energy management, including the following:
 - .1 Ventilation and hydronic free cooling strategies.
 - .2 Setpoints for controlling pressures and temperatures in ventilation and hydronic systems.
 - .3 Operation of variable flow ventilation and hydronic systems.
 - .4 Setpoint optimization in ventilation systems:
 - .1 Supply/return air temperature reset strategies.
 - .2 Supply air static pressure reset strategies.
 - .5 Optimization strategies in hydronic systems:
 - .1 Loop temperature reset strategies in hydronic networks.
 - .2 Equipment staging conditions.
 - .3 Outdoor temperature reset strategies.
 - .6 Occupied and unoccupied zone temperature setpoints.
 - .7 Energy recovery system operation.
- .12 Adjust system response to:
 - .1 Power failure.
 - .2 Loss of natural gas service.
 - .3 Poor outdoor air quality.
 - .4 Loss of domestic water supply.

COMMISSIONING OF HVAC

3.5 COMMISSIONING OF INTEGRATED SYSTEMS

- .1 Operate equipment as directed by Departmental Representative to perform commissioning of integrated systems.

3.6 SITE QUALITY CONTROL

- .1 Manufacturer's Site Services: Obtain written certificates and reports from manufacturer verifying compliance of Work and submit Manufacturer's Site Reports as described in ACTION AND INFORMATIONAL SUBMITTALS in this section.
- .2 Provide manufacturer's site services to complete start-up activities and assist FTP as specified in Division 23.

3.7 CLOSEOUT ACTIVITIES

- .1 Corrections: Provide equipment, materials, and labour required to correct installation or equipment deficiencies identified through the commissioning process.

END OF SECTION

DAMPERS – OPERATING

PART 1 GENERAL**1.1 SUMMARY****.1 Section Includes:**

- .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.

1.2 REFERENCES**.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)**

- .1 Safety Data Sheets (SDS).

1.3 SUBMITTALS**.1 Product Data:**

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

- .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Indicate the following:

- .1 Performance data.
- .2 Specifications

- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

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

- .2 Instructions: submit manufacturer's installation instructions.

- .3 Closeout Submittals:

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

1.4 QUALITY ASSURANCE

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

- .2 Certificates:

DAMPERS – OPERATING

- .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS**2.1 MULTI-LEAF DAMPERS**

- .1 Parallel blade type as indicated.
- .2 Structurally formed steel or extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel or extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Electronic Control Damper Operators
 - .1 To following requirements:
 - .2 Direct coupled or push-pull proportional type as required to obtain linear stroke throughout bank of dampers and proper torque.
 - .3 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
 - .4 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).
 - .5 Power requirements: 5VA maximum at 24VAC. Where required in the contract documents provide 120VAC.
 - .6 Motor to be of Brushless DC Technology.
 - .7 In areas where the operator is within an electrically classified Class I, Group D, Div.1 or Div.2 space or explosive atmosphere, as defined in the

DAMPERS – OPERATING

contract documents, provide an explosion proof housing rated for use in classified areas, and where indicated. In areas where the operator is mounted outdoors provide a damper actuator heater.

.8 Acceptable Manufacturer: Belimo.

.6 Performance:

.1 Leakage: in closed position to be less than 2% of rated air flow at 500 Pa differential across damper.

.2 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.88.

.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

.8 Standard of Acceptance: Tamco Series 9000.

.1 Selected Options:

.1 Severe Cold temperature-SC

.2 Moisture Resistance-MR

.3 Salt Water Resistance-SW

2.2 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum or steel construction with nylon bearings, centre pivoted, spring assisted or counterweighted. Provide for all exhaust fans except where indicated to have motorized dampers.

.2 Standard of Acceptance: Tamco Series 7000.

PART 3 EXECUTION**3.1 INSTALLATION**

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper.

.5 Ensure dampers are observable and accessible.

DAMPERS – OPERATING

3.2 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

HVAC FANS

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 23 05 48 – Vibration and Seismic Control for HVAC Piping and Equipment.

1.2 REFERENCES

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA Standard 99, Standards Handbook.
 - .2 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
 - .3 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
 - .4 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .2 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 AHSRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .4 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1 Motors and Generators
 - .2 NEMA ICS 7.1 Safety Standard for Construction and Guide for Selection, Installation and Operation of Adjustable Drive Systems.
- .5 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual, MPI #18, Primer, Zinc Rich, Organic.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

HVAC FANS

- .3 Shop Drawings:
 - .1 Provide:
 - .1 Dimensional drawings and product data for each fan.
 - .2 Fan curves for each fan at the specified operation point, with the flow, static pressure and horsepower clearly plotted
 - .3 Outlet velocity and fan's inlet sound power readings for the eight octave bands, decibels, and sones
 - .2 Strictly adhere to QUALITY ASSURANCE requirements as stated in section 1.5 of this specification
 - .3 Provide manufacturer's certification that exhaust fans are licensed to bear Air Movement and Control Association (AMCA), Certified Rating Seal for sound and air performance
 - .4 Installation, Operation, and Maintenance Manual (IOM):
 - .1 Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, warranty and electrical wiring diagrams
 - .5 Indicate:
 - .1 Motors, sheaves, bearings, shaft details and materials of construction.
 - .2 Minimum performance achievable with variable speed controllers and variable inlet vans as appropriate.

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

HVAC FANS

- .2 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in a dry location and in accordance with manufacturer's recommendations.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS**2.1 PERFORMANCE CRITERIA:**

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

2.2 AIR FLOW BOOSTER FAN (TUBE-AXIAL): 4

- .1 General Description:
 - 1. Air flow booster fan is designed for air flow to and from dehumidifier in the ice rink area to increase the effective area of a dehumidifier.
 - 2. Performance capabilities range between 3,000 to 4,000 cubic feet per minute (cfm).
 - 3. Fan able to plug into a standard 115-volt outlet.
 - 4. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.
 - 5. Basis of Design:
 - a. Greenheck MAC-20-327-B4-J1; or
 - b. Approved Equivalent.
- .2 Wheel:
 - 1. Propeller type, aluminum construction.
 - 2. A standard hex head bolt locks the propeller to the motor shaft.
 - 3. Statically and dynamically balanced in accordance with AMCA Standard 204-05.

HVAC FANS

- .3 Motors:
 - 1. Motor enclosures shall be Totally Enclosed Fan-Cooled (TEFC) motors: Fully sealed enclosures.
 - 2. Motors are permanently lubricated, heavy duty ball type, carefully matched to the fan load.
 - 3. Motor supports are constructed of structural steel members to prevent vibration and to support the motor and propeller.
 - 4. Accessible for maintenance.
- .4 Finishes:
 - 1. All structural steel parts are coated with corrosion resistance polyester powder coating.
- .5 Wheel Guard:
 - 1. Protect objects from obstructing the fan wheel.
- .6 Accessories:
 - .1 Fan Guard
 - .1 Steel fan guard.
 - .2 Quantity: 4
 - .2 Mounting Kit
 - .1 Ceiling beam mounting kit for horizontal flow:
 - .1 Quantity: 3.
 - .2 Wall mounting kit for horizontal flow:
 - .1 Quantity: 1.
 - .3 Toggle switch
 - .1 NEMA-4X.
- .7 Meets OHSA requirements for safety.

2.3 WALL MOUNTED EXHAUST FAN (TUBE-AXIAL): 4

- .1 General Description:
 - 1. The exhaust fan is designed for exhausting the byproducts produced by the gas-fired infrared radiant heaters.
 - 2. Performance capabilities range between 300 to 400 cubic feet per minute (cfm).
 - 3. Fan able to plug into a standard 115-volt outlet.
 - 4. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number
 - 5. Basis of Design:
 - a. CANARM SD10-ECV; or

HVAC FANS

b. Approved Equivalent.

.2 Wheel:

1. Propeller type, aluminum construction.
2. Statically and dynamically balanced in accordance with AMCA Standard 204-05.

.3 Motors:

1. Motor enclosures shall be Totally Enclosed Fan-Cooled (TEFC) motors: Fully sealed enclosures.
2. Motors are permanently lubricated, heavy duty ball type, carefully matched to the fan load.
3. Motor supports are constructed of structural steel members to prevent vibration and to support the motor and propeller.
4. Accessible for maintenance.

.4 Finishes:

1. All structural steel parts are coated with corrosion resistance polyester powder coating.

.5 Wheel Guard:

1. Protect objects from obstructing the fan wheel.

.6 Accessories:

.1 Toggle switch

.1 NEMA-4X

.2 Gravity Damper

.1 Gravity operated galvanized damper.

.3 Weatherhood

.1 Galvanized 45° steel hood, with bird screen.

.7 Meets OHSA requirements for safety.

2.4 WALL MOUNTING VENTILATION FAN (TUBE-AXIAL):

.1 General Description:

1. The ventilation fan is designed for exhausting contaminated air from the ice rink area and replace it with outside air through the motorized dampers.

HVAC FANS

2. Performance capabilities range between 12000 to 14000 cubic feet per minute (cfm).
 3. Fan powered by 575-volt electrical supply.
 4. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.
 5. Basis of Design:
 - a. Greenheck AER-36; or
 - b. Approved Equivalent.
- .2 Wheel:
1. Propeller type, aluminum construction.
 2. Statically and dynamically balanced in accordance with AMCA Standard 204-05
- .3 Motors:
1. Motor enclosures shall be Totally Enclosed Fan-Cooled (TEFC) motors: Fully sealed enclosures.
 2. Motors are permanently lubricated, heavy duty ball type, carefully matched to the fan load.
 3. Motor supports are constructed of structural steel members to prevent vibration and to support the motor and propeller.
 4. Accessible for maintenance.
- .4 Finishes:
1. All structural steel parts are coated with corrosion resistance polyester powder coating.
- .5 Wheel Guard:
1. Protect objects from obstructing the fan wheel.
- .6 Accessories:
- .1 Toggle switch
 - .1 NEMA-4X
 - .2 Gravity Damper
 - .1 Gravity operated galvanized damper.
 - .3 Weatherhood

HVAC FANS

- .1 Galvanized 45° steel hood, with bird screen.
- .7 Meets OHSA requirements for safety.

PART 3 EXECUTION**3.1 EXAMINATION**

- .1 Verification of conditions: verify that conditions of substrate previously installed are acceptable for HVAC fans installation in accordance with manufacturer's instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 - Vibration and Seismic Control for HVAC and Piping Equipment.
- .2 Provide sheaves required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

3.3 ANCHOR BOLTS AND TEMPLATES

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 COMMISSIONING

- .1 Commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

LOUVRES

PART 1 GENERAL**1.1 SUMMARY****.1 Section Includes:**

- .1 Materials, accessories, administrative procedures and installation procedures for mechanical louvers, intakes, and vents.
- .2 It also includes reinforcement and bracing for air vents, intakes and gooseneck hoods for wind speeds, in accordance with National Building Code of Canada.

1.2 RELATED SECTIONS

- .1 Section 09 91 13 – Exterior Painting

1.3 REFERENCES

- .1 Air Movement and Control Association (AMCA)
 - .1 ANSI/AMCA Standard 500-L, Laboratory Methods of Testing Louvers for Rating.
- .2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 - .1 ASHRAE Handbook – HVAC Applications
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A780/A780M, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - .2 ASTM E 90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - .3 ASTM E2886/E2886M, Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement.
- .4 Fenestration and Glazing Industry Alliance (FGIA, formerly AAMA):
 - .1 AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedure for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- .5 National Fire Protection Association (NFPA):
 - .1 NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).

LOUVRES

- .7 National Research Council Canada (NRC):
 - .1 National Building Code of Canada (NBC).
- .8 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 ANSI/SMACNA 006, HVAC Duct Construction Standards – Metal and Flexible.
- .9 Society of Automotive Engineers (SAE)

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
 - .1 Submit one copy of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate following:
 - .1 Pressure drop
 - .2 Face area
 - .3 Free area
 - .4 Dimensions
 - .3 Show anchorage details, elevations, sections and specific details for each louver. Include a list of all louvers and their locations using the identification numbers on the drawings.
 - .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: When requested, submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .3 Test Reports:
 - .1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E 90.
 - .2 Louvers tested to ANSI/AMCA Standard 500-L for pressure drop, airflow leakage, water penetration, wind-driven rain, wind-driven sand.

1.5 QUALITY ASSURANCE

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

LOUVRES

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Perform in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements: Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated areas.
 - .2 Store and protect roof and wall exhausters from nicks, scratches, and blemishes.
- .4 Waste Management and Disposal:
 - .1 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .2 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

PART 2 PRODUCTS**2.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items:
 - .1 Obtained from tests carried out by manufacturer or those ordered by manufacturer from an independent testing agency signifying adherence to codes and standards.

2.2 FIXED LOUVRES - ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy.
- .3 Blade: drainable, stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 2 mm thick with approved sealant slot, integral to unit. Flanged frame or flush frame as indicated.
- .5 Mullions: at 1500 mm maximum centres.

LOUVRES

- .6 Size: As indicated on the drawings
- .7 Fastenings: stainless steel nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, stainless steel washer and aluminum body.
- .8 Screen: 2.0 mm diameter wire aluminum or galvanized bird screen on inside face of louvres in formed U-frame.
 - .1 Exhaust Screens: 12 gauge, 3.0 mm diameter mesh aperture.
 - .2 Intake Screens: 19 gauge, 3.0 mm diameter mesh aperture
- .9 Finish: factory applied enamel, anodized or prime coated, ready for finish painting in accordance with Section 09 91 13 – Exterior Painting as indicated. Colour: to Contract Administrator approval.

PART 3 **EXECUTION****3.1** **MANUFACTURER'S INSTRUCTIONS**

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

3.2 **INSTALLATION**

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with sealant around to ensure weather tightness.
- .4 Install screens where indicated. Where screen joints are unavoidable, overlap edges and ends by a minimum of 25 mm.

3.3 **CLEANING**

- .1 Proceed in accordance with Section 01 74 00 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

COMMON WORK REQUIREMENTS FOR ELEC.

PART 1 GENERAL**1.1 DESCRIPTION**

- .1 This Section covers items common to Sections of Division 26. This section also supplements requirements of Division 1, Division 23, Division 25, Division 28, Division 33 and Division 44.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, and Ontario Amendments to CSA C22.1 (Ontario Electrical Safety Code).
 - .2 CSA-22.3 No.1, Overhead Systems.
 - .3 CSA-22.3 No.7, Underground Systems.
 - .4 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .5 CSA Z462, Workplace Electrical Safety
 - .6 CSA Z463, Maintenance of Electrical Systems
 - .7 CSA Z85-1983, Abbreviations for Scientific and Engineering Terms.

1.3 CARE, OPERATION AND START-UP

- .1 Instruct Contract Administrator and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance, and calibrate components and instruct operating personnel.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation and ensure that operating personnel are conversant with all aspects of its care and operation.

COMMON WORK REQUIREMENTS FOR ELEC.

1.4 DESIGN REQUIREMENTS

- .1 Perform complete installation in accordance with the latest edition of the Ontario Electrical Safety Code, including latest published Amendments and Bulletins.
 - .1 The design intent of the Contract Documents is for the completed Work to comply with the Electrical Code and not require a deviation or postponement by the Inspection Authority, as defined in Section 2 of the Electrical Code.
 - .2 Refer to Section 1.14 - ACCEPTANCE OF WORK.
- .2 In addition to the codes and standards listed in Section **Error! Reference source not found.** - REFERENCE STANDARDS, do complete installation in accordance with the following:
 - .1 Ontario Building Code (OBC).
 - .2 Electrical Safety Authority (ESA) inspection permits.
 - .3 Local code of governing authorities.
- .3 Operating voltages: to CAN3-C235
 - .1 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's instructions, printed product literature and data sheets, including product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout, and arrangement, proposed conduit routing, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.
 - .3 Identify on wiring diagrams: circuit terminals, internal wiring for each item of equipment, and interconnection wiring between each item of equipment.
 - .4 Indicate on drawings: clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 Submit conduit sleeve plan for wall penetrations as described in Section **Error! Reference source not found.** - CONDUIT AND CABLE INSTALLATION.

COMMON WORK REQUIREMENTS FOR ELEC.

- .6 Submit routing plan for under-slab conduits as described in Section **Error! Reference source not found.** - CONDUIT AND CABLE INSTALLATION.
- .4 Equipment Tagging
 - .1 Submit list of lamicoid labels for approval.
- .5 Quality Control: in accordance with Specification 01 45 00 - Quality Control.
 - .1 Provide CSA certified, or certified by recognized organizations as detailed in ESA Bulletin 2-7-*, equipment and material.
 - .2 Where CSA certified, or ESA recognized approval equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Submit, upon completion of Work, load balance report as described in section 3.8.6 - Load Balance.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.
- .6 Manufacturer's Field Reports: submit to Contract Administrator within seven (7) working days of review, verifying compliance of Work, electrical system and instrumentation testing, as described in section 3.8 - FIELD QUALITY CONTROL.

1.6 PERMITS, FEES, AND INSPECTION

- .1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees associated with this Work.
- .3 Notify Contract Administrator of changes required by Electrical Inspection Division prior to making changes.
- .4 Furnish Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of Work to Contract Administrator.

1.7 SEISMIC RESTRAINTS

- .1 The contractor shall retain a specialty Engineer to develop seismic restraints and perform seismic calculations in accordance with Ontario Building Code. Calculations, restraint selections and installation details shall be done by a professional engineer experienced in seismic restraint design and installation and licensed in the Province of Ontario.
- .2 The seismic restraint calculations, selections and installation details shall be submitted as a shop drawing submittal. This submittal shall be signed and sealed by a professional engineer as stated above.

COMMON WORK REQUIREMENTS FOR ELEC.

- .3 The Design Criteria in accordance with Ontario Building Code for a post disaster building. The seismic restraints design to cover all electrical equipment and cable tray/supports.
- .4 At the completion of the installation, the seismic specialist shall visit the site and review the installation is done in accordance with their design. Once complete the specialist shall provide written certification that the equipment and components have been correctly restrained. This report to forwarded to the Engineer.
- .5 At the completion of the installation the seismic specialist shall visit the site and review the installation of the seismic restraints. The specialist shall provide written certification that the systems have been correctly restrained.

1.8 CO-ORDINATION

- .1 Co-ordinate electrical work with work of other divisions to avoid conflict.
- .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.
- .3 Locate all existing underground services and make all parties aware of their existence and location.
- .4 Where interference occurs, Contract Administrator must approve relocation of equipment and materials regardless of installation order.
- .5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Contract Administrator shall decide the extent of relocation required.

1.9 CUTTING AND PATCHING

- .1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.10 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

COMMON WORK REQUIREMENTS FOR ELEC.

- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.11 RECORD DRAWINGS

- .1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.
- .2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run-in relation to the structure and building.
- .3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.
- .4 Submit record drawings within 30 days prior to start of commissioning.

1.12 SCHEDULING OF WORK

- .1 Work shall be scheduled as per Section 01 11 00.
- .2 Become familiar with any phasing requirements for the work and comply with these conditions.
- .3 No additional monies will be paid for the Contractor's requirement to comply with work phasing conditions.

1.13 INSPECTION OF WORK

- .1 The Contract Administrator will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of their work in conformity with the construction documents and with the requirements of the Inspection Authority.

1.14 ACCEPTANCE OF WORK

- .1 The Work of this division shall be completed to the satisfaction of the Contract Administrator, including but not limited to compliance with the Electrical Code.
- .2 Any Work requiring a deviation or postponement by the Inspection Authority, as defined in Section 2 of the Electrical Code, shall also require approval by the Contract Administrator.
 - .1 The Contractor shall notify the Contract Administrator of any Work of this nature within 48 hours of discovery, and shall submit detailed plans to the

COMMON WORK REQUIREMENTS FOR ELEC.

Contract Administrator for review and approval before completion of the Work.

- .3 No additional monies will be paid for the Contractor's requirement to complete the work to the satisfaction of the Contract Administrator.

1.15 FIRE RATING OF PENETRATIONS

- .1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.
- .2 When cables or conduits penetrate or pass through fire rated assemblies such as walls, floor/ceiling, roof/ceiling or columns protection, do fire stopping and smoke sealing in accordance with an approved system specified in Section 07 84 00 to match the rating of the assembly being penetrated. Refer to architectural drawings to ascertain locations and degree of the fire rated assemblies. Refer to detail ULC System No. SP341 for fire-stopping cable tray floor and wall partitions.

PART 2 PROVISIONAL ITEMS**2.1 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Responsibility of supply and installation is indicated in Motor, Control and Equipment Schedule on electrical drawings, and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings, where applicable.
- .2 Control wiring and conduit is specified in Division 26 for all conduit, wiring and connections related to control systems specified in Division 25 and shown on Mechanical, Process and Civil drawings. Division 26 is responsible for all conduit, wiring, and connections of 120V and below, which are related to control systems in Division 25 and shall comply with the requirements of Division 26 for standard of quality.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material to be CSA certified or ESA recognized certifications, as detailed above. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from CSA Electrical Inspection Division.
- .3 Factory-assemble control panels and component assemblies.

COMMON WORK REQUIREMENTS FOR ELEC.**2.3 FINISHES**

- .1 Shop-finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

2.4 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Contract Administrator.
- .2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels according to its Specification Section, and as follows.
 - .1 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .2 Nameplates:
 - .1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.
- .4 Identification to be English (and French where applicable).
- .5 Disconnects, starters and contactors: indicate equipment being controlled, voltage and circuit fed from.
- .6 Instrumentation: label shall include tag name and circuit fed from.

COMMON WORK REQUIREMENTS FOR ELEC.

- .7 Terminal cabinets, junction boxes and pull boxes: indicate system name and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages, circuit fed from, and equipment being fed.
- .3 Labels:
 - .1 Embossed plastic labels with 6 mm high letters unless specified otherwise.
 - .2 Receptacles: indicate panel name and circuit number.

2.7 WIRING IDENTIFICATION

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

2.8 CONDUIT AND CABLE IDENTIFICATION

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

<u>Conduit System</u>	<u>Prime Color</u>	<u>Auxiliary Color</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

PART 3 EXECUTION**3.1 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels, and identification nameplates are visible and legible after equipment is installed.

COMMON WORK REQUIREMENTS FOR ELEC.

3.2 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 27 26 – Wiring Devices.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit below concrete slab, in applicable areas, to minimize conduit installation on walls.
- .2 Install conduit sleeves: at points where conduit pass through masonry, concrete or fire rated assemblies and as indicated.
 - .1 Sleeves through concrete: schedule 40 galvanized steel pipe.
 - .2 Sizes: maximum 6mm clearance all around, between sleeve and conduit.
 - .3 Terminate sleeves flush with surface of concrete and masonry walls.
- .3 Fill voids around conduit:
 - .1 Caulk between sleeve and conduit in foundation walls with waterproof fire retardant non-hardening mastic.
 - .2 Where sleeves pass through walls, provide space for fire-stopping. Where conduit passes through fire rated walls, maintain fire rating integrity.
 - .3 Ensure no contact between copper conductor and ferrous sleeve.
 - .4 Fill future-use sleeves with lime plaster or other easily removable filler.
 - .5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CGSB 1-GP-181M+Amdt.
- .4 This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete walls for conduit. 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.

3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

COMMON WORK REQUIREMENTS FOR ELEC.

- .3 Install electrical at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted telephone and interphone outlets: 1400 mm.
 - .6 Fire alarm stations: 1200 mm.
 - .7 Fire alarm bells: 2400 mm.
 - .8 Television outlets: 300 mm.
 - .9 Wall mounted speakers: 2400 mm.
 - .10 Clocks: 2400 mm.
 - .11 Door bell pushbuttons: 1200 mm.
 - .12 Exit lights: 2400 mm.
 - .13 Emergency lighting heads: 2400 mm.

3.5 POWER SHUTDOWNS

- .1 Power shutdowns shall be kept to a minimum. Schedule shutdowns well in advance with Contract Administrator stating time(s) and duration(s). Maintain all electrical services to the occupied areas of the buildings. Power shutdowns will be allowed during normal working hours and must be approved by the Owner. Shutdowns to be 4 hours maximum.
- .2 Provide temporary services, equipment and wiring as necessary to maintain continuity of services throughout, during construction of this project.
- .3 Ensure all services, i.e. security, fire alarm, telephone, LAN, normal and essential power, etc. remain operational during construction.
- .4 Refer to construction phasing Section 00 13 14 and perform work as required to meet the multiple phases of completion steps to ensure the plant services are maintained.

3.6 REMOVALS

- .1 Remove existing electrical equipment, wiring, conduit and other devices.
- .2 Where existing walls and partitions are to be removed, remove existing outlets, devices and wiring located therein and make safe. Remove existing equipment, devices and outlets as necessary. Relocate or reinstall these items as indicated and as required. Co-ordinate with applicable trades.

COMMON WORK REQUIREMENTS FOR ELEC.

- .3 Maintain continuity of power, lighting, fire alarm and communication circuits as required.
- .4 Remove all existing redundant wiring associated with all devices. Co-ordinate and arrange for telephone company to remove redundant telephone cables.
- .5 Any material the Contract Administrator does not want, shall be removed from the site by this contractor.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Immediately on award of Contract, prepare a co-ordination study and submit for approval.
- .2 The co-ordination study data shall be presented in tables and on composite charts and shall include but not be limited to the following:
 - .1 Minimum and Maximum available short circuit current 600V, and 120/208V systems based on available MVA at the source. This shall be calculated for every bus down to the lighting panel level.
 - .2 Minimum and Maximum available ground fault current of 600V, and 120/208V systems.
 - .3 Power transformer thermal short circuit damage curve, 3 phase, phase to ground.
 - .4 Main and feeder circuit breakers.
 - .5 Distribution transformer and generator thermal short circuit damage curves.
 - .6 Largest distribution breaker characteristics in each panel.
 - .7 Largest branch breaker in each panel.
 - .8 Establish the required setting for all ground fault protective devices.
 - .9 General damage and decrement curves.
 - .10 Cable damage curves.
 - .11 Co-ordination charts shall be drawn in ink on log paper or printed if computer generated. Each chart shall include a single line diagram of the appropriate devices with description and numbering matching that shown on the contract documents. Transformers shall be shown complete with KVA rating, primary and secondary voltages, winding connections, grounding method and impedance.
 - .12 The study shall meet the requirements of IEEE 242.
- .3 The co-ordination study shall include a list of recommendations to improve co-ordination or protection where possible and minimize arc fault energy levels.
- .4 A copy of the single line diagram in AutoCAD (.dwg) format will be made available if requested.

COMMON WORK REQUIREMENTS FOR ELEC.

3.8 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices. Employees registered in a provincial apprentice's program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical Contractor License as issued by the Province.
- .3 In addition to the inspection and acceptance by the electrical authority having jurisdiction, the Work of this division shall meet the acceptance of the Contract Administrator. Refer to Section 1.14 - ACCEPTANCE OF WORK.
- .4 Conduct and pay for following tests:
 - .1 Distribution system including phasing, voltage, grounding, and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 VFD configuration, testing, commissioning, and training by manufacturer's factory trained and certified technician.
 - .5 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.
 - .6 Systems: fire alarm system, security, and communications.
- .5 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .6 Load Balance
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers, and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
- .7 Insulation resistance testing.
 - .1 Megger and record circuits, feeders, and equipment up to 350V with a 500V instrument.
 - .2 Megger and record 350 – 600V circuits, feeders, and equipment with a 1000V instrument.

COMMON WORK REQUIREMENTS FOR ELEC.

- .3 Check resistance to ground before energizing and record value.
- .8 Carry out tests in presence of Contract Administrator.
- .9 Provide instruments, meters, equipment, and personnel required to conduct tests during and conclusion of project.
- .10 Submit test results for Contract Administrator's review and include in Commissioning Manuals specified in Section 01 91 13 – Commissioning (Cx) Requirements.

3.9 CLEANING

- .1 Do final cleaning in accordance with Section 01 61 00.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.
- .4 Remove construction materials from wiring devices, cover plates, outlets, cabinets, enclosures, tubs, etc.

END OF SECTION

WIRING AND BOX CONNECTORS, 0-1000V

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Material and installation specifications for wire and box connectors for low voltage (LV) systems operating between 0-1000 Volts.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittals
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – Commissioning Requirements
- .4 Section 26 05 00 – Common Work Requirements Electrical.

1.3 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 CLOSEOUT SUBMITTALS

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

WIRING AND BOX CONNECTORS, 0-1000V

1.6 DELIVERY, STORAGE AND HANDLING

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

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 12 AWG or less unless noted otherwise.
- .3 Compression lugs/splices required for all terminations 10 AWG and larger.
- .4 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for copper bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.
 - .5 Sized for conductors and bars as indicated.
- .5 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install compression lugs with lug manufacturer's compression tool and corresponding dies appropriate to wire size.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

WIRING AND BOX CONNECTORS, 0-1000V

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

WIRING AND CABLES 0-1000V

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Material and installation requirements for wire and cables operating between 0-1000 Volts.
- .2 This section does not include HV wiring in excess of 1000 Volts. Refer to 26 05 14 for hv wiring and cable requirements.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittals
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – Commissioning Requirements
- .4 Section 26 05 00 – Common Work Requirements Electrical
- .5 Section 26 05 34 – Conduits, Fastenings and Fittings

1.3 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables
 - .2 CSA C22.2 No. 38-14, Thermoset-insulated Wires and Cables
 - .3 CSA C22.2 No. 51-14, Armoured Cables
 - .4 CSA C22.2 No. 131-14, Type TECK 90 Cable
 - .5 CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations
 - .6 CSA C22.2 No. 214-17, Communications Cables
 - .7 CSA C22.2 No. 239-17, Control and Instrumentation Cables

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 DELIVERY, STORAGE AND HANDLING

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

WIRING AND CABLES 0-1000V

- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS**2.1 BUILDING WIRES FOR 0 - 1000 V POWER WIRING IN CONDUIT**

- .1 Installed in conduit to 26 05 34 – Conduits, Fastenings and Fittings.
- .2 Conductors: stranded for 12 AWG and larger. Minimum size: 12 AWG.
- .3 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90 XLPE for wet or damp locations.
- .4 Copper conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 XLPE for dry locations only.
- .5 Insulation: chemically cross-linked thermosetting polyethylene (XLPE) material.
 - .1 RWU90 in Wet or Damp Locations.
 - .2 RW90 in Dry Locations Only.

2.2 TECK 90 CABLE FOR 0 – 1000 V POWER WIRING IN CABLE TRAY

- .1 TECK 90 cable to CAN/CSA-C22.2 No.131.
- .2 Conductors:
 - .1 Grounding conductor: stranded copper.
 - .2 Circuit conductors: stranded copper, number and size as indicated. Minimum #12 AWG.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, XLPE 1000 V.
 - .2 Hazardous location rating.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: polyvinyl chloride material with LFS/LGE (low fire spread/low gas evolution) FT4 rating.
- .7 Fastenings:

WIRING AND CABLES 0-1000V

- .1 Mount in cable tray to 26 05 36 – Cable Trays for Electrical Systems and per contract drawings.
- .2 As per Section 26 05 29 - Hangers and Supports.
- .8 Connectors:
 - .1 Explosion-proof approved for TECK cable in classified areas.
 - .2 Teck connectors c/w sealing ring in non-classified areas.

2.3 CONTROL & INSTRUMENTATION WIRING

- .1 Analog 4-20mA signals (installed in conduit):
 - .1 CSA, 300V control and instrumentation cable (CIC) to CAN/CSA C22. No. 239
 - .2 Twisted shielded pair #16, stranded tinned copper cable assembly. Shield consisting of 100% aluminum/polyester foil with #18 AWG drain wire.
 - .3 100% overall foil shield and drain wire for multi-pair cables.
 - .4 Standard of Acceptance: Belden 22646 or multi-pair equivalent with individually shielded pairs and overall shield.
- .2 Analog 4-20mA signals (installed in cable tray):
 - .1 CSA, 600V armored control and instrumentation cable (ACIC) to CAN/CSA C22. No. 239
 - .2 Twisted shielded pair #16, stranded tinned copper cable assembly (installed in conduit). Shield consisting of 100% aluminum/polyester foil with #18 AWG drain wire insulated with 600V rated chemically cross linked thermosetting polyethylene material rated RW90 XLPE c/w hazardous location rating, inner jacket of polyvinyl chloride material, armor of interlocking aluminum and over all covering of polyvinyl chloride material with LES/LGE (low fire spread, low gas evolution) rating.
 - .3 Standard of Acceptance: Belden 24500 or multi-pair equivalent with individually shielded pairs and overall shield.
 - .4 Connectors:
 - .1 Explosion-proof approved for TECK cable in classified areas.
 - .2 Teck connectors c/w sealing rings
- .3 24V to 120V control wiring in conduit:
 - .1 Stranded copper #14 AWG, insulation rated 600V of chemically cross-linked thermosetting polyethylene material rated RW90 XLPE.
 - .2 Installed in conduit to 26 05 34 – Conduits, Fastenings and Fittings.
- .4 24V to 120V multiconductor TECK control wiring:
 - .1 CSA TECK 90 cable to CAN/CSA-C22.2 No.131.
 - .2 Stranded copper #14 AWG insulated with 600V rated chemically cross-linked thermosetting polyethylene material rated RW90 XLPE c/w

WIRING AND CABLES 0-1000V

hazardous location rating, inner jacket of polyvinyl chloride material, armor of interlocking aluminum and over all covering of polyvinyl chloride material with LES/LGE (low fire spread, low gas evolution) rating.

.3 Standard of Acceptance: Belden C5500 or multi-conductor equivalent as indicated.

.4 Connectors:

.1 Explosion-proof approved for TECK cable in classified areas.

.2 Teck connectors c/w sealing rings.

.5 Modbus TSIPC.

.1 Low capacitance single pair, twisted shielded, #24 AWG - Belden 9841.

.6 RS485 cables:

.1 2 pair, 18 AWG stranded copper, separately twisted pairs, overall 100% aluminum-polyester shield, tinned copper stranded drain wire by Belden Wire and Cable.

PART 3 EXECUTION**3.1 INSTALLATION**

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.2 INSTALLATION OF BUILDING WIRES

.1 Installed in conduit to Section 26 05 34 – Conduits, Fastenings and Fittings.

3.3 INSTALLATION OF TECK90 CABLE FOR 0-1000V POWER WIRING

.1 Install TECK90 cables within (or passing thru) all Class I, Div.I, and Div.II, Group 'D' locations.

.2 Installed in cable tray to Section 26 05 36 – Cable Trays for Electrical Systems.

.3 Prior to cable installation, indicate on a set of drawings proposed cable type, routing and grouping. Keep on same drawing indicating cable tray routing from Section 26 05 36 – Cable Trays for Electrical Systems. Review drawings with general contractor and other trades to eliminate interferences. Review drawings with engineer before proceeding with installation.

WIRING AND CABLES 0-1000V

3.4 INSTALLATION OF CONTROL AND INSTRUMENTATION CABLES

- .1 Type RW90 and CIC installed in conduit to Section 26 05 34 – Conduits, Fastenings and Fittings.
- .2 Type TECK90 and ACIC installed in cable tray to Section 26 05 36 – Cable Trays for Electrical Systems.
- .3 Ground control cable shield at controller end only.
- .4 Field terminations and joints shall be made on labelled terminal blocks installed in terminal boxes suitable for the classification of location installed. Crimped connections are not acceptable.
- .5 Termination of Data line cable by Division 26.

END OF SECTION

GROUNDING - SECONDARY

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittals
- .2 Section 01 91 13 – Commissioning Requirements
- .3 Section 26 05 00 – Common Work Requirements Electrical.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.41-13 Grounding and Bonding Equipment
- .2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.

GROUNDING - SECONDARY

- .3 Rod electrodes: copper clad steel 19 mm diameter by 3 m long.
- .4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .5 Insulated grounding conductors: green, type RW90, rated 1kV, stranded copper conductor.
- .6 Ground bus: copper, 50mm x 6mm, complete with 25mm insulated supports, fastenings, connectors.
- .7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Thermit welded type conductor connectors, as indicated.
 - .4 Bonding jumpers, straps.
 - .5 Burndy Hyground compression connectors.

PART 3 **EXECUTION****3.1** **INSTALLATION - GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run insulated copper ground wire in conduit and bond EMT at both ends.
- .2 Install connectors in accordance with manufacturer's instructions. Use manufacturer's crimping tool for compression connectors.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.

GROUNDING - SECONDARY

- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.
- .13 Ground secondary service pedestals.

3.2 MANHOLES

- .1 Install conveniently located grounding electrode and size 3/0 stranded copper conductor in each manhole.
- .2 Install ground rod in each manhole so that top projects through bottom of manhole. Provide with lug to which grounding connection can be made.

3.3 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod electrodes and make grounding connections – either cad-weld or compression type.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 2/0 AWG copper conductors for connections to electrodes.
- .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary 208 V system.

3.5 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting and cable trays.

GROUNDING - SECONDARY

3.6 GROUNDING BUS

- .1 Install copper grounding bus 50mm x 6mm around the perimeter of electrical room mounted on 25mm insulated supports on wall.
- 3. Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as indicted on drawings, where not indicted use #6 AWG stranded copper.

3.7 COMMUNICATION SYSTEMS

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, intercommunication systems as indicated.

3.8 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 19 13 – Commissioning (Cx) Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

HANGERS AND SUPPORTS

PART 1 **GENERAL (NOT APPLICABLE)****1.1** **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittals
- .2 Section 26 05 00 – Common Work Requirements Electrical.
- .3 Section 26 05 21 – Wires and Cables 0-1000V.
- .4 Section 26 05 34 – Conduits, Fastenings and Fittings.
- .5 Section 25 05 36 – Cable Trays for Electrical Systems

PART 2 **PRODUCTS****2.1** **SUPPORT CHANNELS**

- .1 U shape aluminum channel, size 41 x 41mm, 2.5 thick, suspended or surface mounted. For use with Teck Cable, PVC conduit and rigid aluminum conduit in corrosive areas.
- .2 U shape galvanized steel channel, size 41 x 41mm, 2.5 thick, suspended or surface mounted, for use with EMT conduit, rigid galvanized steel conduit and supports for junction boxes, wall mounted VFD's and disconnects in non-corrosive areas. On cut ends of the channel apply cold enriched zinc compound until the cut has been covered.

PART 3 **EXECUTION****3.1** **INSTALLATION**

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls with toggle bolts.
- .4 Secure surface mounted equipment to T bar ceilings with twist clip fasteners. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

HANGERS AND SUPPORTS

- .6 Suspended support systems.
 - .1 Provide suspended support systems where direct fastening to building structure is impractical.
 - .2 Support individual cable or conduit runs with 6 mm (1/4") diameter threaded rods and spring clips.
 - .3 Support 2 or more cables or conduits on channels supported by 10 mm (3/8") diameter threaded rod hangers.
 - .4 Support suspended cable tray on channels supported by 10 mm (3/8") diameter threaded rod hangers.
 - .5 On cut ends of the rod, apply cold enriched zinc compound until the cut end has been covered.
- .7 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support. Provide bolted baseplates for vertical supports mounted with stainless steel anchors and leveling nuts. Fill void between underside of baseplate and slab below with non-shrink grout.
- .10 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 Deburr all ends of U channel and threaded rods. Provide rubber caps for the ends of all U channels.

END OF SECTION

SPLITTERS, JB's, PB's, AND CABS

PART 1 GENERAL**1.1 REALTED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 SUBMITTALS

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 PRODUCTS**2.1 BUS SPLITTERS**

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch drilled for NEMA compression lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Bus style splitters only.

2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction. NEMA 12 for indoor dry locations. NEMA 4X for outdoor locations.
- .2 Hinged covers for surface mounting with quarter-turn latch.
 - .1 Screw-on covers for boxes with largest dimension less than of 200mm.
- .3 Screw-on covers with 25 mm minimum extension all around, for flush mounting.
- .4 Cast feraloy bodies c/w cast aluminum threaded covers and threaded hubs suitable for installation in Class 1, Div. 1 and Div. 2, Group 'D' locations.

SPLITTERS, JBS, PBs, AND CABS

2.3 TERMINAL BOXES

- .1 Welded steel construction. NEMA 12 for indoor dry locations. NEMA 4X for outdoor locations.
- .2 Hinged covers with quarter-turn latch and removable back plane.
- .3 Install screw-type terminal blocks on back plane.

2.4 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

PART 3 EXECUTION**3.1 SPLITTER INSTALLATION**

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.
- .3 Provide air space with wall if mounted on exterior walls.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Provide air space with wall if mounted on exterior walls.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

OUTLET BOXES AND FITTINGS

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Requirements Electrical.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-02 Canadian Electrical Code, Part 1

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS**2.1 OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1-02.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gangboxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

OUTLET BOXES AND FITTINGS

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles. Suitable for installation in Class I, Div.I and Div.II Group D locations.

2.6 FITTINGS-GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

CONDUITS, FASTENINGS, FITTINGS

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Specifications for the supply and installation of electrical conduits, fastenings and fittings.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittals
- .2 Section 26 05 00 – Common Work Requirements Electrical.
- .3 Section 26 05 29 – Hangers and Supports

1.3 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 18.3-12 Conduit, Tubing, and Cable Fittings
 - .2 CSA C22.2 No. 18.4-15 Hardware for the Support of Conduit, Tubing, and Cable
 - .3 CSA C22.2 No. 45.1-07 Electrical Rigid Metal Conduit – Steel
 - .4 CSA C22.2 No. 45.2-08 Electrical Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel
 - .5 CSA C22.2 No. 56-13 Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .6 CSA C22.2 No. 83-M1985 Electrical Metallic Tubing
 - .7 CSA C22.2 No. 83.1-07 Electrical Metallic Tubing – Steel
 - .8 CSA C22.2 No. 85-14 Rigid PVC Boxes and Fittings
 - .9 CSA C22.2 No. 211.1-06 Rigid Types EB1 and DB2/ES2 PVC Conduit
 - .10 CSA C22.2 No. 211.2-06 Rigid PVC (Unplasticized) Conduit.
 - .11 CSA C22.2 No. 227.2.2-14 Liquid-Tight Flexible Nonmetallic Conduit
 - .12 CSA C22.2 No. 227.3-15 Mechanical Protection Tubing (MPT) and Fittings

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawing submittals:
 - .1 Submit manufacturer's printed product literature, specifications and datasheets.
 - .2 Submit conduit routing plans per section 3 of this specification.

CONDUITS, FASTENINGS, FITTINGS

- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

PART 2 PRODUCTS**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45.1, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45.1, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2., schedule 40
- .5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
- .6 FRE conduit: to CSA C22.2.
- .7 Flexible braided explosion proof conduit.
- .8 Minimum conduit size: 19 mm.

2.2 CONDUIT FASTENINGS

- .1 Fasten surface mounted conduit to building construction using straps.
 - .1 One-hole straps to secure conduits 50 mm and smaller.
 - .2 Two-hole straps for conduits larger than 50 mm.
 - .3 Two-hole PVC straps for PVC conduit
 - .4 Straps shall be hot dipped galvanized for galvanized when used with rigid galvanized conduit and EMT conduit.
 - .5 Straps shall be aluminum when used with ridged aluminum conduit.
- .2 Provide galvanized steel beam clamps to secure conduit to exposed steel work.
- .3 Provide channel type supports for two or more conduits at 1.5m on center to Section 26 05 29 – Hangers and Supports.
- .4 Provide suspend channel supports as required to Section 26 05 29 – Hangers and Supports.

CONDUITS, FASTENINGS, FITTINGS

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
 - .1 Factory "ells" where 90°, 45 ° or 22.5 ° bends are required for 25 mm and larger conduits.
- .2 Ensure conduit bends other than factory “ells” are made with an approved bender. Making offsets and other bends by cutting and rejoining 90-degree bends are not permitted.
- .3 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene 6mm minimum.

PART 3 EXECUTION**3.1 CONDUIT LAYOUT**

- .1 Contract drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.
- .2 Prior to conduit installation, indicate on a set of drawings proposed conduit type, routing, and grouping. Review drawings with General Contractor and other trades to eliminate interferences. Review drawings with Engineer before proceeding with installation.

3.2 MANUFACTURER'S INSTRUCTIONS

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

CONDUITS, FASTENINGS, FITTINGS

3.3 CONDUIT KEY PLAN

- .1 Use rigid hot dipped galvanized steel threaded conduit in hazardous areas and for exposed work below 2.4m above finished floor or where otherwise subject to mechanical injury in dry locations.
- .2 Use epoxy coated threaded conduit for exposed work below 2.4m above finished floor or where otherwise subject to mechanical injury in damp, wet or corrosive locations.
- .3 Use electrical metallic tubing (EMT), except in cast concrete, for exposed work above 2.4m and not subject to mechanical injury in dry locations, as well as concealed work in hollow masonry construction.
- .4 Use Schedule 40 rigid PVC conduit in cast concrete, underground ductbanks and under concrete slab on grade unless otherwise noted on contract drawings. Also use rigid PVC for exposed work above 2.4m and not subject to mechanical injury in damp, wet or corrosive locations.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed and surface mount light fixtures without a prewired outlet box.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Use explosion proof flexible conduit for connection to explosion proof motors.

3.4 INSTALLATION - GENERAL

- .1 Install all conduit, conduit fittings and accessories in accordance with the Ontario Electrical Safety Code (OESC) in a manner that does not alter, change or violate any part of the installed system components or the CSA/UL certification of these components.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Conceal conduits unless otherwise noted.
- .4 Surface mounted conduit in unfinished areas, electrical and mechanical service rooms, industrial process areas, service garages or otherwise noted on contract drawings.
- .5 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .6 Minimum conduit size for lighting and power circuits: 19mm. 12mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.

CONDUITS, FASTENINGS, FITTINGS

- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19mm diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Run 2 - 25mm spare conduits up to ceiling space and 2 - 25mm spare conduits down to ceiling space from each flush mounted panel. Terminate these conduits in 152 x 152 x 102mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete type box.
- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

3.5 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters within 1.5m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface mount or suspended channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75mm parallel to steam or hot water lines. Cross at right angles with minimum of 25mm clearance at crossovers.
- .7 Do not enter conduit at tops of disconnect switches, terminal boxes, junction boxes, splice boxes or control panels. Boxes with penetrations placed in the top shall be replaced at no cost to the contract.

3.6 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

CONDUITS, FASTENINGS, FITTINGS

3.7 CONDUITS IN CAST IN PLACE CONCRETE SLABS ON GRADE.

- .1 Do not run conduit horizontally within concrete slabs, except as otherwise detailed in drawings.
- .2 Horizontal conduit to run beneath slab with minimum 75mm cover between top of conduit and underside of concrete slab.
- .3 Conduit to stub up vertically and perpendicular to concrete slab. Protect conduits from damage where they stub out of concrete slab.
- .4 Install conduit prior to slab installation. Locate to suit reinforcing steel.

3.8 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.9 EXPANSION FITTINGS FOR RIGID PVC CONDUIT

- .1 Provide minimum of 150mm of expansion joints for conduit exposed to ambient air conditions with minimum (1) expansion joint between fixed points. The point at which conduits rise up out of ground shall be treated as a fixed point.

3.10 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

WIRING DEVICES

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SUBMITTALS

- .1 Submit shop drawings and product data related sections to Section 01 33 00 – Submittal Procedures.

PART 2 PRODUCTS**2.1 SWITCHES**

- .1 20 A, 120 V, & 347 V as noted, single pole, three-way and four-way switches as indicated to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
 - .6 Extra Heavy Duty Industrial Grade.

WIRING DEVICES

- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 20A, 120V as noted, single pole, three-way and four-way switches single and two gang, dead end and feed through c/w threaded hubs, boxes and covers of copper free aluminum suitable for Class I, Div. I & Div. II, Group 'D' installation.
- .5 Switches of one manufacturer throughout project.
- .6 Acceptable products:
 - .1 Hubbel HBL 1221 W,
 - .2 Leviton 1221-2W,

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Simplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Ivory thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Specification grade.
- .6 Acceptable products:
 - .1 Hubbel 5262-W,
 - .2 Leviton 5262-W,

2.3 SURGE SUPPRESSION RECEPTACLES

- .1 Duplex receptacle, CSA 5-15R 125V, 15Amp, 'U' ground with following features.
 - .1 Blue urea molded housing.
 - .2 Suitable for no 10AWG for back and side wiring.
 - .3 Damage alter-alarm with muting screw.

WIRING DEVICES

- .4 Power-on indicator.
- .5 CSA certified to C22.2 No.42m.
- .6 120V-60Hz.
- .7 Response time 5NS.
- .8 Peak energy 210 joules.
- .9 Peak current 13000 amps.
- .10 EMI/RFI attenuation at 50 OHMS-500KHZ-100MHZ.

2.4 SPECIAL WIRING DEVICES

- .1 Special wiring devices:
 - .1 High-Bay Occupancy Sensors, Line-Voltage, single relay, low temp, high-mount: Acuity Sensor Switch CMR 6 LT or approved alternate
 - .2 CT current switch: Hawkeye Series H800HV or approved alternate

2.5 BUILDING TEMPERATURE TRANSMITTER

- .1 Single gang electrical box-mounted temperature transmitter for building ambient air temperature measurement.
 - .1 Sensor: 1000Ω Platinum RTD.
 - .2 Accuracy: ±0.3°C @ 0°C, minimum.
 - .3 Range: 0-50°C, minimum.
 - .4 4-20mA output.
 - .5 24VDC loop-powered.
- .2 Standard of acceptance: Greystone Energy Systems TE500AD121A2, or reviewed & approved equivalent.

2.6 WIRING DEVICES FOR COMPUTER ROOMS

- .1 As indicated.

2.7 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Stainless steel cover, thickness 1 mm for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof, Extra Duty, while in use, cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

WIRING DEVICES

- .6 Gang type coverplates when more than one switch or outlet is required.
- .7 Label cover plates to Section 26 05 00 – Common Work Requirements

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results - Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect 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.

END OF SECTION

FUSES, LOW VOLTAGE

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 78 00 – Closeout Submittals.
- .2 Section 01 91 13 – Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.248.1 to .16, Low Voltage Fuses Parts 1 to 16, edition as shown in Appendix A of Ontario Electrical Safety Code.

1.3 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit fuse performance data characteristics for each fuse type and size above 200 A. Performance data to include: average melting time-current characteristics.

1.4 DELIVERY AND STORAGE

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in moisture free location.

1.5 MAINTENACE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 33 00 – Closeout Submittals.
- .2 Provide three spare fuses of each type and size installed above 200A.

PART 2 PRODUCTS**2.1 FUSES GENERAL**

- .1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

FUSES, LOW VOLTAGE

.2 Fuses installed in fused disconnect switches shall have blown fuse indicators.

.3 Fuses: product of one manufacturer for entire project.

2.2 FUSE TYPES

.1 Class J fuses (formerly HRCI- J).

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 – Common Work Results - Electrical.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit. Ensure correct fuses fitted to physically matched mounting devices.

.1 Install Class R rejection clips for HRCI-R fuses.

.2 Ensure correct fuses fitted to assigned electrical circuit.

.3 Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

.4 Install spare fuses in fuse storage cabinet.

END OF SECTION

MOULDED CASE CIRCUIT

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 - Common Work Results – Electrical.
- .4 Section 26 24 02 – Service Entrance Board
- .5 Section 26 24 16 – Panelboards Breaker Type

1.2 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittals.
- .2 Include time-current characteristic curves for all breakers.

PART 2 PRODUCTS**2.1 BREAKERS GENERAL**

- .1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .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.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Provide electronic trip units for all breakers sized 100 amps and upwards.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide:
 - .1 inverse time current tripping under overload condition, and
 - .2 instantaneous tripping for short circuit protection.

MOULDED CASE CIRCUIT

2.3 SOLID STATE TRIP BREAKERS DESIGN C

- .1 Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide:
 - .1 inverse time current trip under overload condition, and
 - .2 long-time, short-time, and instantaneous tripping for phase and ground fault short circuit protection.

2.4 OPTIONAL FEATURES

- .1 Include:
 - .1 on-off locking device.
 - .2 handle mechanism.
 - .3 shunt trip as indicated.
 - .4 auxiliary switch as indicated.
 - .5 motor-operated mechanism c/w time delay unit as indicated.
 - .6 under-voltage release as indicated.

2.5 ENCLOSURE

- .1 Mounted in NEMA 1A type enclosure, sprinkler proof as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

DISCONNECT SWITCHES FUSED AND NON FUSED

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results for Electrical.
- .4 Section 26 28 14 – Fuses – Low Voltage.

1.2 REFERENCE STANDARDS

- .1 CSA-C22.2 No.4, Enclosed and Dead-Front Switches.
- .2 CSA C22.2 No.39, Fuseholder Assemblies.

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data and dimensions.

PART 2 PRODUCTS**2.1 DISCONNECT SWITCHES**

- .1 Fusible and non-fusible disconnect switches shall be sized as indicated on drawings and enclosed in:
 - .1 NEMA 12 enclosures in indoor, non-hazardous, dry locations.
 - .2 NEMA 7 enclosures in hazardous areas, or
 - .3 NEMA 4X enclosures unless indicated otherwise.
- .2 Service entrance type where required.
- .3 Flange mounted, visible blade c/w viewing window.
- .4 Provision for padlocking in on-off switch position by three locks.
- .5 Mechanically interlocked door to prevent opening when handle in ON position.
- .6 Fuses: type and size as indicated, to Section 26 28 14 – Fuses, Low Voltage.
- .7 Fuse-holders: suitable without adaptors, for type and size of fuse indicated.

DISCONNECT SWITCHES FUSED AND NON FUSED

- .8 Quick-make, quick-break action.
- .9 ON-OFF switch position indication on switch enclosure cover.
- .10 Manufacturer:
 - .1 Use products of a single manufacturer throughout project.
 - .2 Acceptable Manufacturers:
 - .1 Square 'D' Heavy Duty
 - .2 Siemens Heavy Duty
 - .3 Eaton / Cutler Hammer Heavy Duty.

2.2 PLUG/RECEPTACLE SWITCHES

- .1 Decontactor series, HP rated to suit load.
- .2 Padlockable in OFF position.
- .3 Decontactor to include 3 pilot contacts for motor temperature and moisture protection wiring. Also required for pumps with motor leads and pump protection wiring in same cable.
- .4 Manufacturer: Meltric "Decontactor" series switch rated plugs and receptacles.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Install disconnect switches complete with fuses as indicated.
- .2 Ensure all wiring enters/exits the sides or bottom. (Do not enter top of unit).
- .3 Ensure line and load conductors enter/exit the disconnect switch in separate conduits.
- .4 Ensure line and load side conductors do not come into contact with or cross each other inside the disconnect switch.
- .5 Install SS drip hoods over all disconnects installed in sprinklered areas and outdoors.

DISCONNECT SWITCHES FUSED AND NON FUSED

END OF SECTION

CONTACTORS

PART 1 GENERAL**1.1 SECTION INCLUDES**

- .1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.
- .4 Section 26 29 03 - Control Devices.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.14, Industrial Control Equipment.

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

PART 2 PRODUCTS**2.1 CONTACTORS**

- .1 Contactors: to CSA C22.2 No.14, NEMA rated.
- .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Fused switch combination contactor as indicated.
- .4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .5 Mount in NEMA 12 enclosure unless otherwise indicated.
- .6 Include following options in cover:
 - .1 Red indicating lamp.
 - .2 Hand-Off-Auto selector switch.

CONTACTORS

- .7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure. Oversized capacity of 100VA.
- .8 Combination starters to be supplied with oversized enclosure with din rail space for dry run protection relays.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Size 4 nameplate indicating name of load controlled as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install contactors and connect auxiliary control devices.

END OF SECTION

CONTROL DEVICES

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Materials and installation for industrial control devices including pushbutton stations, local control panels, and relay panels.

1.2 **RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 26 05 00 – Common Work Results - Electrical

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.14, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 **SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittals Procedures.
 - .1 Include schematic, wiring, and interconnection diagrams.

1.5 **QUALITY ASSURANCE**

- .1 Submit to Owner's Representative one copy of test results.

PART 2 **PRODUCTS**

2.1 **AC CONTROL RELAYS**

- .1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.
- .2 Sealed contact type: electrically held with 2 DDT contacts and indicating light.
 - .1 Coil rating: 120Vac, 5VA.
 - .2 Contact rating: 120V, 10A.
- .3 Socket bases and DIN rail mounting.

2.2 **RELAY ACCESSORIES**

- .1 Standard contact cartridges: normally-open, convertible to normally-closed in field.

CONTROL DEVICES

2.3 OILTIGHT LIMIT SWITCHES

- .1 Snap action type: roller rod or fork lever, top, side, push or wobble stick actuator, CSA type 1 enclosure. Contact rating as indicated.
- .2 Surface mounted.
- .3 Standard contact block.

2.4 SEALED CONTACT OILTIGHT LIMIT SWITCHES

- .1 Lever type switches: roller fork or rod operated, single or double pole, double throw. Contact rating: as indicated.
- .2 Push type switches: actuated by rod or plunger located on side of operating head, spring return single pole, throw. Contact rating: as indicated.
- .3 Wobble stick cat whisker type switches: actuated by rod or stick extending from tip of operating head. Moving rod in any direction operates contacts. Single pole, double throw. Contact rating: as indicated.
- .4 Lever operated: time delay switch: adjustable time delay from 1/2s to 15s plus 25%. Contact rating: as indicated.
- .5 Plug-in construction switches: CSA Type 4, two or four circuit, lever push or wobble stick type, contact rating: as indicated.

2.5 SOLID STATE TIMING RELAYS

- .1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.
- .2 Operation: on-delay or off-delay.
- .3 Potentiometer: self contained to provide time interval adjustment.
- .4 Supply voltage: 120VAC or 24 VAC, 60 Hz, as indicated.
- .5 Temperature range: -20 degrees C to +60 degrees C.
- .6 Output contact rating: maximum voltage 300 V AC or DC. Current: NEMA ICS 1 as indicated.
- .7 Timing ranges: minimum 0.5 maximum 60s.

2.6 INSTANTANEOUS TRIP CURRENT RELAYS

- .1 Enclosure: CSA Type 1.

CONTROL DEVICES

- .2 Contacts: NO, NC automatic reset with adjustable tripping point.
- .3 Control: 3 wire, with provision for shorting contacts during accelerating period of motor.
- .4 Contact rating: NEMA ICS 1 as indicated.

2.7 OPERATOR CONTROL STATIONS

- .1 Enclosure: CSA Type 12 enclosure, surface mounting.
- .2 Wiring: tin-plated copper stranded conductors, 19 strands minimum, thermosetting type insulation.

2.8 PUSHBUTTONS

- .1 Momentary contact type: Heavy duty – oil tight, operator flush type, 30mm diameter, colour as indicated, 1-NO and 1-NC contacts rated 10A at 120VAC, labels as indicated.
- .2 Push-pull contact type: Heavy duty – oil tight, operator mushroom head type, 30mm diameter, red colour, provision for padlocking in “OFF” position, 2-NO and 2-NC contacts rated 10A at 120VAC, labels as indicated.

2.9 SELECTOR SWITCHES

- .1 Maintained contact type: 2 or 3 positions (as indicated), heavy duty – oil tight, operator’s standard knob, 30mm diameter, contact arrangement as indicated rated 10A at 120V AC, labels as indicated.
- .2 Rotary potentiometer type: heavy duty, oil tight, operator’s standard knob, 30mm diameter, label as indicated.
 - .1 Coordinate power requirements with device being wired to.

2.10 INDICATING LIGHTS

- .1 Heavy duty – oil tight, LED cluster Push-To-Test type, 30mm diameter, lens colour: as indicated, supply voltage: 120VAC, labels as indicated.

2.11 LOCAL CONTROL AND RELAY PANELS

- .1 NEMA 4X stainless steel enclosure. Surface mount with hinged padlockable access door, accommodating relays, timers, labels, as indicated.
- .2 Provide identified terminals for field wiring termination.
- .3 Wiring: tin-plated copper stranded conductors, 19 strands minimum, thermosetting type insulation.

CONTROL DEVICES

- .1 Crimped ferrules on all wires terminating on terminal blocks
- .2 Digital control wiring: type REW wire, irradiated (cross-linked) PVC insulation.
- .3 Analog control wire: type CIC wire, XLPE insulation, twisted-shielded pair/triad as required.
- .4 Anti-condensation heater c/w thermostat control and insulated enclosure for outdoor locations.
- .5 Factory assembled by CSA certified panel shop.

2.12 CONTROL CIRCUIT TRANSFORMERS

- .1 Single phase, dry type.
- .2 Primary: 208, 240 or 600 V, 60 Hz ac.
- .3 Secondary: 120 V, or 24V ac.
- .4 Rating: 50, 150, 250, 350 or 500 VA, as indicated, oversized by 100VA.
- .5 Secondary fuse: size as required.
- .6 Close voltage regulation as required by magnet coils and solenoid valves.

2.13 THERMOSTAT (LINE VOLTAGE)

- .1 Wall mounted, for exhaust fan control.
- .2 Full load rating: Amps as indicated at 120 V.
- .3 Temperature setting range: 10 degrees C to 30 degrees C.
- .4 Thermometer Range: 10 degrees C to 30 degrees C.
- .5 Markings in 5 degrees increments.
- .6 Differential temperature fixed at 20 degrees C.
- .7 Standard of Acceptance: Crouse-Hinds Eaton HRC Thermostat with Honeywell Control Model HRC85.

2.14 MOTION DETECTOR (HMS-1)

- .1 CSA Approved, Explosion Proof
- .2 Motion Detection
- .3 Tilt Angles: -90° to +30° in elevation

CONTROL DEVICES

- .4 Output Hold Time: 0.5 s to 15 min (Adjustable)
- .5 Standard of Acceptance: Larson Electronics Part # EXP-MS-N4X-AT-HV

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install pushbutton stations, control and relay panels, control devices as indicated.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.
- .5 Submit to Engineer one copy of test results.

END OF SECTION

MOTOR STARTERS TO 600V

PART 1 GENERAL**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.
- .4 Section 26 24 19 – Motor Control Center
- .5 Section 26 29 03 – Control Devices.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.14, Industrial Control Equipment
- .2 National Electrical Manufacturer's Association (NEMA)
 - .1 NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors and Overload Relays Rated 600 Volts

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawing Submittals:
 - .1 Submit to engineer for approval for each type of starter provided.
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each starter.
 - .6 Interconnection diagrams.
 - .2 For factory manufactured motor starters, submit shop drawings from a manufacturer certified by CSA, IEC or CUL.
 - .3 For custom/built assembled motor starters/control panels, submit shop drawings and control diagrams from a CSA certified Control Panel Supplier.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

MOTOR STARTERS TO 600V

- .2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide listed spare parts for each different size and type of starter:
 - .1 3 contacts, stationary.
 - .2 3 contacts, movable.
 - .3 1 contacts, auxiliary.
 - .4 1 control transformer.
 - .5 1 operating coil.
 - .6 2 fuses.
 - .7 10% indicating lamp bulbs used.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Starters to NEMA/EEMAC 1CS2 and CSA C22.2 No.14.
- .2 Minimum starter size: Size 1.

2.2 MANUAL MOTOR STARTERS

- .1 Single and Three phase manual motor starters with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One and Three overload heaters, as indicated, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch or pushbutton: heavy duty labelled as indicated.
 - .2 Indicating light: heavy duty type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE NON-REVERSING MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type.
 - .2 Motor electronic overload protective device in each phase, manually reset from outside enclosure.
 - .3 Wiring and schematic diagram inside starter enclosure in visible location.

MOTOR STARTERS TO 600V

- .4 Identify each wire and terminal for external connections, within starter, with oil resistant permanent number marking identical to diagram.
- .2 Combination type starters to include motor circuit protector with flange mounted operating lever on outside of enclosure to control motor circuit protector, and provision for:
 - .1 Locking in "OFF" position with up to 3 padlocks.
 - .2 Independent locking of enclosure door.
 - .3 Provision for preventing switching to "ON" position while enclosure door open.

2.4 FULL VOLTAGE REVERSING MAGNETIC STARTERS

- .1 Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Two - 3 pole magnetic contactors mounted on common base.
 - .2 Mechanical and electrical interlocks to prevent both contactors from operating at same time.
 - .3 Electronic overload relays, manually reset on door.
- .2 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.
 - .3 Auxiliary control devices as indicated.

2.5 MULTI-SPEED STARTERS

- .1 2 speed starters of size, type, rating, and enclosure type as indicated. Starter suitable for constant kW type motor and with components as follows:
 - .1 One-3 pole contactor for each winding for separate winding motors.
 - .2 One-3 pole and one-5 pole contactor for each reconnectable winding for consequent pole type motors.
 - .3 Electronic overload relays and manual reset for each speed on door.
- .2 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type and color as indicated.
 - .3 Auxiliary control devices as indicated.
 - .4 Automatic sequence relays for each speed.

MOTOR STARTERS TO 600V

2.6 MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER

- .1 Auto-transformer starter closed circuit transition type, of size, type, rating and enclosure type as indicated and with following components:
 - .1 Three-3 pole contactors.
 - .2 Auto-transformer with 50%, 65% and 80% taps.
 - .3 One adjustable pneumatic timing relay.
 - .4 One-3 pole manual reset overload device.
 - .5 Electronic overload protection of auto-transformers.
- .2 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.
 - .3 Auxiliary control devices as indicated.

2.7 2.7 MAGNETIC STARTER REDUCED VOLTAGE STAR-DELTA

- .1 Reduced voltage star-delta open transition starter, of size, type, rating and enclosure type as indicated, with components as follows:
 - .1 Two-3 pole delta contactors with auxiliary relays and interlocks.
 - .2 One-3 pole star contactor with auxiliary relays and interlocks.
 - .3 Mechanical interlock to interlock one delta contactor and the star contactor.
 - .4 One timing relay.
 - .5 Three pole manual reset electronic overload relays.
 - .6 Reduced voltage star-delta closed transition starter, of size, type, rating and enclosure type as indicated, with components as follows:
 - .7 Two-3 pole delta contactors with auxiliary relays and interlocks.
 - .8 One-3 pole star contactor with auxiliary relay and interlocks.
 - .9 One-3 pole transition contactor.
 - .10 One set of transition resistors.
 - .11 Mechanical interlock, to interlock one delta contactor and the star contactor.
 - .12 One timing relay.
 - .13 Three pole manual reset electronic overload relays.
- .2 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.
 - .3 Auxiliary control devices as indicated.

MOTOR STARTERS TO 600V

2.8 MAGNETIC STARTER REDUCED VOLTAGE PART WINDING

- .1 Two-step reduced voltage, part winding starter of size, type, rating and enclosure type as indicated, with components as follows:
 - .1 Two-3 pole contactors.
 - .2 Adjustable pneumatic timer.
 - .3 Six manual reset electronic overload relays.
 - .4 Three step reduced voltage part winding starter of size, type, rating and enclosure type as indicated, with components as follows:
 - .5 Three-3 pole contactors.
 - .6 One set starting resistors.
 - .7 Six manual reset electronic overload relays.
- .2 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type, LED type and color as indicated.
 - .3 Auxiliary control devices as indicated.

2.9 THREE PHASE MANUAL REVERSING STARTER

- .1 Three phase manual reversing starter of size, type, rating and enclosure type as indicated, with components as follows:
 - .1 Two-3 pole manual motor starters, quick make and break.
 - .2 Six overload relays and manual reset.
 - .3 Mechanical interlock to prevent both switches from closing at same time.
- .2 Accessories
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type and color as indicated.

2.10 THREE PHASE MANUAL TWO SPEED SEPARATE WINDING STARTERS

- .1 Three phase manual two speed separate winding starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Two-3 pole manual motor starters, quick make and break.
 - .2 Six overload relays and manual reset.
 - .3 Mechanical interlock to prevent both switches from closing at same time.
- .2 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type and color as indicated.

MOTOR STARTERS TO 600V

2.11 DC FULL VOLTAGE NON-REVERSING STARTERS

- .1 DC full voltage non-reversing starters of size, type, rating and enclosure type as indicated, with components as follows:
 - .1 Contactor: single or two pole solenoid operated type as required.
 - .2 Indirectly-heated, manual reset thermal overload relay.
- .2 Accessories:
 - .1 Pushbuttons: heavy duty, oil tight labelled as indicated.
 - .2 Selector switches: heavy duty, oil tight labelled as indicated.
 - .3 Indicating lights: heavy duty type and colour as indicated.

2.12 DC FULL VOLTAGE REVERSING STARTERS

- .1 DC full voltage reversing starter of size, type, rating and enclosure type as indicated, with components as follows:
 - .1 Two contactors: single or two pole solenoid operated type, mechanically and electrically interlocked.
 - .2 Indirectly-heated, manual reset thermal overload relay.
- .2 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight, labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight type and color as indicated.
 - .3 Auxiliary control devices as indicated.

2.13 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 24 or 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 100VA spare capacity.

2.14 ENCLOSURE

- .1 Welded steel enclosure with hinged front cover suitable for surface mounting.
 - .1 NEMA 12 enclosures in indoor, non-hazardous, dry locations.
 - .2 NEMA 7 enclosures in hazardous areas, or
 - .3 NEMA 4X stainless steel enclosures unless indicated otherwise.
- .2 Oversized enclosure with DIN rail space and unused terminal blocks where pump protection relays or additional control relays are required as indicated on contract drawings.

MOTOR STARTERS TO 600V

- .3 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work Results - Electrical.

2.15 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 2 engraved as indicated.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and electronic overload devices set correctly.
- .3 Confirm motor nameplate and adjust overload device settings to suit.
- .4 Ensure all wiring enters/exits the sides or bottom of starter. (Do not enter top of unit.).
- .5 Ensure line and load conductors enter/exit the disconnect switch in separate conduits.
- .6 Ensure line and load side conductors do not come into contact with or cross each other inside the starter enclosure.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical, manufacturer's instructions and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

MOTOR STARTERS TO 600V

END OF SECTION

LIGHTING EQUIPMENT

PART 1 GENERAL**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)
- .2 ANSI C82.11-1993, lamp current crest factor.
- .3 ANSI C82.2 Input wattage.

1.2 RELATED SECTIONS

- .1 Information For Tenderers.
- .2 Refer to Section 26 05 00 Common Work Results - Electrical for related Sections applicable to this Project.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 00 Common Work Results - Electrical.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires.
- .3 Submit list of replacement lamp data for each luminaire. Include lamp type, voltage, wattage, base type and order code. Include list in Maintenance Manual.
- .4 Submit a luminaire and driver and lamp shop drawing for each luminaire type.
- .5 Ensure that each of the specified driver features is specifically shown on the shop drawings.
- .6 Provide test reports for LED modules and drivers.

1.4 CODE REQUIREMENTS

- .1 Installation of lighting equipment to conform to Section 30, Canadian Electrical Code, Part I, and as amended or supplemented by Provincial, municipal, or other regulatory agencies having jurisdiction.

1.5 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 26 05 00 Common Work Results – Electrical.

LIGHTING EQUIPMENT

1.6 GUARANTEE

- .1 Replace:
 - .1 Drivers that fail or exceed their labelled noise level rating within 12 months of substantial completion
 - .2 Luminaires which show evidence of corrosion, rough handling, scratching of finishes, etc., are to be replace with new luminaires at no additional cost.

1.7 OPERATIONAL TESTING

- .1 Check wiring for agreement with design circuits.
- .2 Test for short circuits and improper grounds.
- .3 Test operation of luminaire and lamp with ballast.
- .4 Allow for third party testing of all lighting controls.

1.8 LAMP USED FOR TEMPORARY LIGHTING

- .1 Fluorescent lamps may be used for temporary lighting and lamps used for this purpose will be accepted when the project or portions of the work are turned over to the Owner Representative. Spot re-lamp faulty or burned out lamps prior to acceptance.
- .2 Metal halide, incandescent and quartz lamps are not to be used for temporary lighting unless all lamps so used are replaced with new lamps immediately prior to completion.

PART 2 PRODUCTS**2.1 GENERAL**

- .1 Verify the Catalogue Number of all fixtures with the description prior to ordering and check for final ceiling finish in all areas where recessed fixtures are called for in order to purchase ceiling trim, flanges and mounting brackets to suit the particular construction used where the fixtures are installed.
- .2 Different luminaires may be supplied by different manufacturers. Similar luminaires shall be supplied by the same manufacturer.
- .3 Provide only luminaires which are structurally well designed and constructed and which use new parts and materials of highest commercial grade available.
- .4 Use cadmium-plated chains for suspended luminaires in unfinished areas.
- .5 Luminaires shall carry the CSA label.

LIGHTING EQUIPMENT

- .6 Provide supporting devices, plaster frames, junction boxes and outlet boxes where required.
- .7 Provide lenses or diffusers of glass or acrylic material as indicated. Acrylic lenses shall be minimum 3mm thick.
- .8 Include finishes to Section 26 05 00 Common Work Results - Electrical and as indicated.
- .9 Where soffits or ceilings have thermal insulation, provide luminaires which are CSA approved for such use.

2.2 LUMINAIRES SCHEDULE

- .1 Refer to Legend on Electrical drawings for Luminaire types.

PART 3 EXECUTION**3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated, complete with all wiring, connections, fittings, hangers, aligners, box covers and accessories, as required.
- .2 Review all ceiling types, construction details and mounting arrangements before placing luminaire orders and ensure that all mounting assemblies, framing rings and similar features are included and match the required installation.
- .3 Install luminaires and lens materials in architectural details.
- .4 Install luminaires parallel with building lines. Wall-mounted luminaires shall be installed plumb.
- .5 All luminaires and assemblies shall be properly secured and supported. Support luminaires independent of the ceiling construction, complete with all fasteners such as 'S' hooks, framing and hangars, as may be required. Do not secure luminaires to mechanical ductwork or other vibration producing apparatus, unless specifically detailed on the drawings.
- .6 Where a luminaire is suspended from the ceiling using a self-aligning box cover, an additional ground wire from the outlet box to the luminaire shall be provided.
- .7 Coordinate the installation of luminaires with the work of other trades, ensuring that the necessary depths and mounting spaces are provided. Luminaires which cannot be installed due to a conflict with structural members, pipes or ductwork shall be relocated to a more suitable location, as directed by Engineer.

LIGHTING EQUIPMENT

3.2 WIRING

- .1 Connect luminaires to lighting circuits:
 - .1 Directly for luminaire designs.
 - .2 Through rigid conduit for luminaire designs.
 - .3 By use of modular wiring system for luminaire design.
- .2 Connect luminaires to lighting circuits rated to CEC.
- .3 Ground lighting equipment to a separate grounding conductor.

3.3 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Support luminaire independently of ceiling. Using "S" hooks and chains to structural steel or suspended "U" channels and in accordance with Ontario Hydro Safety Code.
- .3 Explosion fixture to be mounted to the underside of precast concrete roof slab unless noted otherwise on drawings.
- .4 Support continuous row mounted fluorescent fixtures every 1M.
- .5 Weatherproof fluorescent to be mounted to the underside of pre-cast concrete roof slab unless noted otherwise on drawings.

3.4 CO-ORDINATION OTHER DIVISIONS

- .1 Fully co-ordinate with other divisions to avoid interference with ductwork and piping and other services.

3.5 TEST

- .1 Perform tests in accordance with Section 26 08 01 - Electrical Testing Requirements.
- .2 Check luminaires and replace defective lamps, ballasts, lenses, drivers, modules, and accessories.

3.6 3.6 CLEANING

- .1 Prior to take-over of the project, clean the lenses and reflectors of all luminaires with damp cloth to remove dust, smudges and fingerprints.

END OF SECTION

COMMISSIONING OF ELEC SYSTEMS

PART 1 GENERAL**1.1 SCOPE OF WORK**

- .1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

1.2 SECTION INCLUDES

- .1 Commissioning of all building electrical systems and component including:
 - .1 Testing and adjustment.
 - .2 Demonstrations and Training.
 - .3 Instructions of all procedures for Owner's personnel.
 - .4 Updating as-built data.
 - .5 Co-ordination of Operation and Maintenance material.

1.3 RELATED SECTION

- .1 Section 01 77 00 – Closeout Procedures.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.4 REFERENCES

- .1 CSA (Canadian Standards Association).
- .2 Underwriters Laboratories of Canada.

1.5 QUALITY ASSURANCE

- .1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.
- .2 Submit the names of all personnel to be used during the Commissioning activities for Owner Approval.

1.6 COMMISSIONING

- .1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.

COMMISSIONING OF ELEC SYSTEMS

- .2 The Commissioning activities shall be coordinated by the General Contractor.
- .3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.
- .4 Contractor shall be responsible to update all documentation with information and any changes noted during the Commissioning exercise.
- .5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.7 SUBMITTALS

- .1 A commissioning document shall be prepared by the Owner's Representative prior to conducting these activities for use by the Commissioning Team.
- .2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and coordinated through the General Contractor.
- .3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.8 PREPARATION

- .1 Provide test instruments required for all activities as defined in the commissioning documents.
- .2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.
- .3 Confirm all scheduled activities have identified personnel available.
- .4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.9 SYSTEM DESCRIPTION

- .1 Perform all start-up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.
- .2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.

COMMISSIONING OF ELEC SYSTEMS

- .3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.
- .4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .5 Conduct presentation on Owner's premises. Owner will provide space.

1.10 FINAL REPORT

- .1 This trade shall assemble all testing data and commissioning reports and submit them to the Owner.
- .2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.11 SCHEDULE OF ACTIVITIES

- .1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.
- .3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.
- .4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

END OF SECTION

WIRING OF EQUIP SUPPLIED BY OTHERS

PART 1 GENERAL**1.1 GENERAL**

- .1 This section describes the extent of services to be provided for wiring of equipment supplied by others.
- .2 Within the context of this section, Others means:
 - .1 Other divisions of this specification (i.e.: Division 25 – Integrated Automation).
 - .2 The Owner, as defined in the Contract.
 - .3 Other contractors supplying and installing equipment to the contract.

1.2 EXTENT OF SERVICES PROVIDED

- .1 The work of this contract is to include all power and control wiring of equipment which is provided by Division 26.
- .2 All power and control wiring for equipment supplied by all other divisions, including but not limited to, Division 22, 25, 27, 28 & 44 will be the responsibility of this contractor. Coordinate with Integrated Automation contractor for exact control wiring requirements.
- .3 All power and control wiring associated with equipment supplied by Division 01 will be the responsibility of this contractor. Coordinate with general contractor for exact requirements. See Section 26 27 97 – Door Hardware Wiring for exceptions for wiring of door lock systems.
- .4 Final connection of all wiring to equipment provided by Others will be by Division 26. Coordinate with the provider for connection instructions.

1.3 RESPONSIBILITY OF DIVISION 26

- .1 It is the responsibility of the Division 26 contractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:
 - .1 Confirmation of electrical characteristics.
 - .2 Location of connection point.
 - .3 Method of connection (i.e. direct or plug-in etc.)
- .2 Obtain and become familiar with shop drawings for all relevant equipment.
- .3 No claim for extra will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

WIRING OF EQUIP SUPPLIED BY OTHERS

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

FIRE ALARM SYSTEM

PART 1 GENERAL**1.1 REGULATORY REQUIREMENTS**

- .1 All equipment shall be listed by Underwriters' Laboratory of Canada (ULC).
- .2 All components of the system shall be the product of a single manufacturer.
- .3 The system and installation shall conform to the latest edition of the Ontario Building Code (OBC) and the Ontario Electrical Safety Code (OESC).
- .4 The system shall be installed in accordance with CAN/ULC-S524-14, and shall be subject to the approval of the local Authority Having Jurisdiction.
- .5 Fire Alarm System to be verified to CAN/ULC-S537-13

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittals
- .2 Section 01 78 00 – Closeout Submittals
- .3 Section 01 91 13 – Commissioning Requirements
- .4 Section 26 05 00 – Common Work Requirements Electrical
- .5 Section 26 90 00 – Wiring of Equipment Supplied by Others

1.3 SUBMITTALS

- .1 Submit pdf shop drawings in accordance with 01 33 00 – Submittal Procedures.
- .2 Shop drawings must be submitted and approved by project Engineer before any equipment is shipped to site.
- .3 Shop drawings to consist of the following:
 - .1 Project title page with project name, Engineer, contractor, and equipment manufacturers.
 - .2 Project detailed equipment list
 - .3 Project verification requirements
 - .4 System/device data sheets and typical wiring schematics
 - .5 Graphic annunciators detailed construction drawings.
 - .6 Main fire alarm control panel.
 - .7 Fire alarm transponder panel (if applicable).

FIRE ALARM SYSTEM

- .4 Provide 'as-built' drawings upon completion showing all devices c/w addresses including line isolator and conduit runs.

1.4 OPERATION AND MAINTENANCE MANUALS

- .1 Operation and maintenance manuals to consist of the following:
 - .1 Operation and maintenance instructions for the complete fire alarm system to permit effective operation and maintenance.
 - .2 Recommended spare parts list with parts catalogue numbers.
 - .3 Copy of approved shop drawings.

1.5 MAINTENANCE

- .1 Provide one year's free maintenance with two inspections by manufacturer during the year. Inspection tests to conform to CAN/ULC-S537-13.

1.6 TRAINING

- .1 Provide on-site lectures and demonstrations by fire alarm equipment manufacturer, to train operational personnel in use and maintenance of the fire alarm system. Two separate lectures a minimum of 2 hours each. Coordinate training schedule with Owner.

1.7 QUALIFICATIONS OF MANUFACTURERS

- .1 Manufacturers bidding this project must provide a Letter of Compliance, indicating they have met the specifications and system operation exactly.

1.8 SYSTEM DESCRIPTION

- .1 Existing conventional fire alarm system to be modified as indicated on contract drawings.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Equipment and devices: ULC listed and labelled; standard product of single manufacturer. Addressable type unless otherwise noted.
- .2 Power supply: to CAN/ULC-S524 and OBC requirements.
- .3 Audible signal devices: to ULC-S525.
- .4 Control unit: to CAN/ULC-S527.
- .5 Manual fire alarm stations: to ULC-S528.

FIRE ALARM SYSTEM

.6 Smoke detectors: to CAN/ULC-S529.

.7 Thermal detectors: to ULC-S530.

2.2 SYSTEM OPERATION – SINGLE STAGE

.1 Single stage operation. Operation of any alarm initiating device:

.1 Cause on electronic latch to lock-in the alarm state at the control panel.

.2 Cause audible signal devices to sound throughout entire building.

.3 Transmit signal to remote monitoring station via telephone line to CAN/ULC S561.

.4 Cause zone of alarm signal to be indicated on fire alarm control panel and remote annunciator panel.

.5 Automatically record the time, date and zone of alarm at the control panel.

.6 Cause fire doors and smoke control doors if normally held open, to close automatically.

.7 Fire alarm system shall automatically shut down the A/C systems and fans which are fitted with duct smoke detectors or otherwise indicated. Provide relay as required.

.8 Fire alarm system shall recall elevator in the event of fire detection in the elevator machine room.

.2 Supervisory Device Activation

.1 Actuation of and supervisory device shall:

.1 Cause on electronic latch to lock-in the supervisory state at the control panel.

.2 Indicate the respective supervisory zone at the control panel.

.3 Automatically record the event by time and date at the control panel.

.4 Cause a distinctive audible signal at the control panel.

.5 Activate a common supervisory sequence.

.3 Resetting System:

.1 Resetting the alarm or supervisory device and the system shall:

.1 Be automatically recorded at the control panel.

.2 Return all other system indications/functions back to normal.

.4 Trouble Activation:

.1 The system shall continuously monitor the system devices and wiring. Any trouble on the system shall:

.1 Indicate the circuit/device in trouble on the control panel.

.2 Automatically record the time, date and device in trouble.

FIRE ALARM SYSTEM

- .3 Activate the “system trouble” indication, buzzer and the common trouble sequence. Acknowledging the trouble condition shall silence the audible indication, whereas the visual indication shall remain until the trouble is cleared and the system is back to normal.

2.3 CONTROL PANEL

- .1 Existing EST FireShield Control Panel to remain

2.4 MANUAL PULL STATIONS

- .1 Existing manual pull stations to remain.
- .2 Manual alarm stations: pull lever, break glass, wall mounted flush type, non-coded single pole normally open contact for single stage.

2.5 AUTOMATIC ALARM INITIATING DEVICES

- .1 All automatic initiating devices to be compatible with existing fire alarm system.
- .2 Heat detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57°C, rate of rise 8.3°C per minute. Low profile type.
- .3 Heat detector base to be compatible with smoke detectors.
- .4 Smoke detector: ionization type
 - .1 Plug-in type.
 - .2 Wire-in base assembly with integral continuously lit red LED, when in alarm mode. Flashing or alarm pulsating is not acceptable.
 - .3 Base compatible with heat detectors.
 - .4 Low profile type.
- .5 Duct type smoke detectors; ionization type addressable c/w remote indicating lamp.
- .6 All devices to be low profile type.

2.6 SYSTEM MANUFACTURES

- .1 Acceptable manufacturers:
 - .1 Edwards

FIRE ALARM SYSTEM

PART 3 **EXECUTION****3.1** **INSTALLATION**

- .1 Install systems in accordance with CAN-ULC-S524.
- .2 Ensure wire and cable are copper conductors with insulation rated at 300 V minimum, as follows:
 - .1 Fire alarm addressable circuits shall be #18 AWG twisted shielded pair. Maximum allowable length of run (wire distance) must not exceed 762 m.
 - .2 Signal circuit: 300 V 105°C PVC insulated copper conductors. Minimum conductor size #12 AWG. Voltage drop must not exceed the maximum permissible value recommended by the manufacturer.
 - .3 All wiring to be in conduit, unless otherwise specified on Contract Drawings.
- .3 All Fire Alarm devices shall have both the device and its base labelled with p-touch to indicate building (if in a campus), floor, column line, device type. i.e. device labelled as T2-5-G3-SD would indicate tower 2, floor 5, column G3, smoke detector. This description should also be indicated at the annunciator and control panel.
- .4 All fire alarm work is to be logged in at the main security station by the contractor, and shall indicate the location of the work, a description of the work, and the name of the contractor performing the work.
- .5 The installation contractor shall notify the building owner of verification times, so the owner can include their maintenance contractor in review.

3.2 **FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC S536.
- .2 Fire alarm system:
 - .1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm ancillary devices.
 - .2 Test to demonstrate correct operation of each interlock device, auxiliary device, and by-pass switches.
 - .3 Check annunciator panels to ensure zones are shown correctly.
 - .4 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of trouble signals and the capability for providing a subsequent alarm during any imposed single circuit fault condition (open, ground).
 - .5 Perform the system verification and certification per Clause 3.3 "Verification and Certification".

FIRE ALARM SYSTEM

3.3 CERTIFICATION AND VERIFICATION

- .1 Verify system to "CAN-ULC-S537".
- .2 Verification is the responsibility of the manufacturer for testing the wiring in relation to field devices operation.
- .3 To avoid unnecessary alarms during testing, the system's program shall be capable of being temporarily disabled to disconnect only the audible signals that are being tested. Re-enable the zones after the testing is performed at the end of the day.
- .4 Inspect and test wiring to every device to verify the removal of the device or breaking the wire will cause a trouble condition at the Control Panel.
- .5 Inspect all equipment installed as part of the system for visible damage or tampering which may be a potential problem with its intended operation.
- .6 Activate each manual initiating device to verify and ensure their proper operation.
- .7 Test each self-restoring heat detector utilizing a heat source to test the device operation.
- .8 Test each ionization smoke detector. Detector operation shall be tested by introducing "smoke" into the detector head.
- .9 Test all audible signals for proper operation. Tests shall be made to determine that the signal is audible throughout the area and above the normal ambient noise level.
- .10 Verify all field wiring and terminate on a single conductor per terminals basis.
- .11 Test system annunciators to ensure proper operation correct zoning and visibility of window inscriptions. All lamps and indicators shall be tested for proper operation.
- .12 Test all control equipment for proper operation. Inspect and test all cable terminals, plug connectors, plug-in modules circuitry, lamp sockets and controls to confirm that their mechanical and electrical connections and mounting are acceptable to confirm their electrical supervision.
- .13 Test ancillary equipment connections. Inspect such equipment to ensure that faults and malfunctions will not interfere with the alarm system.
- .14 Test the following control functions for proper supervision, operation and annunciation.
 - .1 The Central station connection.
- .15 Only make changes to the system program or zone identifications as approved by authorized personnel.

FIRE ALARM SYSTEM

- .16 Notify and demonstrate the complete system to Owner's representative and Building Inspection's representatives only after testing and verification performances has been completed and all deficiencies rectified. In their presence, demonstrate the proper functioning of the system. Have system manufacturer's certified technician present.
- .17 Upon completion of the inspection and when all of the above conditions have been performed and complied with, the manufacturer shall issue to the Owner's representative the following:
 - .1 A copy of the inspection report identifying the location of each device and certifying the test results of each device.
 - .2 A certificate of verification confirming that the inspection has been completed and outlining the conditions upon which such an inspection and certification have been rendered.
 - .3 Proof of liability insurance for the inspection.
- .18 All costs involved in this inspection for both the manufacturer's and the Contractor's work shall be included in the overall tender price.

3.4 VERIFICATION RECORDS

- .1 Complete accurate records of the verification shall be maintained with the following requirements but not limited to:
 - .1 Show the date on which each device and equipment has been verified.
 - .2 Show the date of all deficiencies encountered in the control system equipment, wiring and field devices.
 - .3 Show the date when the deficiencies have been corrected and re-verified.
 - .4 Show dB levels measured during verification.

3.5 INTEGRATED SYSTEMS TESTING

- .1 Following are tests required to show system integration with other systems. Initiate a fire alarm via a manual pull station verify the following:
 - .1 Alarm initiated.
 - .2 Signal sent to central alarm facility.
 - .3 Signal sent to security system.
 - .4 Alarm annunciates at fire control panel.
 - .5 Audible devices are operating.

END OF SECTION

EXCAVATION TRENCHING AND BACKFILLING

PART 1 **GENERAL****1.1** **RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 05 16 – Aggregate Materials
- .3 Section 33 05 13 – Precast Structures
- .4 Section 33 11 16 – Site Water Utility Distribution Piping
- .5 Section 33 31 13 – Sanitary and Storm Sewers
- .6 Section 31 23 33 – Erosion & Sedimentation Controls

1.2 **REFERENCES**

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB).
 - .1 CA/CGSB-8.2, Sieves, Testing, Woven Wire, Metric
- .3 Ontario Provincial Standard Specifications (OPSS) and Drawings (OPSD)

1.3 **DEFINITIONS**

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 2 m³. Frozen material not classified as rock. There shall be no compensation for boulder removal.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in work.

EXCAVATION TRENCHING AND BACKFILLING

- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .4 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
- .6 Unsuitable materials:
 - .1 Weak and compressible materials under excavated areas.
 - .2 Frost susceptible materials under excavated areas.
 - .3 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	%Passing
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
0.005 mm	0-45
 - .2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .7 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum Portland cement content of 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 h.
 - .4 Concrete aggregates: to CSA-A23.1/A23.2,
 - .5 Cement: to CSA A3000, Type GU.
 - .6 Slump: 160 to 200 mm.

1.4 SUBMITTALS

- .1 Inform Contract Administrator at least 2 weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.
- .2 Submit 20 kg samples of type of fill specified including representative samples of excavated material to be designated testing laboratory.
- .3 Ship samples as directed by Contract Administrator in tightly closed containers to prevent contamination.

1.5 QUALITY ASSURANCE

- .1 Submit design and supporting data at least 2 weeks prior to commencing work.
- .2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the Province of Ontario.

EXCAVATION TRENCHING AND BACKFILLING

- .3 Keep design and supporting data on site.
- .4 Do not use soil material until written report of soil test results are reviewed and approved by Contract Administrator.

1.6 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
 - .6 Confirm locations of buried utilities by careful test excavations utilizing a hydro-vac system.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of Contract Administrator before removing or re-routing.
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Contract Administrator condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by work.
 - .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Contract Administrator.
 - .3 Where required for excavation, cut roots or branches as approved by Contract Administrator.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Type 1 fill: Granular 'A' as per OPSS 1010 and Section 31 05 16 - Aggregate Materials.
- .2 Type 2 fill: Granular 'B' Type II as per OPSS.MUNI 1010 and Section 31 05 16 – Aggregate Materials.
- .3 Type 3 fill: select subgrade material as per OPSS.MUNI 1010 from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

EXCAVATION TRENCHING AND BACKFILLING

PART 3**EXECUTION****3.1 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 PREPARATION/PROTECTION

- .1 Keep excavations clean, free of standing water, and loose soil.
- .2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Contract Administrator's approval.
- .3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage. Protect buried services that are required to remain undisturbed.
- .4 Protect buried services that are required to remain undisturbed.
- .5 Locate all underground watermain, sewers, and other utilities by hydro-vac methodology and report locations and elevations to Contract Administrator.

3.3 EROSION AND SEDIMENT CONTROL

- .1 As per the requirements of Specification 31 32 25.

3.4 STRIPPING OF TOPSOIL

- .1 Commence topsoil stripping of areas as indicated in Contract Documents after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to full depths. Do not mix topsoil with subsoil.
- .3 Stockpile in locations on or offsite. Stockpile height not to exceed 2 m.
- .4 Dispose of unused topsoil off-site or as directed by Contract Administrator.

3.5 STOCKPILING

- .1 Stockpile fill materials on or offsite. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

3.6 PREVENTION

- .1 Keep excavations free of water while work is in progress.
- .2 Submit for Contract Administrator's review details of proposed dewatering or heave prevention methods.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

EXCAVATION TRENCHING AND BACKFILLING

- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas. Maximum allowable concentration of suspended solids in discharge shall be 25 mg/L TSS.

3.7 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated by Contract Documents.
- .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation. Dispose of material off site.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 For trench excavation, unless otherwise authorized by Contract Administrator in writing, do not excavate more than 20 m of trench in advance of installation operations and do not leave open more than 10 m at end of day's operation.
- .6 Keep excavated and stockpiled materials a safe distance away from edge of trench.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material off site.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Notify Contract Administrator when bottom of excavation is reached.
- .12 Obtain Contract Administrator approval of completed excavation.
- .13 Remove unsuitable material from trench bottom to extent and depth as directed by Contract Administrator.
- .14 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 100% of corrected maximum dry density.
- .15 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
- .16 Division 31 will complete all required trenching and backfilling required for work of Division 26.

EXCAVATION TRENCHING AND BACKFILLING

3.8 FILL TYPES AND COMPACTION

- .1 Use fill of types as indicated or specified below. Compaction densities are percentages of Standard Proctor Maximum Dry Densities (SPMDD) obtained from ASTM D698.
 - .1 Trenching:
 - .1 Type 2 fill, thickness as required or specified, compacted to minimum 98% SPMDD, in maximum 300 mm thick lifts.
 - .2 Type 1 fill as specified in Contract Documents, minimum compacted thickness of 150 mm, compacted to minimum 100% SMPDD.
 - .2 Subgrade:
 - .1 Compact existing subgrade under footings, walkways, paving, and sidewalks to same compaction as fill above.
 - .3 Under grassed areas:
 - .1 Type 3 fill, thickness as required to reach underside of topsoil, compacted to 95% SPMDD.
 - .4 To correct over excavation:
 - .1 Type 2 fill to underside of Granular "A" bedding, compacted to 98% SPMDD.
 - .5 Utility trenching – natural sand as per OPSS MUNI 100 Winter Sand.

3.9 BACKFILLING

- .1 Vibratory compaction equipment: approved by Contract Administrator.
- .2 Do not proceed with backfilling operations until Contract Administrator has inspected and approved installations.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 Backfill around installations.
 - .1 Import Type 'III' fill material as required to backfill the entire site to meet design elevations.
- .7 Division 31 will perform required excavation, trenching and backfilling required for all Divisions. General Contractor to coordinate details of all Divisions to determine the extent of work to be provided.

3.10 RESTORATION

- .1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Contract Administrator.
- .2 Replace topsoil as indicated by Contract Administrator.
- .3 Reinstate lawns to elevation which existed before excavation.

EXCAVATION TRENCHING AND BACKFILLING

- .4 Reinstall pavement and sidewalks distributed by excavation to thickness as specified, structure, and elevation which existed before excavation.
- .5 Clean and reinstall areas affected by work as directed by Contract Administrator.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash and debris.
- .7 Dispose of surplus material and material unsuitable for fill grading or landscaping off site.

3.11 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Owner.
- .2 Do not begin backfilling or filling operations until material has been approved for use by Contract Administrator.
- .3 Not later than 48 hours before backfilling or filling with approved material, notify Contract Administrator to allow compaction tests to be carried out by testing agency designated by Owner.

END OF SECTION

TOPSOIL

PART 1**GENERAL****1.1****RELATED SECTIONS**

- .1 Section 31 23 33 – Excavating, Trenching, and Backfilling
- .2 Section 32 92 23 - Sodding

1.2**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 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.3**SOURCE QUALITY CONTROL**

- .1 Advise Contract Administrator of sources of topsoil to be utilized seven (7) working days in advance of stating time.
- .2 Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.

PART 2**PRODUCTS****2.1****TOPSOIL**

- .1 Topsoil for sodded areas: imported, screened, topsoil with a mixture of mineral particulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 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.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Free from:
 - .1 Debris and stones over 25 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .4 Consistence: friable when moist.

PART 3**EXECUTION****3.1****STRIPPING OF TOPSOIL**

- .1 As per Section 31 23 33 – Excavating, Trenching and Backfilling.

TOPSOIL

3.2 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct. If discrepancies occur, notify Contract Administrator, and do not commence work until instructed by Contract Administrator.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones more than 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials, and petroleum products.
 - .2 Remove debris which protrudes more than 50 mm above surface.
 - .3 Dispose of removed material off site.
- .4 Course cultivate entire area which is to receive topsoil to minimum depth of 100 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Contract Administrator has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 Spread topsoil as indicated to following minimum depths after settlement and 80% compaction:
 - .1 100 mm for sodded areas.
- .4 Manually spread topsoil/planting soil around trees, shrubs, and obstacles.

3.4 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Contract Administrator. Leave surfaces smooth, uniform and firm against deep foot printing.

3.5 ACCEPTANCE

- .1 Contract Administrator will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading. Approval of topsoil material subject to soil testing and analysis.
- .2 Testing of topsoil will be carried out by testing laboratory designated by Contract Administrator. Soil sampling, testing and analysis to be in accordance with Provincial regulations and standards. Contract Administrator will pay for cost of tests as specified in Section 01 45 00 – Quality Control.

TOPSOIL

3.6 SURPLUS MATERIAL

- .1 Dispose of surplus or unsuitable material off site or as directed by Contract Administrator.

3.7 CLEANING

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

END OF SECTION

SODDING

PART 1**GENERAL****1.1 RELATED WORK**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 32 91 19 - Topsoil Placement and Grading.

1.2 SUBMITTALS

- .1 Submit:
 - .1 Sod for each type specified.
 - .1 Install approved samples in one square metre mock-ups and maintain in accordance with maintenance requirements during establishment period.
 - .2 Bio-degradable geotextile fabric.
- .2 Obtain approval of samples by Contract Administrator.

1.3 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.

1.4 SCHEDULING

- .1 Schedule sod installation when frost has left ground and preferably before June 15 or between August 15 and September 30.
- .2 Schedule sod laying to coincide with preparation of soil surface.

1.5 WARRANTY

- .1 For sodding, 12 months warranty period is extended to 24 months.
- .2 Contractor hereby warrants that sodding will remain free of defects in accordance with General Conditions CCDC GC 12.3, but for 24 months. Any deficient sod is to be replaced at no cost to the Owner.
- .3 End-of-warranty inspection will be conducted by Owner.

PART 2**PRODUCTS****2.1 MATERIALS**

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Number one Named Cultivars: Nursery Sod grown from certified seed.
 - .2 Turf Grass Nursery Sod Quality:

SODDING

- .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
- .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
- .3 Mowing height limit: 35 to 65 mm.
- .4 Soil portion of sod: 6 to 15 mm in thickness.
- .2 Sod establishment support:
 - .1 Wooden pegs: 19 x 19 x 300mm.
- .3 Water:
 - .1 Supplied by Contractor.
 - .2 Potable, free of impurities.
- .4 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65% of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Contract Administrator of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization.

PART 3 EXECUTION**3.1 PREPARATION**

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19 - Topsoil Placement and Grading. If discrepancies occur, notify Contract Administrator.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turfgrass Nursery Sod, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 25 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Contract Administrator.
- .5 Cultivate fine grade approved by Contract Administrator to 25mm depth immediately prior to sodding.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted.

SODDING

- .2 Lay sod sections in rows, longitudinally, along contours of slopes, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Contract Administrator. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.
- .4 Peg sod on slopes of 3 horizontal to 1 vertical and steeper, within 1 m of catch basins and ditch inlets, and within 1 m of drainage channels and ditches to following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes
 - .2 Not less than 3-6 pegs per square metre in slopes.
 - .3 Not less than 6-9 pegs per square metre in drainage structures.
 - .4 Drive pegs to 20 mm above soil surface of sod sections.

3.3 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods to following program agreed to by Contract Administrator.

3.4 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .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 50 mm when or prior to it reaching height of 75 mm. Remove clippings as directed by Contract Administrator.
- .3 Maintain sodded areas weed free by mechanical means.
- .4 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
- .5 Repair and resod dead or bare spots to allow establishment of sod prior to acceptance.

3.5 ACCEPTANCE

- .1 Sod areas will be accepted by Contract Administrator provided that:
 - .1 Sodded areas are properly established after 30 days.
 - .2 Sod is free of bare and dead spots, and without weeds.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut minimum 2 times, and within 24 h prior to acceptance.
 - .5 Fertilizing in accordance with fertilizer program has been carried out at least once.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

SODDING

- .3 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.

3.6 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance until end of warranty period, water the sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
- .2 Repair and re-sod dead or bare spots to satisfaction of Contract Administrator.
- .3 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
- .4 Eliminate weeds by mechanical means to extent acceptable to Contract Administrator.

3.7 CLEANING

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

END OF SECTION